ASSOCIATIONS OF AGE, ANXIETY, COGNITIVE FUNCTIONING AND SOCIAL IMPAIRMENT WITH AGGRESSION IN YOUTH WITH AUTISM

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Abstract

Previous research has indicated that aggression in children with autism is associated with anxiety, cognitive functioning, age, and social functioning although most samples only include parent-report measures and participants without intellectual disability. The aim of this study was to clarify the relationships between these variables and aggression in youth with autism in a large, cognitively diverse sample, with parent- and teacher-report measures, and a wide age range. I found that age and intellectual disability presence/severity had small positive relationships with teacher-measured aggression while anxiety and social impairment severity had strong relationships with aggression when measured by parents and teachers. In a regression analysis anxiety and social communication problems had the strongest positive relationships with aggression while social motivation problems had a negative relationship with aggression. These results indicate the importance of anxiety and social problems, particularly in social communication and motivation, when studying and treating aggression in youth with autism.

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Introduction

Autism spectrum disorder (ASD) is a developmental disorder characterized by social-communication deficits alongside restricted-repetitive behaviours, interests, or activities (American Psychiatric Association, 2013). The diagnosis of autism is applied broadly to a heterogenous group of individuals who exhibit a wide variety of symptoms that can range from mild to severe impairment in functioning. This symptom presentation is complicated by the presence of intellectual disability (ID) which is found in 31% of people with autism, with 25% in the borderline range of intellectual functioning and the remaining 44% exhibiting intellectual functioning that falls into the average range (Baio et al., 2018). While general delay is common in children with autism, specific delays are also present in which some domains of functioning, often relating to verbal reasoning and adaptive behaviour, show great impairment. This complicates the study of children with autism as children at different verbal and cognitive levels cannot all complete the same measures. Many studies include only participants with verbal language skills and without ID, which does not represent the true population of people with autism (Jack & Pelfrey, 2017; Russell et al., 2019).

Complicating the diagnosis of autism even further is the frequent presence of co-occurring symptoms of psychological disorders, both internalizing disorders (e.g., anxiety) and externalizing disorders (e.g., aggression). These symptoms may warrant a diagnosis themselves but also exist on a continuum as symptoms that can have a significant effect without meeting criteria for a clinical diagnosis. Aggression in children with autism can range from threats and lashing out when in stressful situations to apparently unprovoked physical outbursts consisting of punching, kicking, and biting (Fitzpatrick et al., 2016). Aggression in children with autism is

often directed at their caregivers with reports indicating 68% of children with autism have some history of aggression directed at caregivers while 49% have a history of aggression directed at non-caregivers (Kanne & Mazurek, 2011). Aggressive behaviour in children with autism has also been associated with co-occurring symptoms of anxiety, which itself can present as a problem for children with autism (Kanne & Mazurek, 2011).

Although externalizing behaviour is common, internalizing behaviour is also often reported in children with autism. Even though formal diagnoses are not always applied, study of comorbid psychiatric symptoms using diagnostic interviews modified for children with autism indicates that 72% of children with autism exhibit sufficient symptoms for at least one comorbid psychological disorder with 30% exhibiting criteria for two or more (Gjevik et al., 2011). Of these co-occurring psychopathologies, anxiety is the most common as it occurs in approximately 41% of children with autism (White et al., 2009; Gjevik et al., 2011). Anxiety in children with autism can present as social anxiety, generalized anxiety, separation anxiety, and specific phobia, although elevated scores are found in all domains of anxiety (Leyfer et al., 2006). While anxiety may present by itself, it is also sometimes associated with co-occurring aggression. Considering the prevalence of anxiety in youth with autism it is important to understand the various risk factors that are associated with it.

Children with autism who have higher IQ scores are at higher risk for co-occurring anxiety and this anxiety is also associated with higher language skills although different aspects of language appear to have different relationships with anxiety (Sukhodolsky et al., 2009; Davis et al., 2011; Rodas et al., 2017). While high levels of comprehension of the structural aspects of language, such as semantics and syntax, are associated with higher anxiety, comprehension of the pragmatic aspects of language, such as turn-taking and conversational skills, have been

associated with lower levels of anxiety (Rodas et al., 2017). These associations of anxiety with IQ and language have led to the hypothesis that anxiety is higher in children with autism who are able to understand their surroundings better despite their interactions being impaired by the core symptoms of autism (Davis et al., 2011). This hypothesis explains some of the discrepancy in findings regarding language and anxiety in autism, as the presence of better social communication skills would support more typical interactions with others and the environment, whereas only having knowledge of the structural aspects of language may not aid in these interactions (Rodas et al., 2017).

Although the findings by Rodas et al. (2017) and Davis et al. (2011) should guide research investigating anxiety in children with autism, it is important not to overlook anxiety in children with autism who have comorbid intellectual disability and impaired language skills. Anxiety is reportedly higher in subgroups with higher IQ and language scores, but this may be a function of measurement issues as their anxiety may be more easily verbalized and present in a more typical way (Davis et al., 2011). Research investigating anxiety in children with more severe autism symptoms has shown that the anxiety that occurred was related to the core symptoms of autism, demonstrating minimal correlation with IQ and language scores but a strong correlation with autism symptom severity (Kerns & Kendall, 2014). Considering the relationship between anxiety, intelligence, and the core deficits in autism, it is important to understand this relationship when assessing risk factors for mental health problems and deciding on appropriate treatments.

Treatment of anxiety in children with autism can be addressed in a number of ways although treatments are relatively new. Cognitive behavioural therapy for youth with autism and anxiety has become widely implemented, with treatments using standard (or slightly modified)

child cognitive behavioural treatments in individual and group settings (Wood et al., 2015; Luxford et al., 2017). Other avenues for treatment of anxiety have addressed emotion regulation, which can then be used to address more specific problems such as anxiety and externalizing behaviours (Weiss et al., 2018). Social skills interventions have also shown some promise in decreasing anxiety despite initially being developed for treating the social-communication deficits present in autism (Schohl et al., 2014; McVey et al., 2016). Treatments have been successfully applied to youth and adults with autism and higher levels of cognitive functioning, although there has been little investigation of treatments for individuals with intellectual disability as many of the typical anxiety treatments such as cognitive behavioural therapy require the use of reading, writing, and thought-based verbal exercises that may be difficult or impossible in youth with impaired cognition and limited communication (Vasa et al., 2016).

While anxiety itself is a cause for concern, there are additional issues in children with autism that may be exacerbated by the symptoms of anxiety. In typically developing (TD) children anxiety has been suggested as a potential causal mechanism for aggressive behaviour with it preceding later aggression (Moscovitch et al., 2008; Granic et al., 2014). Considering that children with autism display heightened levels of aggressive behaviour when compared to their TD peers, it is possible that the anxiety observed in children with autism plays a role in this problem (Matson & Rivet, 2008). While Kanne and Mazurek (2011) did not report a correlation between autism symptom severity or IQ with frequency of aggression, other findings have indicated that children with a combination of autism and intellectual disability were more likely to exhibit aggression than those with a diagnosis of intellectual disability alone (Matson & Rivet, 2008; Esteves et al., 2021). Youth with autism and intellectual disability also displayed a positive correlation between the frequency of aggressive behaviours and adaptive behaviour scores while

youth with intellectual disability alone displayed a negative correlation between aggression and adaptive behaviour (Esteves et al., 2021). Additional studies comparing youth with autism and intellectual disability and youth with intellectual disability alone found that those with intellectual disability and autism did not experience a decline in aggressive behaviours with age but youth with intellectual disability alone engaged in more relational aggression. This is somewhat conflicting with previous research which found that while autism symptom severity is not predictive of aggression there is a correlation between increased aggression and greater social-communication deficits (Kanne & Mazurek et al., 2011). This also conflicts with the finding that aggression was lower in the older participants suggesting that aggression decreases as children get older (Kanne & Mazurek, 2011). Consequences of aggression are wide ranging and can cause detrimental effects to the quality of life for individuals with autism and their families. Greater aggression in children and adults with autism has been associated with worse parent and peer relationships, family stress, increased likelihood of being placed in restricted home and school environments, and increased use of physical restraints (Bromley & Blacher, 1991; Dagnan & Weston 2006; Stith et al., 2009).

Treatment of aggression in autism has been diverse with a variety of behavioural and pharmacological interventions being tested. It is common for aggression in autism to be treated by antipsychotic medications which have been shown to demonstrate some efficacy. However, approximately 39% of individuals in pharmacological investigations do not show decreases in problem behaviour (Fitzpatrick et al., 2016). Antipsychotic medications also have side effects that include weight gain, dyskinesia, rashes, gastrointestinal upset, as well as disrupted cognitive function, communication, and adaptive behaviour (Fitzpatrick et al., 2016).

Another method of addressing aggression in children with autism is through behavioural therapy. Behavioural interventions focus on the environment before and after the aggressive behaviour in order to determine the purpose or function of the behaviour, which then determines what strategies should be used to prevent or reduce the behaviour (Roth et al., 2014). These typically include teaching a more appropriate skill that serves the same function as the aggression (e.g., a means of seeking attention, requesting things, or discontinuing unpleasant or difficult tasks).

Communication-based interventions have also been proposed to treat aggression; however these studies have been limited by sample size (Braithwaite & Richdale, 2000). Social skills-based treatments have been associated with a decrease in aggressive behaviour which suggests social functioning may be related to aggression in children with autism (Lordo et al., 2017). Considering the severity of the consequences of aggression and its lack of a clear treatment path it is important to understand the developmental mechanisms underlying the aggressive behaviour problems of children with autism at all levels of cognitive functioning.

Recent research has focused on understanding the context in which anxiety and aggression occur as well as how IQ affects these constructs and the relationship between them. Anxiety often precedes aggressive behaviour, particularly when the aggression is reactive in nature, as when the children are faced with stressful situations such as doctors' appointments and vaccinations (Bronsard, 2010). Sullivan et al. (2019) used latent profile analysis to create group profiles for children with autism based on aggression, finding that those with aggressive behaviour problems also demonstrated high anxiety regardless of IQ score. Sullivan and colleagues (2019) also observed that there was a small difference between the level of anxiety demonstrated by IQ groups when high levels of aggression were present (Sullivan et al., 2019). It

is possible that children who demonstrate high aggression have high underlying anxiety which results in the aggression, regardless of other previously identified predictors of anxiety such as IQ.

Further investigation of the relationship between anxiety and aggression has established that there may be moderating variables in this relationship that may explain some of the previous conflicting effects. Niditch et al. (2012) conducted a study on two age groups (preschool and early elementary aged) of children using a diverse sample that consisted of children with autism who had high and low IQ scores alongside varying levels of anxiety, aggression, and social understanding. The results indicated that cognitive functioning and social understanding moderated the relationship between anxiety and aggression. Children in the preschool age group with low cognitive functioning and low social understanding demonstrated low levels of anxiety regardless of aggression level, while those with high aggression and high social understanding but low cognitive functioning displayed high levels of anxiety. In children with high cognitive functioning in the preschool age group, those with low social understanding and high levels of aggression displayed high levels of anxiety while those with high social understanding displayed high anxiety regardless of the presence of aggressive behaviour. In the older group (early elementary school aged children) there was no difference in anxiety within the children with lower cognitive functioning however there was a difference by age group in the children with high levels of cognitive functioning. In this group all children had relatively high levels of anxiety. However, participants with low aggression and low social understanding, as well as those with high aggression and high social understanding, had less anxiety, indicating that an interaction occurs between aggression and social understanding in this age and cognitive subgroup.

Considering the differences observed between the preschool and early elementary school age groups in Nitditch et al.'s (2012) study as well as Vaillancourt et al.'s (2016) finding that internalizing and externalizing behaviours in children with autism decrease over time, it seems likely that further investigation of additional age groups may uncover more changes in the relationships between anxiety and aggression. The Niditch et al. (2012) study also only used social understanding as a moderator which may have a weaker or different influence over the relationship between anxiety and aggression when compared to additional aspects of social communication such as social motivation and social cognition. Further, both groups in their study were quite young.

Another area in which there has been less exploration is how anxiety, aggression, and social understanding are perceived by different observers. Literature examining the moderating effects of social impairment and IQ on the relationship between anxiety and aggression virtually exclusively focuses on parent report measures. Differences between parent and teacher reports of social impairment, problem behaviour, and anxiety have been observed in children with autism, but their ratings have not been examined as much in terms of moderation effects (Ellison, 2015; Palmer et al., 2022). Thus, it would be useful to observe these constructs across home and school environments (Adams et al., 2019; Hurtig et al., 2009; Jepsen et al., 2012) and examine moderators for both.

Current Study

The purpose of the current study was to investigate the relationship between anxiety and aggression in autism across a wide range of ages using cognitive level and several specific aspects of social communication as moderating variables, considering both parent and teacher perspectives. First, I compared rates of aggression in groups divided by age, social impairment,

and level of anxiety. Comparing aggression across these groups allowed for identification of which groups are most at risk for aggressive behaviour. I then investigated the linear relationships between aggression, anxiety, IQ, age, and social impairment to determine which domains of social impairment were most strongly associated with aggression and whether these relationships were better explained by anxiety, age, and IQ. Considering that previous research has suggested age and IQ are associated with the development of anxiety and aggressive behaviour in youth with autism, anxiety has been associated with the development of aggressive behaviour and social problems, and social problems have been associated with aggression, I decided a regression analysis would be most suitable for this question (Davis et al., 2011; Lordo et al., 2017; Niditch et al., 2012; Rodas et al., 2017; Schohl et al., 2017; Sullivan et al., 2019; Vaillancourt et al., 2016).

Lastly, I explored the relationship between anxiety and aggression with age and social impairment as moderating variables. Previous studies examining how developmental factors (age, IQ, social communication) effect the relationship between anxiety and aggression have been limited to youth in early-childhood which has resulted in a lack of data on older children and adolescents (Niditch et al., 2012; Rodas et al., 2017). This is particularly important as there is evidence that internalizing and externalizing symptoms in autism change over the course of development (Vaillancourt et al., 2016). Furthermore, different aspects of social functioning (social cognition, social motivation, etc.) may play different roles in the relationship between anxiety and aggression as social understanding and social communication have opposite effects in young children with high cognitive functioning (Niditch et al., 2012; Rodas et al., 2017).

The moderator analysis was guided by previous research and our initial linear results which resulted in investigation of social awareness, social cognition, autistic social mannerisms,

social communication, social motivation, and age as moderating variables while IQ was used a s covariate. We expected the relationship between anxiety and aggression to change in strength such that anxiety and aggression would be more highly correlated when social impairment is low and less correlated in older age groups when clinically significant anxiety and aggression problems are less common.

Methods

Design

The current study used data obtained from the Simons Foundation for Autism Research (SFARI). This study will use a subset of the SFARI data know as the Simons Simplex Collection (Fischbach & Lord, 2010), which consists of phenotypic information obtained from families in which one child is diagnosed with autism (Gotham et al., 2013). The Simons Simplex Collection is a database that includes a wide variety of measures from a large sample of children with autism that can be used by researchers to understand the symptoms and treatment of children with autism. This study used a wide age range for the regression analyses and a cross-sectional design for comparisons among three different age groups (early childhood, mid childhood, and adolescence).

Procedures

Data were collected from 12 research centres across the US and Canada (Baylor College of Medicine, Boston Children's Hospital/Harvard Medical School, Columbia University, Emory University, McGill University, University of California – Los Angeles, University of Illinois at Chicago, University of Michigan, University of Missouri, University of Washington, Vanderbilt University, and Yale University). The study was given ethics approval by Institutional Review Boards at each research site. Informed consent was obtained from the parents or caregivers

alongside assent from the child participant. Participation was voluntary and families were informed that they could leave the study at any time. Parents were required to give 4.5 to 7 hours of their time and the child was required to give 2.5 to 4 hours. Parents were given a $25 visa gift card after the initial questionnaire and an additional $50 visa gift card once all the parent and child measures were completed.

During their participation, children and parents were administered diagnostic and behavioural measures that assessed the children's cognitive functioning, adaptive behaviour, communication ability, motor function, autism symptom severity, and emotional and behavioural problems, with all information being collected within a 6-month timeframe. Parent information collected consisted of medical history, developmental progress, and dietary supplements alongside a variety of parent and teacher report measures assessing the children's behaviour. These data were then entered into a database, with data entry and cleaning being done by employees of SFARI. Missing data for individual measures was minimal although only about half the original sample had any teacher-report measures included. Our use of this data was approved by the York University Human Participants Review Committee and approval for use of the data was given by SFARI.

Participants

Child participants were between the ages of 4 and 18 and all were from simplex families (i.e., only one child with autism in the family). Children were excluded from the SFARI data collection if they exhibited sensory impairments, motor difficulties, genetic syndromes, or a medical history of birth complications. Participants were also required to have a non-verbal mental age of at least 24 months.

I used data from 1179 participants (1011 male; 168 female), those who have both parent and teacher data. Descriptive statistics for age and other continuous variables of interest can be found in Table 1. The median parental education for mothers and fathers was a bachelor's degree with the distributions being skewed towards having a higher education. See Table 2. The median income range was $66,000 to $80,000 USD and was evenly distributed aside from a lack of representation in families with incomes ranging from $101,000 to $160,000. The family income distribution can be found in Table 3.

Table 1

Descriptive Statistics for Child Variables

	N	Minimum	Maximum	*M*	*SD*
CBCL aggression parent *T* score	1179	50	93	59.69	9.29
CBCL anxiety parent *T* score	1179	50	92	60.41	9.14
CBCL aggression teacher *T* score	1179	50	97	60.05	8.00
CBCL anxiety teacher *T* score	1179	50	93	60.94	7.99
Age (months)	1179	4.00	17.92	8.74	3.48
IQ	1179	10	156	78.86	27.98
SRS-parent total score	1179	11	170	99.65	27.09
SRS-teacher total score	1179	13	179	94.25	30.45

Table 2

Parental Education

Parent	Education Level	Frequency	Percent
Fathers	Less than high school	29	2.5
	High school	117	9.9
	Some post-secondary	306	26.0
	Bachelor's degree	382	32.4
	Graduate degree	337	28.6
	Total	1171	
	Missing	8	0.6
Mothers	Less than high school	10	0.8
	High school	91	7.7
	Some post-secondary	329	27.9
	Bachelor's degree	436	36.9
	Graduate degree	310	26.4
	Total	1176	
	Missing	3	0.3

Table 3

Family Income

Income	Frequency	Percent
Less than 20,000	130	11.0
21,000-35,000	95	8.1
36,000-50,000	118	10.0
51,000-65,000	149	12.6
66,000-80,000	185	15.7
81,000-100,000	180	15.3
101,000-130,000	36	3.1
131,000-160,000	56	4.7
161,000 and above	191	16.2
Total	1140	
Missing	39	3.3

Measures

Achenbach System of Empirically Based Assessment (ASEBA; Achenbach, 2004). Both the independent variable (anxiety) and dependent variable (aggression) were assessed using the ASEBA. The ASEBA includes a set of forms used to measure a child's externalizing and

internalizing problems using parent and teacher reports, with forms that have been normed for younger and older children. The measure yields various derived scores, including five DSM-oriented scales that measure symptoms related to diagnoses (Affective Problems, Anxiety Problems, Pervasive Developmental Disorder problems, Attention Deficit/Hyperactive Disorder Problems, and Oppositional Defiant problems) as well as eight empirically based syndrome scales (Anxious/depressed, Withdrawn/depressed, Somatic complaints, Social problems, Thought problems, Rule-breaking behaviour, and Aggressive behaviour).

The current study used the Aggressive Behaviour score from the syndrome scales and the Anxiety Problems score from the DSM-oriented scales. The Anxiety problems scale measures symptoms of Separation Anxiety Disorder, Generalized Anxiety Disorder, and Specific Phobia. This scale was used because the anxious/depressed syndrome scale contains items that measure depression which is outside the scope of our study and may have a different role in the relationship between internalizing symptoms and aggression. The Anxiety Problems scale has demonstrated some validity for assessing anxiety in children with autism using a sample that contained a wide range of IQ and adaptive behaviour scores (Magyar & Pandolfi, 2017). The Aggressive Behaviour subscale of the CBCL is a widely used assessment of aggression in children with autism as well as other populations and has demonstrated some validity in children with autism and intellectual disability (Hartley et al., 2008; Farmer et al., 2014; Pandolfi et al., 2012).

The parent version of the Child Behavior Checklist (CBCL) is split into two versions corresponding to ages 1.5-5 and 6-18 years. The parent report version consists of 113 items that assess a child's emotional functioning as well as their behaviour. The teacher scales are also split into two groups corresponding to the age groups used to divide the parent report forms. These

consist of the caregiver-teacher report form (C-TRF) for the younger children and the teacher report form (TRF) for the older ages. The C-TRF consists of 98 items while the TRF consists of 113, both of which assess the same constructs as the parent report CBCL questionnaires. For all the ASEBA forms, items are scored on a 3-point scale (0=*not true*, 1=*somewhat or sometimes true*, 2=*very true or often true*). Raw scale scores for both aggression and anxiety are converted to population-based standardized *T* scores (*M*=50, *SD*=10). *T* scores of 70 or above are considered clinically significant while scores of 65 to 69 are in the range of borderline clinical significance. These *T* scores will be used in the current study (rather than raw scores) to provide comparisons based on central with both age versions and both respondent versions of the measure. This resulted in four *T*-scores for each participant, a teacher and parent report score for both aggression and anxiety.

Social Responsiveness Scale (SRS; Constantino & Gruber, 2005). The SRS was used to assess social impairment from the perspective of both teachers and parents. The SRS is a 65-item questionnaire that assesses autism-related social deficits across five domains (Social Awareness, Social Cognition, Social Communication, Social Motivation, and Restricted Interests and Repetitive Behaviours) and also has a total score. Items are rated using a 4-point Likert-type scale (1 = *not true*, 2 = *sometimes true*, 3 = *often true*, 4 = *almost always true*).

I used all of the subscale scores for parents and teachers, resulting in 10 subscale scores and two total scores for each participant. The Social Communication subscale consists of 22 items assessing deficits in communication that occur in social interactions. Its internal consistency was good in parents (Cronbach's α= .826) and teachers (α = .872). The Social Cognition subscale consists of 12 items that assess deficits related to the ability to understand social behaviour. Its internal consistency was acceptable in parents (α= .710) and teachers (α= .752). The Social

Motivation subscale consists of 11 items that assess deficits associated with the motivation to engage in social interaction with others. Its internal consistency was acceptable in parents (α = .765) and teachers (α = .785). The Social Awareness subscale consists of 8 items that assess deficits in the awareness of social cues. Its internal consistency was questionable in parents (α= .646) and teachers (α = .679). The autistic mannerisms subscale consists of 12 items and assesses the restricted or repetitive behaviours and interests associated with autism. Its internal consistency was acceptable in parents (α= .784) and good in teachers (α = .837). Total SRS internal consistency was excellent in both parents (α= .935) and teachers (α= .947).

Cognitive Functioning. An age- and developmentally appropriate measure of cognitive functioning was used to assess cognitive functioning, as is typical in autism research because of the range of cognitive levels. The cognitive measures included: The Differential Ability Scales-Second Edition (DAS-II; Elliott, 2007), Mullen Scales of Early Learning (MSEL; Mullen 1995), Wechsler Intelligence Test for Children-Fourth Edition (WISC-IV; Wechsler, 2003), and the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler 1999). The most common measure in our sample was the DAS-II which was completed by 82% of the participants, followed by the MSEL at 9%, then the WASI at 4%, and the WISC-IV at 2%. The remaining 3% of the sample completed a combination of the measures. Full scale IQ scores (*M*=100, *SD*=15) were obtained from the WISC-IV and the WASI, Early Learning Composite standard scores from the MSEL (M=100, SD=15), General Conceptual Ability standard scores (M=100, SD=15) from the DAS-II. Full scale deviation IQ scores were, thus, calculated for 78% of the sample. Lastly, youth without a standard score for any of these measures had their mental age divided by their chronological age x 100 to create a ratio IQ score. The ratio IQ scores were used for 22% of the sample.

Demographic Variables. Participants' age and gender was obtained via parent questionnaires that also included demographic information on parental education, occupation, marital status, and household income.

Analyses

Data were analyzed using version 28 of SPSS statistics software. Initial analyses consisted of examining variable distributions as well as summaries of demographic information and all variables used in the analyses. These summaries consisted of value ranges, averages, standard deviations, skewness, and kurtosis, and intercorrelations among all variables.

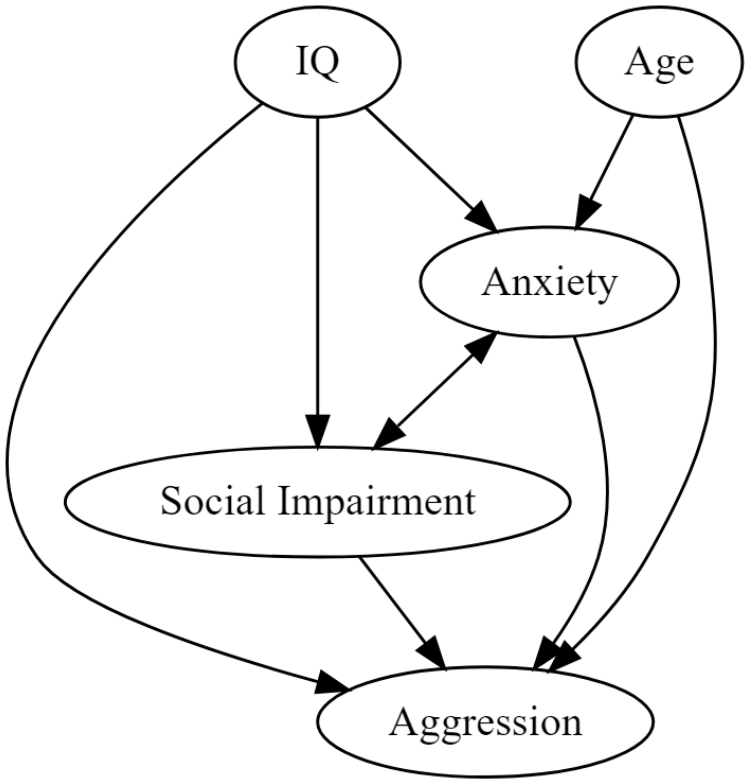
Univariate statistics were reported for all variables of interest, based on both respondents' scores, including descriptive data (*M, SD*, range, and % in relevant categories) for aggression, anxiety, and social impairment for the total sample, as well as for subgroups based on age (early-mid-childhood, adolescence), IQ (no ID, borderline , mild ID, moderate ID, severe ID), and social impairment (low, mild, moderate, and severe deficits). Analyses of variance were conducted to compare subgroups on all relevant variables to determine whether there were group differences using these categorical subgroups. Parent and teacher reports were compared using paired *t*-tests to determine differences between observers for the ASEBA and SRS scores.

Regression and moderation analyses were then completed. The hierarchical regression analyses were completed with aggression as the dependent variable while age, IQ, anxiety, and all subscales of the SRS were inserted in order to determine which variables had the strongest association with aggression. The independent variables were ordered to reflect the hypothesized mechanisms for the causal relationships between them (Figure 1). For the moderation analyses anxiety was the independent variable, aggression was the dependent variable, and the role of IQ, age, and social impairment were examined. Using judgment from our earlier results we included

age and each domain of the SRS as moderators while IQ was included as a potential covariate. Each analysis was done first using parent-report measures and then with teacher-report measures using all scores as continuous variables.

Figure 1

Causal Diagram: Relationships Between Independent Variables and Aggression



Results

Descriptive statistics were calculated for the main variables used in our analyses. The mean, range, and standard deviation for the continuous variables can be found in Table 3. Using clinical cutoffs for the CBCL parent aggression *T*-scores, just over 28% of our sample showed levels of aggression in the borderline or clinical range on parent measures while 24% of the reported in the borderline or clinically significant range by the teachers. Parents were more likely

to rate aggression as clinically significant. CBCL aggression score clinical cutoff frequencies and the chi-square test can be found in Table 4.

Table 4

CBCL Aggression Scores

	Range	*n*	%
Parent	Normal	843	71.5
	Borderline	175	14.8
	Clinical	161	13.7
Teacher	Normal	888	75.3
	Borderline	179	15.2
	Clinical	112	9.5

X^2 (2, N = 1179) = 94.74, $p < .001$

Using clinical cutoffs for the CBCL parent anxiety *T*-scores, parents reported that 38% of the sample exhibited borderline or clinical levels of anxiety while teachers reported that 39% of the sample exhibited borderline or clinical levels of anxiety. Parents rated more children as falling into the borderline range while teachers were more likely to rate children's anxiety as clinically significant. CBCL Anxiety score frequencies and the chi-square test can be found in Table 5.

Table 5

CBCL Anxiety Scores

	Range	Frequency	Percent
Parent	Non-clinical	728	61.7
	Borderline	179	15.2
	Clinical	272	23.1
Teacher	Non-clinical	711	60.3
	Borderline	245	20.8
	Clinical	223	18.9

X^2 (2, N = 1179) = 111.79, $p < .001$

Estimates of intellectual functioning using the methods outlined in the measures section indicated that, according to IQ based cutoffs, 49% of children in our sample did not meet criteria

for an ID, 18% were in the borderline range, 20% were in the mild-to-moderate range, and 13% were in the severe/profound range. Frequencies for intellectual disability presence/severity can be found in Table 6.

Table 6

Intellectual Disability Groups

ID Groups	Frequency	Percent
no ID	575	48.8
borderline	215	18.2
mild/moderate ID	239	20.3
severe/profound ID	150	12.7
Total	1179	100

Using total SRS-parent report *T*-scores for social impairment, it was observed that 70% exhibited high levels of social impairment while teacher reports indicated that 14% exhibited high levels of social impairment. Parents were much more likely to rate their children's social problems as severe and thus less likely to rate their children's social problems as low, mild, or moderate when compared to teachers. Frequency tables for SRS total scores and the chi-square test can be found in Table 7.

Table 7

Social Responsiveness Scale Severity Ratings

	Severity	Frequency	Percent
Parent	low	43	3.6
	mild	78	6.6
	moderate	233	19.8
	high	825	70
Teacher	Low	327	27.7
	mild	279	23.7
	moderate	392	33.2
	severe	181	15.4

X^2 (3, N = 1179) = 104.93, $p < .001$

Level of Aggression in Subgroups

One-way analyses of variance were conducted to determine how aggression varied with additional participant measures of interest, by dividing participants into subgroups based on levels of clinical significance. These analyses were conducted in each case for parent and teacher ratings.

Parents. Initial tests showed that parent-rated aggressive behaviour problems did not differ significantly by age groups or intellectual disability groups (see Tables 8 and 9). However, the ANOVA for anxiety was significant and post tests showed that children with clinically significant anxiety problems were rated as having higher aggression than children with borderline and low levels of anxiety problems while borderline levels of parent-rated anxiety problems had higher levels of aggressive problems than children with low levels of anxiety problems (see Table 10). When using parent rated social impairment it was found that there was a significant difference between groups (see Table 11). Children high in social problems exhibited the highest levels of aggression while children in the mild and moderate groups did not significantly differ from each other but both had higher levels of aggression than children with low levels of social impairment.

Table 8

Comparison of aggressive behaviour across age groups

	Early childhood	Middle childhood	Adolescence		
	M(SD)	*M(SD)*	*M(SD)*	*F*	η_p^2
Parent	59.06 (9.97)	60.28 (9.03)	59.12 (9.01)	F (2, 1177) = 2.45, p = .09	.004
Teacher	58.34 (7.69)	60.79 (9.19)	60.33 (7.66)	F (2, 1177) = 9.74, p < 0.001	.016

Note. Parent post-hoc (p < 0.01): Early childhood = Middle childhood = Adolescence.
Teacher post-hoc (p < 0.01): Early childhood < Middle childhood = Adolescence.

Table 9

Comparison of aggressive behaviour across intellectual disability severity groups

	No ID	Borderline	Mild/ Moderate	Severe/ Profound		
	M(SD)	*M(SD)*	*M(SD)*	*M(SD)*	*F*	η_p^2
Parent	59.86 (9.60)	59.90 (10.00)	58.98 (9.27)	59.88 (9.51)	F (3, 1176) = .58, p = .63	.001
Teacher	59.28 (8.23)	59.67 (8.00)	60.93 (8.00)	62.11 (7.09)	F (3, 1176) = 6.30, p < 0.001	.016

Note. Parent post-hoc (p < 0.01): No ID = Borderline ID = Mild/Moderate ID = Severe/Profound ID.
Teacher post-hoc (p < 0.01): No ID < Borderline ID < Mild/Moderate ID = Severe/Profound ID.

Table 10

Comparison of aggressive behaviour across anxiety severity groups

	Non-clinical	Borderline	Clinical		
	M(SD)	*M(SD)*	*M(SD)*	*F*	η_p^2
Parent	57.19 (7.99)	60.97 (8.21)	65.56 (10.33)	F (2, 1177) = 95.74, p < 0.001	.140
Teacher	58.15 (7.07)	61.78 (7.74)	64.21 (9.00)	F (2, 1177) = 61.73, p < 0.001	.095

Note. Parent post-hoc (p < 0.01): Non-clinical < Borderline < Clinical.
Teacher post-hoc (p < 0.01): Non-clinical < Borderline < Clinical.

Table 11

Comparison of aggressive behaviour across social responsiveness severity groups

	Low	Mild	Moderate	Severe		
	M(SD)	*M(SD)*	*M(SD)*	*M(SD)*	*F*	η_p^2
Parent	51.37 (2.68)	55.32 (6.86)	56.33 (7.78)	61.49 (9.47)	F (3, 1176) = 41.61, p < 0.001	.096
Teacher	55.74 (5.69)	59.18 (7.36)	61.60 (7.59)	65.81 (8.79)	F (3, 1176) = 83.54, p < 0.001	.176

Note. Parent post-hoc (p < 0.01): Low < Mild < Moderate < Severe.
Teacher post-hoc (p < 0.01): Low < Mild < Moderate < Severe.

Teachers. When examining teacher-rated aggression, it was found that aggression significantly differed by age group as the adolescent and middle childhood age groups were reported to have significantly higher levels of aggressive problems than those in the early-

childhood group (see Table 8). Teacher-rated aggressive problems also differed significantly across level of intellectual disability as children with severe/profound levels of intellectual disability were reported to have significantly more aggressive behaviour problems than all other groups while those in the mild/moderate group were reported to display significantly more aggression than those in the borderline and no ID groups (see Table 9). There was no significant difference between the borderline and no ID groups. In addition to this, teacher-rated aggression also differed with levels of teacher-rated anxiety (see Table 10). This followed the same pattern as the parent ratings, in which children with clinically significant anxiety problems were rated as having higher aggression than children with borderline and low levels of anxiety problems while borderline levels of parent-rated anxiety problems had higher levels of aggressive problems than children with low levels of anxiety problems. Teacher-rated aggression also differed significantly in social impairment groups as those with high teacher-rated social impairment displayed the highest levels of teacher-rated aggression, followed by those with moderate levels of social impairment, then mild social impairment, and finally followed by those with low levels of social impairment (see Table 11).

Relationships among All Study Variables

Parents. Correlations between aggression and other variables of interest were calculated separately for parent and teacher data (see Table 12). Parent-rated aggression had a moderate correlation with parent-rated anxiety and low to moderate correlations with all domains of the SRS. Parent-rated aggression was not significantly correlated with chronological age, or IQ. Age had low-level correlations with parent-rated anxiety and all domains of the parent-rated SRS. IQ scores were negatively associated with parent-rated anxiety and positively associated with all domains of the parent-rated SRS.

Teachers. The same correlations were also conducted for the teacher-rated variables. Teacher-rated aggression problems had a small positive correlation with age. Teacher-rated aggression also had a medium correlation with teacher-rated anxiety and mild-moderate correlations with all domains of the teacher-SRS. Age had small positive correlations with anxiety and teacher-rated social awareness but was not correlated with any other domains of the teacher-SRS.

Table 12

Correlations

	1	2	3	4	5	6	7	8	9	10
1. Aggression		.41*	.03	-.01	.31*	.34*	.37*	.38*	.25*	.39*
2. Anxiety	.35*		.11*	.22*	.11*	.30*	.26*	.36*	.42*	.35*
3. IQ	-.10	-.04		-0.03	-.23*	-.28*	-.27*	-.20*	-.18*	-.28*
4. Age	.07	.21*	-.03		-.06	.07	.09*	.14*	.12*	.10*
5. Social Awareness	.34*	.12*	-.34*	-.13*		.63*	.70*	.57*	.46*	.76*
6. Social Cognition	.32*	.31*	-.39*	-.04*	.67*		.74*	.67*	.57*	.85*
7. Social Communication	.40*	.25*	-.32*	-.04	.74*	.76*		.71*	.67*	.94*
8. Social Mannerisms	.49*	.38*	-.31*	.04	.62*	.70*	.73*		.56*	.85*
9. Social Motivation	.27*	.41*	-.24*	.04	.55*	.63*	.75*	.60*		.78*
10. SRS Total Score	.43*	.34*	-.37*	-.23*	.80*	.87*	.95*	.85*	.82*	

* = significance at the $p < .001$ level. Parent correlations can be found to the right of the line and teacher correlations can be found to the left.

Predictors of Aggressive Behaviour

Hierarchical multiple regressions were conducted for parent and teacher measures to determine which domains of the SRS were most strongly related to aggression once additional child variables were added in logically derived steps. Age and IQ were entered in the first model of the regression to account for non-clinical child characteristics, anxiety was inserted in the second step to incorporate its influence in the model separate from non-clinical and social characteristics, and all domains of the social responsiveness scale were added in the third step to determine their association with aggression when the previous variables were included.

Parents. The first step in the parent regression, as seen in Tables 13 and 14, accounted for less than 1% of variance in aggression and was not statistically significant. However, when anxiety was added in the second step, there was a significant improvement in R^2 and explained 18% of variance in aggression. Anxiety was significant and its addition resulted in age also being a significant predictor of aggression. The final step included all domains of the SRS and resulted in IQ becoming significantly associated with aggression while age was no longer significant in the model. Anxiety continued to be statistically significant and all domains of the SRS but social cognition were statistically significant. All significant variables in the final step were positively correlated with aggression aside from age and social motivation. That is, greater social difficulties were generally associated with higher aggression scores, except better social motivation was associated with aggression. This final step accounted for 29% of the variance in parent-rated aggression.

Table 13

Parent Model Summary

Block	*R*	R^2	*SE*	ΔR^2	*F* Change	Sig. *F* Change
1	.04	< 0.01	9.29	< 0.01	0.74	.479
2	.43	0.18	8.40	0.18	262.30	< .001
3	.54	0.29	7.84	0.11	36.17	< .001

Combined beta significance: F (8, 1170) = 60.55, $p < .001$

Table 14

Parent Regression

Model		B	SE. B	β	*t*
1	(Constant)	59.196**	1.073		55.190
	IQ	.011	.010	.032	1.088
	Age	-.003	.006	-.015	-0.501
2	(Constant)	35.761**	1.742		20.527
	IQ	-.006	.009	-.019	-0.701
	Age	-.025	.006	-.112	-4.149**
	Anxiety	.447	.028	.44	16.196**
3	(Constant)	26.337**	1.879		14.019
	IQ	.025	.009	.075	2.836*
	Age	-.024	.006	-.109	-4.262**
	Anxiety	.386	.030	.38	12.969**
	Social Awareness	.259	.091	.104	2.834*
	Social Cognition	.048	.068	.029	0.711
	Social Communication	.225	.045	.241	4.986**
	Social Mannerisms	.165	.052	.121	3.169*
	Social Motivation	-.290	.058	-.180	-5.049**

Dependent Variable: Aggression. ** = $p < .001$, * = $p < .01$.

Teachers. The first step in the teacher regression, as seen in Tables 15 and 16, was statistically significant but accounted for only 1% of variance in teacher-rated aggression with only age being significant. In the second step, anxiety was statistically significant while age was not. This step accounted for 11.7% of variance in teacher-rated aggression. The final step included all domains of the SRS which were statistically significant and anxiety continued to be significant. All statistically significant correlations in this model were positive (higher social difficulties related to higher aggression) aside from social cognition and social motivation which were negatively related, i.e., better social cognition and motivation were associated with higher aggression. This final step accounted for 31.1% of the variance in teacher-rated aggression.

Table 15

Teacher Model Summary

Block	*R*	R^2	*SE*	ΔR^2	*F* Change	Sig. *F* Change
1	.12	0.01	7.95	0.01	8.10	<.001
2	.36	0.13	7.47	0.12	157.80	<.001
3	.56	0.31	6.66	0.18	61.46	<.001

Combined beta significance: F (8, 1170) = 66.10, $p < .001$

Table 16

Teacher Regression

Model		B	SE. B	β	*t*
1	(Constant)	60.992	.918		66.446
	IQ	-.028	.008	-.097	-3.346
	Age	.012	.006	.062	2.132**
2	(Constant)	40.872	1.819		22.468**
	IQ	-.025	.008	-.086	-3.15
	Age	-.002	.005	-.01	-0.355
	Anxiety	.35	.028	.349	12.562**
3	(Constant)	34.596	1.87		18.504**
	IQ	.012	.008	.043	1.617
	Age	.006	.005	.029	1.14
	Anxiety	.260	.029	.26	9.007**
	Social Awareness	.200	.076	.101	2.623*
	Social Cognition	-.178	.054	-.137	-3.292*
	Social Communication	.205	.037	.286	5.509**
	Social Mannerisms	.389	.042	.365	9.327**
	Social Motivation	-.300	.052	-.226	-5.793**

Dependent Variable: Aggression. ** = $p < .001$, * = $p < .01$.

Moderators of the Relationship Between Anxiety and Aggression

Moderation analyses were conducted using model 3, with two moderators that may interact with each other in their influence over independent and dependent variable, in the Process (Version 4.00) macro for SPSS. Interaction effects were probed for age and social impairment as moderators of the relationship between anxiety and aggression. IQ was incorporated into the model as a covariate as has been associated with anxiety and aggression in the literature and in our sample had small but statistically significant correlations with social impairment but was not significantly correlated with anxiety or aggression.

Parents. Using anxiety as the predictor variable, age and total social impairment as moderators, and IQ as a covariate, it was found that the model predicted a statistically significant amount of variance in aggression (Table 17). Of these variables, IQ was not a significant covariate, anxiety had a moderate positive direct effect on aggression, age had a very small negative effect on aggression, social impairment had a small negative effect on aggression, and no significant moderating effects were observed. These relationships were the same when social cognition, social communication, social awareness, and social mannerisms were used as moderator variables (Tables 18 – 22). When social motivation was used as a moderator, anxiety and age had small effects on aggression while social motivation, IQ and the moderator effects were not significant.

Table 17

Parent SRS Total Model Summary

	B	*SE*	*t*	95% LLCI	95% ULCI
Constant	57.668	.744	77.535*	56.209	59.127
IQ (covariate)	.027	.009	2.989	.009	.044
Anxiety	.323	.029	11.156*	.267	.380
Age	-.027	.006	-4.506*	-.040	-.016
Age X Anxiety	-.001	.001	-1.915	-.003	< .001
Social Functioning	.106	.010	10.714*	.087	.126
Social Functioning X Anxiety	< .001	.001	.125	-.002	.002
Social Functioning X Age X Anxiety	< .001	< .001	.587	-.001	.001

Dependent variable = Parent report aggression. * = $p < .001$.
$R = .51$, $R^2 = .26$, $F(8, 1170) = 52.16$, $p < .001$

Table 18

Parent Social Awareness Model Summary

	B	*SE*	*t*	95% LLCI	95% ULCI
Constant	58.480	.729	80.183*	57.049	59.911
IQ (covariate)	.017	.009	1.920	< .001	.034
Anxiety	.402	.027	14.811*	.348	.455
Age	-.018	.006	-3.125*	-.030	-.007
Age X Anxiety	-.001	.001	-1.739	-.002	< .001
Social Awareness	.681	.067	10.167*	.549	.812
Social Awareness X Anxiety	< .001	.007	.418	-.019	.008
Social Awareness X Age X Anxiety	< .001	.001	.303	-.002	.003

Dependent variable = Parent report aggression. * = $p < .001$.
$R = .50$, $R^2 = .25$, $F(8, 1170) = 49.46$, $p < .001$

Table 19

Parent Social Cognition Model Summary

	B	*SE*	*t*	95% LLCI	95% ULCI
Constant	58.186	.752	77.409*	56.711	59.660
IQ (covariate)	.021	.009	.2.279	.003	.038
Anxiety	.359	.029	12.521*	.303	.415
Age	-.026	.006	-4.253*	-.038	-.014
Age X Anxiety	-.001	.001	-2.053	-.003	< .001
Social Cognition	.423	.049	8.694*	.328	.519
Social Cognition X Anxiety	-.002	.005	-.318	-.011	.001
Social Cognition X Age X Anxiety	< .001	.001	.340	-.002	.003

Dependent variable = Parent report aggression. * = $p < .001$.
$R = .49$, $R^2 = .24$, $F(8, 1170) = 46.08$, $p < .001$

Table 20

Parent Social Communication Model Summary

	B	*SE*	*t*	95% LLCI	9% ULCI
Constant	57.850	.733	78.917*	56.411	59.288
IQ (covariate)	.024	.009	2.713	.006	.041
Anxiety	.355	.028	12.860*	.310	.410
Age	-.029	.006	-4.936*	-.041	-.018
Age X Anxiety	-.001	.001	-2.040	-.003	< .001
Social Communication	.281	.026	10.905*	.230	.331
Social Communication X Anxiety	.002	.003	.740	-.003	.007
Social Communication X Age X Anxiety	< .001	< .001	.267	< .001	.002

Dependent variable = Parent report aggression. * = $p < .001$.
$R = .52$, $R^2 = .27$, $F(8, 1170) = 53.39$, $p < .001$

Table 21

Parent Social Mannerisms Model Summary

	B	*SE*	*t*	95% LLCI	95% ULCI
Constant	58.462	.738	79.182*	57.014	59.91
IQ (covariate)	.016	.009	1.869	< .001	.034
Anxiety	.33	.029	11.534*	.279	.393
Age	-.028	.006	-4.540*	-.040	-.016
Age X Anxiety	-.001	.001	-1.238	-.002	< .001
Social Mannerisms	.387	.039	9.840*	.310	.464
Social Mannerisms X Anxiety	< .001	.004	.063	-.008	.008
Social Mannerisms X Age X Anxiety	< .001	< .001	-.097	-.002	.002

Dependent variable = Parent report aggression. * = $p < .001$.
$R = .50$, $R^2 = .25$, $F(8, 1170) = 48.80$, $p < .001$

Table 22

Parent Social Motivation Model Summary

	B	*SE*	*t*	95% LLCI	95% ULCI
Constant	59.751	.763	78.341*	58.254	61.247
IQ (covariate)	< .001	.009	.034	-.018	.018
Anxiety	.405	.031	12.895*	.344	.466
Age	-.028	.006	-4.339*	-.041	-.016
Age X Anxiety	-.001	.001	-1.754	-.003	< .001
Social Motivation	.140	.050	2.792	.041	.236
Social Motivation X Anxiety	< .001	.005	.090	-.009	.010
Social Motivation X Age X Anxiety	< .001	< .001	-.375	-.002	.003

Dependent variable = Parent report aggression. * = $p < .001$.
$R = .51$, $R^2 = .26$, $F(8, 1170) = 52.16$, $p < .001$

Teachers. Similar analyses were conducted for teachers' data. Using anxiety as the predictor variable, social impairment and age as moderators, and IQ as a covariate, it was found that the model predicted a significant amount of variance in aggression (Table 23). Of these variables IQ was not a significant covariate, anxiety had a moderate positive direct effect on aggression, age did not have an effect, social impairment had a small negative effect on

aggression, and no significant moderating effects were observed. This pattern of results was the same when social awareness, social cognition, social communication, social mannerisms, and social motivation were substituted for total social impairment as the moderator variable (Tables 24 – 28).

Table 23

Teacher SRS Total Model Summary

	B	*SE*	*t*	95% LLCI	95% ULCI
Constant	58.909	.660	89.274*	57.614	60.204
IQ (covariate)	.013	.008	1.656	-.002	.029
Anxiety	.219	.029	7.693*	.163	.275
Age	.005	.005	.947	-.006	.016
Age X Anxiety	< .001	.001	.832	-.001	.002
Social Functioning	.098	.001	12.426*	.083	.114
Social Functioning X Anxiety	.001	.001	.870	-.001	.002
Social Functioning X Age X Anxiety	< .001	< .001	-.512	< .001	< .001

Dependent variable = Teacher report aggression. * = $p < .001$.
$R = .49$, $R^2 = .24$, $F(8, 1170) = 45.30$, $p < .001$

Table 24

Teacher Social Awareness Model Summary

	B	*SE*	*t*	95% LLCI	95% ULCI
Constant	59.476	.661	89.930*	58.178	60.773
IQ (covariate)	.006	.008	.782	-.009	.022
Anxiety	.305	.027	11.142*	.252	.359
Age	.008	.005	1.579	-.002	.019
Age X Anxiety	.001	.001	.693	-.001	.002
Social Awareness	.624	.057	10.987*	.512	.735
Social Awareness X Anxiety	-.002	.001	.651	-.008	.017
Social Awareness X Age X Anxiety	.006	.008	-1.242	-.004	.001

Dependent variable = Teacher report aggression. * = $p < .001$.
$R = .46$, $R^2 = .21$, $F(8, 1170) = 39.94$, $p < .001$

Table 25

Teacher Social Cognition Model Summary

	B	*SE*	*t*	95% LLCI	95% ULCI
Constant	59.943	.691	86.808*	58.589	61.299
IQ (covariate)	.002	.008	.213	-.015	.018
Anxiety	.280	.029	9.582*	.223	.338
Age	.002	.006	.292	-.009	.013
Age X Anxiety	< .001	.001	.466	-.001	.002
Social Cognition	.305	.041	7.541*	.226	.385
Social Cognition X Anxiety	-.004	.004	-.910	-.012	.005
Social Cognition X Age X Anxiety	< .001	.001	-.181	-.002	.002

Dependent variable = Teacher report aggression. * = $p < .001$.
$R = .42$, $R^2 = .18$, $F(8, 1170) = 31.13$, $p < .001$

Table 26

Teacher Social Communication Model Summary

	B	*SE*	*t*	95% LLCI	95% ULCI
Constant	59.492	.650	91.561*	58.217	60.767
IQ (covariate)	.005	.008	.755	-.001	.021
Anxiety	.263	.028	9.545*	.210	.317
Age	.004	.005	.785	-.006	.015
Age X Anxiety	< .001	.001	.574	-.001	.002
Social Communication	.247	.021	11.887*	.210	.288
Social Communication X Anxiety	< .001	.002	1.206	-.002	.007
Social Communication X Age X Anxiety	< .001	.001	-.298	-.001	.001

Dependent variable = Teacher report aggression. * = $p < .001$.
$R = .48$, $R^2 = .23$, $F(8, 1170) = 43.93$, $p < .001$

Table 27

Teacher Social Mannerisms Model Summary

	B	*SE*	*t*	95% LLCI	95% ULCI
Constant	59.013	.629	93.878*	57.779	60.246
IQ (covariate)	.011	.008	1.511	-.003	.026
Anxiety	.184	.028	6.619*	.129	.239
Age	.003	.005	.565	-.007	.023
Age X Anxiety	.001	.001	1.004	-.001	.002
Social Mannerisms	.464	.031	15.068*	.404	.525
Social Mannerisms X Anxiety	.004	.004	1.134	-.003	.011
Social Mannerisms X Age X Anxiety	< .001	.001	-.427	-.002	.001

Dependent variable = Teacher report aggression. * = $p < .001$.
$R = .53$, $R^2 = .28$, $F(8, 1170) = 55.75$, $p < .001$

Table 28

Teacher Social Motivation Model Summary

	B	*SE*	*t*	95% LLCI	95% ULCI
Constant	61.179	.674	90.802*	59.857	62.500
IQ (covariate)	-.015	.008	-1.873	-.031	.001
Anxiety	.294	.031	9.591*	.234	.354
Age	-.001	.006	-.245	-.013	.010
Age X Anxiety	.001	.001	.820	-.001	.002
Social Motivation	.181	.042	4.364*	.100	.263
Social Motivation X Anxiety	.001	.005	-.63	-.008	.010
Social Motivation X Age X Anxiety	-.001	.001	.431	-.003	.001

Dependent variable = Teacher report aggression. * = $p < .001$.
$R = .38$, $R^2 = .15$, $F(8, 1170) = 25.05$, $p < .001$

Discussion

Our main objectives were to assess the associations that aggression has with anxiety, social impairment, cognitive level, and age. This objective was split into questions of how these associations were observed in clinically relevant groupings, simple linear relationships, when grouped together in a multiple regression, and when used in a moderation analysis.

When examining groups based on clinically relevant categories, we found that neither age group nor level of intellectual disability were associated with parent-measured aggression. Our results for age deviate from some previous research that has found externalizing problems are lower in adolescents than younger children, although previous studies have relied on parent measures of aggression, which were not statistically significant in our study (Niditch et al., 2012; Vaillancourt et al., 2016). Other researchers have also failed to find correlations between age and parent-measured aggression, so this result is not completely unexpected as there are conflicting results in the literature (Oubrahim & Combalbert, 2021). Teachers, however, observed participants in middle-childhood and adolescence had higher levels of aggression than those in early-childhood while youth with mild to profound intellectual disability had higher levels of aggression than those in the borderline range who then had higher levels of aggression than those in the average range of cognitive functioning. While these differences in teacher-ratings were statistically significant, it should be noted that they were relatively small in magnitude and should be interpreted cautiously.

It is possible the lack of age-based effects in the parent group may be due to our choice of measurement for aggressive behaviour. The Achenbach forms of assessment have a variety of different items that assess relational aggression (e.g., noncompliance, verbal threats) and direct aggression (e.g., hitting). It is possible that youth may switch from direct to relational forms of aggression as they develop which may result in an effect of age on aggression not being shown when using this measure. It could be interesting in future research to examine individual items or clusters of items separately. What this is unable to explain is why teachers noticed more aggression in older participants albeit only of relatively small magnitude.

Our results for the effect of cognitive functioning also had some differences from the literature, as previous research has found intellectual disability is associated with more parent-rated behaviour problems (Esteves et al., 2021; Matson & Rivet, 2008). It should be noted that our study did not include measurements of adaptive behaviour and only used IQ score guidelines as a measure for intellectual disability, which may have compromised the validity of our groupings as adaptive behaviour must also be considerably impaired for the diagnosis of intellectual disability to be made (APA, 2013). It is possible these results are also related to the Achenbach's emphasis on direct and relational aggression, in which relational aggression may be more common in youth without intellectual disability while direct aggression is more common in those with intellectual disability. While previous research investigating intellectual disability and different types of aggression is sparse, Oubrahim and Combalbert (2021) found that relational aggression is higher in children with intellectual disability alone when compared to children with intellectual disability and autism, indicating that different types of aggression can vary with the diagnoses investigated in this study. Again, this measure-based hypothesis does not fit with our finding on teachers who did notice a small but consistent increase in aggression from youth in the normal IQ range to youth in the borderline ID range, and then from youth in the borderline range to youth with mild to profound ID. This may be due to the difference in environments in which the participants are being observed, as the increase in schoolwork demands could be associated with greater stress and therefore more aggressive behaviour in youth with ID, who may struggle more with academic-related demands due to their ID. While the effects found in the teacher analysis were not large, it still may be of importance to further understand why this effect occurs as student supports that aim to prevent aggressive behaviour in youth with autism and ID

could be used to minimize school-related distress and provide more accessible learning opportunities.

When using subgroups based on clinical severity of anxiety as the independent variable, parents and teachers both reported the lowest levels of aggression when anxiety scores were in the non-clinical range, more aggression when anxiety scores were in the borderline range, and reported the most aggression when anxiety problems were in the clinically significant range on the Achenbach. A similar pattern was found for social impairment in which low social impairment was associated with the lowest levels of aggression, mild social impairment with the second lowest, moderate social impairment with the second highest, and severe social impairment was associated with the highest levels of aggression. Using the continuous scores, for both social impairment and anxiety the standardized effect size measure indicated a medium to large magnitude and the mean differences between groups indicated these differences were clinically significant. These results fit with previous research which has found anxiety is strongly associated with aggressive behaviour in youth with autism and typically developing youth (Sullivan et al., 2019). While there is less literature examining social impairment and aggression in youth with autism, what has been published suggests a positive relationship between the two (Lordo et al., 2017).

The magnitude of the differences in aggression associated with anxiety and social impairment appears to hold clinical significance as those with clinical levels of anxiety and severe levels of social impairment were, on average, approaching the borderline cutoff for clinically significant aggression problems as opposed to those with mild social impairment and non-clinical levels of anxiety who, on average, were well within the normal range for aggression problems. There are a variety of reasons for why each of these relationships may exist which will

be explored here. In typically developing youth, anxiety has been reported to result in subsequent aggressive behaviour (Granic et al., 2014). It is possible this relationship also occurs in youth with autism and may present a significant problem given the high rates of clinically significant anxiety and aggressive problems in this population. Considering that anxiety-based treatments in typically developing youth have been reported to reduce aggressive behaviour, it is possible treatment of anxiety will also reduce aggressive behaviour problems in youth with autism (Granic et al., 2014). This does present some problems though, as many youths with autism are nonverbal and have intellectual disability which may result in problems when administering treatments such as cognitive behavioural therapy which typically rely heavily on cognitive understanding and verbal language skills as opposed to completely behavioural treatments which are more common in this population.

There is also the possibility that anxiety and aggression both stem from similar root causes, such as trouble regulating emotions. Anxiety and aggression have also been associated with broader emotion dysregulation in typically developing youth which may explain why they are also associated with each other in youth with autism (Paulus et al., 2021). Considering youth with autism often have trouble regulating their emotions, it is possible that those with severe emotion dysregulation experience anxiety and aggression as a consequence of this rather than anxiety resulting in subsequent aggression (Mazefsky et al., 2013). It is possible that the relationship of social impairment with aggression is similar to that with anxiety in which there are possibilities that are causal in nature but also that they could both be related to similar underlying problems. Social impairment could result directly in aggressive behaviour in situations such as the aggressor not understanding why their actions may harm others or if their social interactions are unskilled or negative which then may lead to confrontational behaviour.

While there is less research on the relationship between social impairment and aggression in youth with autism, typically developing youth with conduct problems can have trouble understanding social situations and social problem solving, which has been identified as a potential mechanism for treatment (Matthys & Schutter, 2022).

Our correlational analyses reflected similar relationships to those found in our analyses that were based on clinical groupings. Parent and teacher rated aggression had a medium positive correlation with each rater's observations of anxiety as well as small-to-medium correlations with impairment in social awareness, social cognition, social communication, social mannerisms, social motivation, and total social functioning. Aggression was not correlated with IQ or age although IQ had a small correlation with parent measured anxiety and age was positively correlated with parent- and teacher- measured anxiety. The correlation between IQ and parent-measured anxiety was expected as previous work has established this as a consistent finding in youth with autism (Davis et al., 2011; Rodas et al., 2017). The relationship between age and anxiety is a bit less clear in the literature as studies of youth with autism have found internalizing problems were lower in adolescence although in typically developing youth anxiety often increases during adolescence (McLaughlin & King, 2016; Vaillancourt et al., 2016). Parent- and teacher-measured anxiety were associated with more social impairment across all subscales albeit with small effects. This effect was expected as previous work has implicated social skills interventions with decreases in anxiety and may reflect a relationship in which a lack of social skills results in subsequent social anxiety from the uncertainty around social situations and negative social relationships (McVey et al., 2016). IQ also had small negative correlations with parent and teacher measures of all social impairment subscales. Lastly, all subscales of our social impairment measure had strong correlations with each other.

Our regression analyses were exploratory in nature and aimed to determine how strong the associations between our main variables and aggression were when they were all included in the same regression equation. The final step in our analysis for the parent measures suggested that age and social motivation impairment had negative associations with aggression while anxiety and social communication impairment were positively associated with aggression. Social cognition and autistic social mannerisms had comparatively small positive associations with aggression as well. When using teacher measures, we found that the final step in our regression suggested social motivation impairment was negatively associated with aggression while anxiety, social communication impairment and autistic social mannerisms were positively associated with aggression. Smaller associations were found in which teacher measured social awareness impairment had a small positive association with aggression and teacher measured social cognition ad a small negative association with aggression. These results were unexpected, particularly around social motivation impairment, as we did not expect any domains of the social responsiveness scale to be negatively associated with aggression even when the influence of the other domains of social impairment were accounted for. It is possible that less social motivation results in less drive to engage in aggressive behaviour with others as well as less time interacting with others in general while those with less impairment in social motivation are more likely to seek out others not only in positive interactions but also negative or less effective ones. Social communication impairment exerting the only positive effect in parents and a shared effect with autistic social mannerisms in the teacher analysis was expected as an inability to effectively communicate with others may lead to maladaptive communicative strategies (e.g., aggression) as well as frustration when failing to communicate effectively, which may then lead to aggression. The relationship between aggression and autistic social mannerisms in the teacher model but not

the parent presents a challenge for interpretation, as this subscale rates the impairment associated with restricted/repetitive behaviours, mannerisms, and interests associated with the autism diagnosis. It is possible that things such as rituals and routines may be more likely to be disrupted in school environments as opposed to home environments where parents are able to accommodate their children's needs more than schools are. Another possibility is that children with sensory issues may be more likely to face aversive stimuli in a school environment such as noises from other children. These disruptions may invoke stress which can sometimes be accompanied by aggressive behaviour which would be observed by teachers but not parents. The finding that anxiety continued to exert an effect when social factors were already accounted for suggests the effect of anxiety on aggression is at least partially separate from the effect exerted by social impairment.

Our regression results indicate the importance of anxiety and social communication as factors associated with aggression in youth with autism at school and at home. While it should be stressed that this study does not provide evidence for causal relationships, these constructs should be investigated more closely in their clinical relationship with aggression as treatments that address anxiety and promote the development of social communicative skills have already been developed and implemented in youth with autism (Schohl et al., 2014). The clinical implications of our findings for social motivation are less clear, as it appears more atypical social motivation is associated with less aggression, although it is possible this may be considered when implementing additional social skills treatments so that participants are taught ways to engage in positive approaches when seeking social contact. In addition to the findings related to social impairment and anxiety, the effect of restricted and repetitive behaviour may have some clinical relevance as well. It is possible that further accommodations at school to minimize

aversive stimuli when possible or forms of exposure therapy could be beneficial assuming our hypothesis for this relationship is correct.

Lastly, in our moderation analyses we found that there were no moderating effects of social impairment or age in the relationship between anxiety and aggression. We had anticipated moderation effects given previous work by Niditich and colleagues (2012) which suggests there are moderating effects of age, cognitive functioning, and social understanding. There are several possibilities for why we had different results, the first of which is sampling differences, as Niditch and colleagues (2012) used a much younger sample (2 to 9 years). It is possible the moderating effects that were found in their study are stronger in younger samples where constructs such as cognitive functioning and social understanding are developing more rapidly than they are later in childhood. Another issue with our analysis is that the subscale of the social responsiveness scale that is most similar to the variable they used (social understanding) is the SRS scale social awareness, which we found to have mediocre internal consistency. It is possible the issue with this measure in our sample caused its moderation effect not to be found and that social understanding/awareness is the only domain of social functioning to exert a moderating effect. Finally, our measure of social functioning, the SRS, was one of autism-related social impairment, not a measure of social skills, and does not measure positive aspects of social functioning. This may have resulted in a diminished effect in our study as we could not identify positive aspects of social functioning which may have driven some of the effect found in Niditch and colleagues' (2012) study.

Limitations

This study had a variety of limitations that should be addressed in future research. The first of these is the use of anxiety and aggression measures that were designed for use in typically

developing youth. This presents a problem because it assumes that the presentation of anxiety and aggression are the same in youth with autism as they are in typically developing youth. While the presentation of aggression has not received as much study there is some evidence to suggest that youth with less severe autism symptoms present their anxiety more similarly to their typically developing peers (Kerns et al., 2014). While issues with anxiety measurements have been investigated, there are also issues with our measurement of aggression as several items on that scale require verbal communication such as making threats. While this may be possible for verbal youth this could present as a problem for minimally or nonverbal participants who would not be able to engage in these behaviours, which then limits the number of items on the measure that are applicable to them. Measurement based limitations were not limited to the Achenbach scales as there are also some issues with the Social Responsiveness Scale that should be remedied in future research investigating social skills and their relationship with anxiety and aggression. The Social Responsiveness Scale was designed for use in youth with autism however this scale takes a deficit-based approach and therefore does not take the presence of social skills strengths into consideration. This limited our ability to incorporate social strengths into our analysis which is problematic as it is possible strengths may also play a role in the relationship between anxiety and aggression. Lastly, we were limited in our conceptualization of intellectual disability in this study. Diagnostic procedure for intellectual disability, as defined by the APA, requires significant impairment on measures of cognitive functioning and adaptive behaviour, the latter of which we did not use in our study. By not including adaptive behaviour in our study, our method of sorting groups based only on IQ severity lacks clinical validity.

In addition to the measurement-based limitations of our study our sample also has some issues that may affect the generalizability of our results. The first of which is that the parents in

our sample were predominantly highly educated and were high earners. Due to the time commitment needed for the Simons Simplex Collection's data collection procedure, it is possible that families with lower socioeconomic status were unable to meet these requirements. It is important for future studies to incorporate more accessible recruitment and participation procedures to ensure that samples are representative of the general population. Our sample also only included simplex families which may also have some impact on the results. While families with one child with autism are common there is also a significant number of families that have more than one child with autism. Considering the parent-report nature of this study it is possible that parents of more than one child with autism may perceive traits such as anxiety and aggression differently due to having another child with autism to use as a point of comparison rather than only typically developing siblings.

Lastly, our study was limited by its cohort-based design that did not allow for longitudinal observations of the development of anxiety and aggression. It is possible that support services and therapies may have changed over time which may then influence the levels of aggression that we see in different age groups. While this result was not observed in parents, teachers did observe small increases in the middle-childhood and adolescent groups when compared to the participants in early-childhood. The influence of cohort effects may also be involved in other variables observed in our study, in particular early interventions or the lack thereof could have long-lasting effects on cohorts in social skills and cognitive functioning (Perry et al., 2013).

Future Directions

Future research investigating anxiety and aggression in youth with autism should seek to clarify whether moderating effects of cognitive and social functioning exist in some segments of the population. This should include examining whether moderation effects are stronger in

younger children when social development is more rapid as well as with measures that assess positive and negative aspects of social functioning rather than taking a purely social-deficit approach. Understanding the skills in children and when the development of aggression and anxiety occur can be useful for developing clinical treatment plans that aim to build upon social skills and target children when they are developing maladaptive behaviours to intervene at the earliest point possible. In addition to these changes, more appropriate and specific measurements of anxiety and aggression could be used to examine the relationship between different subtypes of aggression and anxiety. In particular, it would be interesting to see how these relationships may vary across different levels of cognitive functioning, in which anxiety and aggression may manifest differently in nonverbal youth. By furthering our understanding of how types of aggression and anxiety vary in youth with different levels of needs, appropriate treatment plans can be developed to address the concerns experienced by these specific Subgroups. Lastly, future research should aim to gain more information from the youth themselves on their feelings of anger, frustration, and anxiety across different contexts, whenever possible. Our study showed some differences between parent- and teacher-reports but further context can be given to these differences by understanding why the children behave differently in these contexts. Self-report measures and interviews could also be important for gaining insight into the cognitive mechanisms behind the anxiety and aggression problems observed in youth with autism.

References

Adams, D., Young, K., & Keen, D. (2019). Anxiety in children with autism at school: A systematic review. *Review Journal of Autism and Developmental Disorders*. https://doi.org/10.1007/s40489-019-00172-z

Achenbach, T. M. (1999). The Child Behavior Checklist and related instruments. In M. E. Maruish (Ed.), *The use of psychological testing for treatment planning and outcomes assessment* (pp. 429–466). Lawrence Erlbaum Associates Publishers.

American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.). Washington, DC: Author

Baio, J., Wiggins, L., Christensen, D. L., Maenner, M. J., Daniels, J., Warren, Z., & Dowling, N. F. (2018). Prevalence of autism spectrum disorder among children aged 8 Years - Autism and developmental disabilities monitoring network, 11 Sites, United States, 2014. *MMWR Surveillance Summaries*, *67*(6). https://doi.org/10.15585/mmwr.ss6706a1

Elliott, C. D. (2007). Differential Ability Scales (2nd ed.). San Antonio, TX: Harcourt Assessment. *Canadian Journal of School Psychology*, *22*(1), 128–132. https://doi.org/10.1177/0829573507302967

Braithwaite, K. L., & Richdale, A. L. (2000). Functional communication training to replace challenging behaviors across two behavioral outcomes. *Behavioral Interventions*, *15*(1), 21–36. https://doi.org/10.1002/(sici)1099-078x(200001/03)15:1<21::aid-bin45>3.0.co;2-%23

Bromley, B. E., & Blacher, J. (1991). Parental reasons for out-of-home placement of children with severe handicaps. *Mental Retardation*, *29*(5), 275–280.

Bronsard, G., Botbol, M., & Tordjman, S. (2010). Aggression in low functioning children and adolescents with autistic disorder. *PLoS ONE*, *5*(12). https://doi.org/10.1371/journal.pone.0014358

Constantino, J. N., & Gruber, C. P. (2005). *The Social Responsiveness Scale (SRS). Los Angeles: Western Psychological Services*.

Dagnan, D., & Weston, C. (2006). Physical intervention with people with intellectual disabilities: The influence of cognitive and emotional variables. *Journal of Applied Research in Intellectual Disabilities*, *19*(2), 219–222. https://doi.org/10.1111/j.1468-3148.2005.00262.x

Davis, T. E., Moree, B. N., Dempsey, T., Reuther, E. T., Fodstad, J. C., Hess, J. A., & Matson, J. L. (2011). The relationship between autism spectrum disorders and anxiety: The moderating effect of communication. *Research in Autism Spectrum Disorders*, *5*(1), 324–329. https://doi.org/10.1016/j.rautism.2010.04.015

Davis, T. E., Moree, B. N., Dempsey, T., Hess, J. A., Jenkins, W. S., Fodstad, J. C., & Matson, J. L. (2012). The effect of communication deficits on anxiety symptoms in infants and toddlers with autism spectrum disorders. *Behavior Therapy*, *43*(1), 142–152. https://doi.org/10.1016/j.beth.2011.05.003

Elliott, C. D. (2007). Differential Ability Scales (2nd ed.). San Antonio, TX: Harcourt Assessment. *Canadian Journal of School Psychology*, *22*(1), 128–132. https://doi.org/10.1177/0829573507302967

Ellison, K. (2015). Comparisons: BASC-2 parent and teacher reports for children on the DSM-5 Autism Spectrum. In *ProQuest Dissertations and Theses*.

Farmer, C., Butter, E., Mazurek, M. O., Cowan, C., Lainhart, J., Cook, E. H., & Aman, M. (2015). Aggression in children with autism spectrum disorders and a clinic-referred comparison group. *Autism*, *19*(3), 281–291. https://doi.org/10.1177/1362361313518995

Fischbach, G. D., & Lord, C. (2010). The Simons Simplex Collection: A resource for identification of autism genetic risk factors. *Neuron*. https://doi.org/10.1016/j.neuron.2010.10.006

Fitzpatrick, S. E., Srivorakiat, L., Wink, L. K., Pedapati, E. V., & Erickson, C. A. (2016). Aggression in autism spectrum disorder: Presentation and treatment options. *Neuropsychiatric Disease and Treatment*. https://doi.org/10.2147/NDT.S84585

Gjevik, E., Eldevik, S., Fjæran-Granum, T., & Sponheim, E. (2011). Kiddie-SADS reveals high rates of DSM-IV disorders in children and adolescents with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *41*(6), 761–769. https://doi.org/10.1007/s10803-010-1095-7

Gotham, K., Pickles, A., & Lord, C. (2009). Standardizing ADOS scores for a measure of severity in autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *39*(5), 693–705. https://doi.org/10.1007/s10803-008-0674-3

Granic, I. (2014). The role of anxiety in the development, maintenance, and treatment of childhood aggression. *Development and Psychopathology*, *26*, 1515–1530. https://doi.org/10.1017/S0954579414001175

Hurtig, T., Kuusikko, S., Mattila, M. L., Haapsamo, H., Ebeling, H., Jussila, K., & Moilanen, I. (2009). Multi-informant reports of psychiatric symptoms among high-functioning adolescents with Asperger syndrome or autism. *Autism*, *13*(6), 583–598. https://doi.org/10.1177/1362361309335719

Jack, A., & A. Pelphrey, K. (2017). Annual research review: Understudied populations within the autism spectrum – current trends and future directions in neuroimaging research. *Journal of Child Psychology and Psychiatry and Allied Disciplines*. https://doi.org/10.1111/jcpp.12687

Jepsen, M. I., Gray, K. M., & Taffe, J. R. (2012). Agreement in multi-informant assessment of behaviour and emotional problems and social functioning in adolescents with autistic and Asperger's disorder. *Research in Autism Spectrum Disorders*, *6*(3), 1091–1098. https://doi.org/10.1016/j.rautism.2012.02.008

Kanne, S. M., & Mazurek, M. O. (2011). Aggression in children and adolescents with autism: Prevalence and risk factors. *Journal of Autism and Developmental Disorders*, *41*(7), 926–937. https://doi.org/10.1007/s10803-010-1118-4

Kerns, C. M., Kendall, P. C., Berry, L., Souders, M. C., Franklin, M. E., Schultz, R. T., & Herrington, J. (2014). Traditional and atypical presentations of anxiety in youth with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 44*(11), 2851–2861. https://doi.org/10.1007/s10803-014-2141-7

Lord, C., Rutter, M., Goode, S., Heemsbergen, J., Jordan, H., Mawhood, L., & Schopler, E. (1989). Austism diagnostic observation schedule: A standardized observation of communicative and social behavior. *Journal of Autism and Developmental Disorders, 19*(2), 185–212. https://doi.org/10.1007/BF02211841

Lordo, D., Bertolin, M., L. Sudikoff, E., Keith, C., Braddock, B., & Kaufman, D. A. S. (2017). Parents perceive improvements in socio-emotional functioning in adolescents with autism following social skills treatment. *Journal of Autism and Developmental Disorders, 47*(1), 203–214. https://doi.org/10.1007/s10803-016-2969-0

Luxford, S., Hadwin, J. A., & Kovshoff, H. (2017). Evaluating the effectiveness of a school-based cognitive behavioural therapy intervention for anxiety in adolescents diagnosed with autism spectrum Ddsorder. *Journal of Autism and Developmental Disorders*, *47*(12), 3896–3908. https://doi.org/10.1007/s10803-016-2857-7

Matson, J. L., & Rivet, T. T. (2008). Characteristics of challenging behaviours in adults with autistic disorder, PDD-NOS, and intellectual disability. *Journal of Intellectual and Developmental Disability, 33*(4), 323–329. https://doi.org/10.1080/13668250802492600

Matthys, W., & Schutter, D. J. L. G. (2022). Improving our understanding of impaired social problem-solving in children and adolescents with conduct problems: Implications for

cognitive behavioral therapy. *Clinical Child and Family Psychology Review*. https://doi.org/10.1007/s10567-021-00376-y

McVey, A. J., Dolan, B. K., Willar, K. S., Pleiss, S., Karst, J. S., Casnar, C. L., & Van Hecke, A. V. (2016). A replication and extension of the PEERS for young adults social skills intervention: Examining effects on social skills and social anxiety in young adults with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *46*(12), 3739–3754. https://doi.org/10.1007/s10803-016-2911-5

Moscovitch, D. A., McCabe, R. E., Antony, M. M., Rocca, L., & Swinson, R. P. (2008). Anger experience and expression across the anxiety disorders. *Depression and Anxiety*, *25*(2), 107–113. https://doi.org/10.1002/da.20280

Mullen, E. M. (1995). Mullen Scales of Early Learning, AGS Edition: Manual and item administrative books. *American Guidance Services, Inc.*, 1–92.

Niditch, L. A., Varela, R. E., Kamps, J. L., & Hill, T. (2012). Exploring the association between cognitive functioning and anxiety in children with autism spectrum disorders: The role of social understanding and aggression. *Journal of Clinical Child and Adolescent Psychology*, *41*(2), 127–137. https://doi.org/10.1080/15374416.2012.651994

Oubrahim, L., & Combalbert, N. (2021). Frequency and origin (reactive/proactive) of aggressive behavior in young people with intellectual disability and autism spectrum disorder. *International Journal of Developmental Disabilities*, *67*(3), 209–216. https://doi.org/10.1080/20473869.2019.1640972

Palmer, M., Tarver, J., Carter Leno, V., Paris Perez, J., Frayne, M., Slonims, V., Pickles, A., Scott, S., Charman, T., & Simonoff, E. (2022). Parent, teacher and observational reports of emotional and behavioral problems in young autistic children. *Journal of Autism and Developmental Disorders*. https://doi.org/10.1007/s10803-021-05421-x

Rodas, N. V., Eisenhower, A., & Blacher, J. (2017). Structural and pragmatic language in children with autism: Longitudinal impact on anxiety and externalizing behaviors. *Journal of Autism and Developmental Disorders, 47*(11), 3479–3488. https://doi.org/10.1007/s10803-017-3265-3

Roth, M. E., Gillis, J. M., & DiGennaro Reed, F. D. (2014). A meta-analysis of behavioral interventions for adolescents and adults with autism spectrum disorders. *Journal of Behavioral Education*, *23*(2), 258–286. https://doi.org/10.1007/s10864-013-9189-x

Russell, G., Mandy, W., Elliott, D., White, R., Pittwood, T., & Ford, T. (2019). Selection bias on intellectual ability in autism research: A cross-sectional review and meta-analysis. *Molecular Autism*. https://doi.org/10.1186/s13229-019-0260-x

Schohl, K. A., Van Hecke, A. V., Carson, A. M., Dolan, B., Karst, J., & Stevens, S. (2014). A replication and extension of the PEERS intervention: Examining effects on social skills and social anxiety in adolescents with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *44*(3), 532–545. https://doi.org/10.1007/s10803-013-1900-1

Stith, S. M., Liu, T., Davies, L. C., Boykin, E. L., Alder, M. C., Harris, J. M., & Dees, J. E. M. E. G. (2009). Risk factors in child maltreatment: A meta-analytic review of the literature. *Aggression and Violent Behavior*. https://doi.org/10.1016/j.avb.2006.03.006

Sukhodolsky, D. G., Lecavalier, L., Johnson, C., Smith, T., Swiezy, N., Bearss, K., & Scahill, L. (2020). Anxiety in 3- to 7-year-old children with autism spectrum disorder seeking treatment for disruptive behavior. *Autism*, *24*(2), 400–410. https://doi.org/10.1177/1362361319866561

Vaillancourt, T., Haltigan, J. D., Smith, I., Zwaigenbaum, L., Szatmari, P., Fombonne, E., & Bryson, S. (2017). Joint trajectories of internalizing and externalizing problems in preschool children with autism spectrum disorder. *Development and Psychopathology*, *29*(1), 203–214. https://doi.org/10.1017/S0954579416000043

Vasa, R. A., Mazurek, M. O., Mahajan, R., Bennett, A. E., Bernal, M. P., Nozzolillo, A. A., & Coury, D. L. (2016). Assessment and treatment of anxiety in youth with Autism spectrum disorders. *Pediatrics*, *137*, S115–S123. https://doi.org/10.1542/peds.2015-2851J

Wechsler, D. (2003). WISC-IV Wechsler Intelligence Scale for Children—Fourth Edition. Technical and interpretive manual. *San Antonio, TX: The Psychological Corporation*.

Wechsler, D. (1997). *Manual for the Wechsler Intelligence Scale for children-revised. WASI.*

Weiss, J. A., Thomson, K., Burnham Riosa, P., Albaum, C., Chan, V., Maughan, A., & Black, K. (2018). A randomized waitlist-controlled trial of cognitive behavior therapy to improve emotion regulation in children with autism. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *59*(11), 1180–1191. https://doi.org/10.1111/jcpp.12915

White, S. W., Oswald, D., Ollendick, T., & Scahill, L. (2009). Anxiety in children and adolescents with autism spectrum disorders. *Clinical Psychology Review*. https://doi.org/10.1016/j.cpr.2009.01.003

Wood, J. J., Ehrenreich-May, J., Alessandri, M., Fujii, C., Renno, P., Laugeson, E., & Storch, E. A. (2015). Cognitive behavioral therapy for early adolescents with autism Ssectrum disorders and clinical anxiety: A randomized, controlled Ttial. *Behavior Therapy*, *46*(1), 7–19. https://doi.org/10.1016/j.beth.2014.01.002