The Relation Between Callous-Unemotional Traits and Treatment-Related Variables in a Sample of Adolescents with ADHD

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Abstract

The Relation Between Callous-Unemotional Traits and Treatment-Related Variables in a Sample of Adolescents with ADHD

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Background: Callous-unemotional (CU) traits are associated with lower treatment engagement, more severe symptoms, and worse treatment outcome for youths with disruptive behaviours (Hawes et al., 2014; Perlstein et al., 2023). Another condition that is often comorbid with disruptive behaviour is attention-deficit/hyperactivity disorder (ADHD) (Graziano et al., 2017). Preliminary research suggests that nearly half of youths with ADHD have CU traits. CU traits may similarly predict lower treatment engagement and response for youths with ADHD, but research is lacking. This study examines associations between CU traits and post-treatment ADHD symptoms, reliable improvement, and treatment engagement for youths. **Method:** Data were drawn from a previous study examining the effectiveness of summer treatments for youths with ADHD. Seventy-two youths (M_{age} = 13.04) were assessed at baseline, end of summer treatment, and end of academic year. Multiple and binary logistic regression analyses assessed if CU traits predicted 1) post-treatment ADHD symptoms, 2) reliable clinical improvement in ADHD symptoms, and 3) treatment engagement. **Results:** CU traits did not significantly predict parent- (b = -0.003, p =.509) or teacher-rated (b = 0.020, p =.712) post-treatment ADHD symptoms. Additionally, only parent-rated CU traits positively predicted reliable improvement from baseline to end of summer (b = 0.051, OR = 1.053, p =.048). Finally, CU traits were not a significant predictor of treatment engagement (b = -0.002, p =.663). **Implications:** Overall, the research contributes to understanding of adolescents with ADHD and CU traits and their responsiveness in summer treatment programs.

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The Relation Between Callous-Unemotional Traits and Treatment-Related Variables in a Sample of Adolescents with ADHD

Attention-deficit/hyperactivity disorder (ADHD) is the most common neurodevelopmental disorder, and it is characterized by symptoms of inattention, hyperactivity, and impulsivity (American Psychiatric Association, 2013). These symptoms must be present before the age of 12 and interfere with functioning at school, at home, at work, and in social settings. It is estimated that 8% of children and adolescents around the world have ADHD (Ayano et al., 2023). Childhood ADHD is associated with negative outcomes in adulthood such as substance abuse and higher suicidality (Barkley & Brown, 2008; Barbaresi et al., 2013).

One of the most common comorbidities with ADHD is disruptive behaviour disorders (DBDs). Specifically, a previous study found that 44.2% of adolescents with ADHD had a comorbid DBD (Graziano et al., 2017). DBDs consist of oppositional, aggressive, defiant, and antisocial behaviours, as well as conduct problems (American Psychiatric Association, 2013). Callous-unemotional (CU) traits are a specifier for individuals who have DBDs. These symptoms consist of a lack of empathy, unconcern about one's performance, shallow or deficient affect, callousness, and a lack of guilt (American Psychiatric Association, 2013). This specifier has become increasingly important as research has found that CU traits are related to more severe disruptive behaviour symptoms both before and after treatment in youths with DBDs compared to youths with DBDs alone (Hawes et al., 2014; Perlstein et al., 2023). For example, children and adolescents with CU traits are more likely to commit violent offenses relative to those without CU traits (e.g., Salekin et al., 2004). In another study of youths receiving treatment for conduct problems, it was found that CU traits were associated with violent reoffending during treatment and higher levels of conduct problems at the end of treatment (White et al., 2013).

Moreover, CU traits can differentiate individuals who will develop antisocial behaviours later in life (e.g., Frick et al., 2003).

Although CU traits are less researched in the context of ADHD, there appears to be high comorbidity between ADHD and CU traits. For example, one study found that 44% of adolescents with ADHD have high CU traits (Graziano et al., 2017). Indeed, the Hierarchical Taxonomy of Psychopathology (HiTOP) framework, a dimensional approach to explaining psychopathology, considers ADHD and CU traits as part of the externalizing superspectrum (Kotov et al., 2017; Kotov et al., 2018; Krueger et al., 2018; Krueger et al., 2021), albeit ADHD relates more to disinhibition and CU traits relate more closely to antagonism (Ruggero et al., 2019). Overall, there is strong shared genetic contributions between factors within the externalizing superspectrum (Krueger et al., 2021; Ruggero et al., 2019). In addition, both ADHD and CU traits independently worsen the presence of conduct disorders (Haas & Waschbusch, 2012). Furthermore, children with ADHD and children with CU traits show difficulties in peer relationships as well as elevated aggressive, delinquent, and antisocial behaviours (Piatigorsky & Hinshaw, 2004). In a study that examined the association between ADHD, CU traits, oppositional defiant disorder, and behavioural challenges, researchers found that CU traits significantly predicted parent- and teacher-rated ADHD when the severity of ADHD was low to moderate (Brammer & Lee, 2011). Therefore, the few studies that explore ADHD and CU traits suggest some association, but the study of these two conditions together is lacking. With an understanding that individuals with CU traits are more difficult to treat in the context of DBDs (Frick et al., 2014), this comorbidity may also present a challenge for the treatment of ADHD.

There exists an abundance of research on effective interventions for individuals with ADHD. Broadly, common treatment types include pharmacological, psychosocial, or multimodal (combined) treatments (Abikoff et al., 2004; Van der Oord, 2008; Wolraich et al., 2019). Despite treatments for ADHD being a highly researched topic, treatments thus far have mostly focused on child populations. Few treatments have been specifically developed or adapted for adolescents (Smith et al., 2000). Intervening during adolescence is critical: adolescents with ADHD have been found to confront difficulties related to their first jobs (Barkley et al., 2008), romantic relationships (Flory et al., 2006), crimes (Sibley et al., 2011), and substance use (Molina et al., 2007). Challenges related to organization, study skills, and friendships may worsen (Wolraich et al., 2005) during adolescence. Demands of middle and high school have been found to be associated with sharp increases in ADHD symptoms and academic difficulties (Kent et al., 2011; Langberg et al., 2008). These changes in symptomatology and challenges faced by adolescents highlight the importance to study adolescents with ADHD and interventions that are suitable to them.

In interventions for children and adolescents with ADHD, it is essential that professionals target activities and social interactions in addition to the presence of ADHD symptoms. An intervention with strong efficacy is the Summer Treatment Program (STP; Pelham et al., 2010). STP is an 8-week summer intervention originally developed for children aged 6 to 12 years. The intervention teaches children strategies to improve their organizational and social skills within a summer school setting. STP includes contingency management, in which children are encouraged to practice skills. They also participate in class activities, daily jobs, student council meetings, sports, and summer activities. STP also includes a parent component, in which parents participate in parent management training. Moreover, STP involves consistent communication

between staff and parents to help parents reinforce the behaviours youths learned in the intervention at home.

There exist some studies that evaluate the effects of STP for children with CU traits. In a review by Waschbusch and colleagues (2025), the authors emphasize that STP can be an effective treatment for youth with CU traits. It is believed that the structure and intensity of STP as well as the focus on positive social interactions may help children with CU traits improve their behaviours and interpersonal skills. Tailoring STP to children with CU traits by prioritizing rewards over punishments appear to be beneficial but more research is needed (Waschbusch et al., 2025). The review identified that for children with CU traits, STP is effective for reducing disruptive behaviours, and in some cases, also CU traits. However, children with CU tend to remain impaired post-treatment.

An additional recent study examined STP among young children who had only ADHD, ADHD and DBDs, and typically developing children (Graziano et al., 2025). Children with ADHD and DBD had higher parent-rated and teacher-rated CU traits at baseline compared to children with only ADHD or typically developing children (Graziano et al., 2025). Children with only ADHD also had higher teacher-report baseline CU traits compared to typically developing children. Both ADHD groups improved significantly over time compared to the typically developing group. However, at the 1-year follow-up, children with ADHD and DBDs continued to have significantly more CU traits than children with only ADHD and typically developing children. The authors suggest in order to improve CU traits, behavioural interventions should also target socio-emotional functioning. Although research has evaluated the effectiveness of STP for children with CU traits, it has not been examined in adolescent populations.

STP has been adapted for adolescents, known as Summer Treatment Program – Adolescent (STP-A; Sibley et al., 2011). Adaptations strive to account for developmental differences between the age groups (Sibley et al., 2011) and aim to help adolescents develop skills in academic, social, and behavioural domains. A major focus of STP-A is to teach academic and organizational skills that are required for high school such as note taking, study skills, and planning with an agenda. The types of social skills that are taught relate to employment, social and romantic relationships, participating in extracurricular activities, substance use, and fundraising. In addition to parent management training, STP-A emphasizes parent-teen collaboration and increased overall parental involvement (Sibley et al., 2011).

In the first randomized controlled trial (RCT) of STP-A, Sibley and colleagues (2018) explored the effectiveness of high versus low intensity summer treatments for adolescents with ADHD. The treatment was found to be beneficial for both groups. Specifically, the high intensity group outperformed the low intensity group in terms of note taking, contingency management, and parent-rated ADHD symptoms (i.e., symptom improvement) for youths. The high intensity group benefitted more than the no treatment group for parent-rated organization problems, parent-teen conflict, and grade point average. However, no differences emerged between groups for a few outcomes, including teacher-rated ADHD symptoms. In addition, STP-A has been perceived positively by both adolescents and their parents (Sibley et al., 2011).

While the effects of STP-A on treatment engagement are unknown, treatment engagement has long been considered an important factor for positive therapeutic effects and has been found to be associated with improving symptoms and creating change for youth with DBDs (Florsheim et al., 2000; Kazdin et al., 2005). It is considered a multidimensional construct composed of observable behaviours, attitude about treatment, relationships with those involved

in treatment, and thoughts and beliefs about treatment (Englebrecht et al., 2008; Hawke et al., 2005). Key factors to consider when measuring treatment engagement include attendance, therapeutic alliance, active participation, homework completion, and treatment credibility (Becker et al., 2018, 2015; Garland et al., 2012; Stevens et al., 2006). Treatment engagement has been found to be difficult for adolescents with ADHD, especially in terms of treatment attrition (Johnson et al., 2008). Even when treatments include elements to increase engagement, the engagement outcomes have not been optimal. For example, in a RCT on a motivational interviewing enhanced behavioural therapy for adolescents with ADHD, parent attendance in parent-adolescent sessions was 74.2% compared to 45.7% in usual care (Sibley et al., 2021). While this engagement-focused treatment improved treatment engagement, they still did not attend about 26% of treatment sessions (Sibley et al., 2021). In a study that examined engagement barriers for interventions for adolescents with ADHD, main barriers included attitudes about treatment (i.e., little interest in participating), lack of parent monitoring of skill practice, forgetfulness, and a lack of belief that behaviour change was needed (Sibley et al., 2023).

Additionally, research has demonstrated that youths with CU traits display less participation and poorer quality of participation in treatment compared to those without CU traits (Falkenbach et al., 2003; Hawes & Dadds, 2005; O'Neill et al., 2003). In a study that examined treatment engagement in a sample of detained female adolescents, Colins and colleagues (2017) found that self-reported CU measured dimensionally was negatively associated with various components of treatment engagement, including readiness to change, rapport with treatment staff, collaboration, and therapeutic engagement (e.g., 'I am willing to talk about my feelings during my stay here'). This association remained statistically significant after controlling for the

shared variance of CU and conduct disorder. It is important to note, however, that parent-rated CU was not found to significantly predict treatment engagement. In sum, adolescents with ADHD and adolescents with CU traits have been found to independently (a) be at increased risk for poorer treatment engagement, and (b) experience increased engagement barriers. The same pattern may be evident among adolescents with ADHD and comorbid CU traits, but to our knowledge, treatment engagement has not been studied in this population.

Taken together, there is limited research examining ADHD and CU traits together and the impact of CU traits on treatment response and outcomes for youths with ADHD, especially among adolescents. Further, treatment engagement has not been examined in the context of both ADHD and CU traits. To address these gaps, the current study examines: (1a) if CU traits predict post-treatment ADHD symptoms, (1b) if CU traits predict reliable improvement in ADHD symptoms across different phases of treatment, and (2) if CU traits predict treatment engagement for adolescents with ADHD. I hypothesized the following: (1a) higher baseline CU traits will predict higher post-treatment ADHD symptoms, (1b) higher baseline CU traits will predict less ADHD symptom improvements; and (2) higher baseline CU traits will predict lower treatment engagement.

Method

Participants

In the current study, data were previously collected as part of a RCT examining the effectiveness of high-intensity versus low-intensity summer treatments for adolescents (STP-A) with ADHD (Sibley et al., 2018). Participants had to satisfy the following eligibility criteria for the clinical trial: (a) Meet diagnostic criteria for ADHD (according to DSM-IV-TR), (b) Be in the summer before Grade 6 or 9, (c) Exhibit notable academic difficulties (according to teacher

report), (d) Have an intelligence quotient (IQ) of at least 75, and (e) Have no diagnosis of autism spectrum disorder. The clinical trial consisted of 325 participants that attended public schools in Florida. This school district is one of the largest in the United States which is noteworthy as it includes rural, suburban, and urban neighbourhoods. It is also one of the most ethnically diverse neighbourhoods in the United States. The adolescents were recruited in four cohorts. The first three cohorts (n = 218) obtained treatment and the fourth cohort was a control group (n = 107). In the treatment cohorts, half were randomized to a low-intensity intervention and half to a high-intensity intervention (n=109 for each group).

Descriptive Statistics and Sociodemographic Characteristics

The current study included participants from Cohort 1, as the data on CU traits is only available for this cohort. In all, there were 72 youths. At baseline, children were 10- to 16-years old (M_{age}= 13.04, SD_{age}= 1.64) and were rising 6th and 9th graders (M_{grade} = 6.42, SD_{grade} = 1.51). For the grade breakdown, 53.52% (n = 38) of children were rising 6th graders. Thirty-seven youth received low-intensity treatment and 35 received high-intensity treatment. Child participants were predominantly male (68.5%; 50 boys, 22 girls) and of Hispanic or Spanish American ethnicity (69.4%). Largely, children were diagnosed with inattentive (41.7%) or combined (56.9%) type ADHD. Nearly half of the sample (n = 32; 44.4%,) also met criteria for Oppositional Defiant Disorder (ODD) and over one third of the sample (n = 25; 34.7%) had elevated CU traits. Most children were not on stimulant medication (n = 44; 61.11%). The demographic characteristics of this cohort are comparable to those of the full sample (Sibley et al., 2018). See Table 1 for a complete depiction of the sociodemographic characteristics of this study's sample.

Table 1

Sociodemographic Characteristics of Sample (n = 72)

Age at baseline, *M* (SD)	13.04 (1.64)
Grade at baseline, *M* (SD)	6.42 (1.51)
Rising 6th grader	38 (53.52)
Rising 9th grader	33 (46.48)
IQ, *M* (SD)	94.07 (11.86)
Gender, *n* (%)	
Female	22 (30.6)
Male	50 (69.4)
Stimulant medication status, *n* (%)	
No medication	44 (61.11)
Medication	28 (38.89)
Treatment Group, *n* (%)	
Low-intensity summer treatments	37 (51.39)
High-intensity summer treatments	35 (48.61)
Ethnicity, *n* (%)	
White (not Hispanic)	6 (8.3)
Black of African American	13 (18.1)
Hispanic or Spanish American (Mexican, Puerto Rican, Cuban, or Latin American)	50 (69.4)
Mixed Race	3 (4.2)
Parent Education, *n* (%)	
High School or Less	22 (30.6)
Some College (Two-year degree or trade school)	25 (34.7)
Bachelor's Degree	17 (23.6)
Graduate Degree	8 (11.1)
Parent Language, *n* (%)	
English	56 (77.8)
Spanish (non-English speaking)	16 (22.2)
Class Placement, *n* (%)	
Regular Education	52 (72.2)
Regular and Special Education	17 (23.6)
Advanced/ Gifted	3 (4.2)
ADHD Diagnosis, *n* (%)	
Inattentive	30 (41.7)
Hyperactive/ Impulsive	1 (1.4)
Combined	41 (56.9)

ODD diagnosis, *n* (%)	32 (44.4)
CD Diagnosis, *n* (%)	5 (6.9)
Elevated CU traits, *n* (%)	25 (34.7)
Female	11 (50.0)
Male	14 (28.0)

Notes. *M* represents the mean of the criterion in the sample. SD represents the standard deviation of the criterion in the sample. *n* represents the number of participants that meet each criterion. % represents the valid percentage of participants that meet each criterion.

Measures

Callous-Unemotional (CU) Traits

Callous-Unemotional (CU) traits were measured at baseline using the Inventory of Callous-Unemotional Traits parent report (ICU; Frick, 2003). The scale consists of 24 items that aim to identify CU traits in youth and adolescents. Each item is rated on a 4-point Likert scale ranging from 0, *not at all true,* to 3, *definitely true.* For this scale, a total score was computed by summing each of the responses for the 24 items. The Cronbach alpha for the total score in our sample is 0.877. High versus low CU traits were determined based on sex-specific normative cutoffs suggested by Kemp and colleagues (2019; 2023) for descriptive purposes. As such, a cutoff of 34 was used for males and a cutoff of 30 was used for females.

Attention-Deficit/Hyperactivity Disorder (ADHD) Symptoms

Attention-deficit/hyperactivity disorder (ADHD) symptoms were examined with the Disruptive Behavior Disorder (DBD) rating scale, parent and teacher reports (DBDRS; Pelham et al., 1992). This questionnaire consists of 45 items related to ADHD (with inattention and hyperactivity/ impulsivity symptoms measured separately), oppositional defiant disorder, and conduct disorder. The symptoms included are based on the Diagnostic and Statistical Manual of Mental Disorders fourth edition (DSM-IV). The DBDRS employs a four-point Likert scale, from 0, *not at all*, 1, *just a little*, 2, *pretty much*, and 3, *very much*. An item/ symptom is considered to be endorsed if it is rated as a 2, *pretty much*, or a 3, *very much*. For this study, nine items related to inattention and nine items related to hyperactivity/ impulsivity were used. The number of endorsed items was summed to indicate a total symptom count of inattention and hyperactivity/ impulsivity. ADHD symptoms were assessed at baseline, post summer treatment, and end of academic year. For parent-rated data, Cronbach alphas were 0.936, 0.897, and 0.921, for

baseline, end of summer, and end of year, respectively. For teacher-rated data, Cronbach alphas were 0.909, 0.939, and 0,946, respectively.

Treatment Engagement

Treatment engagement was evaluated using the Family Participation Inventory, rated by the STP-A therapist (Sibley et al., 2013a). There were 10 items: half of the items related to the parents' engagement and half related to the adolescents' engagement. Items were rated on a seven-point Likert scale. Depending on the question, the Likert scale varied from 1, *not at all* effectively, to 7, *very effectively*, from 1, *very negative*, to 7, *very positive*, or from 1, *very difficult*, to 7, *very easy*. Higher scores suggest more treatment engagement. A total score was calculated. Treatment engagement was assessed at the end of the academic year. The Cronbach alpha for this scale in our sample is 0.974.

Procedure

For recruitment, schools that were part of the district referred their students directly. More precisely, in the spring before the study began, the research team provided study information and forms to the district's elementary and middle school counselors, special education teachers, and administrators. These staff nominated students in accordance with parent permission. After students were nominated, research assistants contacted their parents via the phone to complete a short screening about ADHD symptoms and their impairment. To move onto the next stage and complete an eligibility assessment, adolescents were required to endorse a minimum of four symptoms of inattention or hyperactivity/ impulsivity as rated by parents and teachers and have impaired academic difficulties. Following the screening, an ADHD assessment was conducted through parent diagnostic structured interviews as well as the completion of

questionnaires about symptoms and impairment levels by parents and teachers. Participants had to meet diagnostic criteria for ADHD to be eligible to participate.

Participants were randomly assigned to the high-intensity or the low-intensity group. The high intensity group consisted of 360 hours of STP-A, 12 hours of parent training, daily phone calls between parents and teachers with a written summary, and consultation during the following school year, if needed. In the low-intensity group, adolescents received 12 hours of a summer treatment program (1.5 hours per week for 8 weeks), 12 hours of parent training, and the same consultation as the high-intensity group during the following school year, if needed (Sibley et al., 2018). Throughout the study, adolescents were allowed to take medication and participate in other psychosocial interventions of their choice. Participants completed assessments at baseline, end of summer, and end of academic year. End of summer corresponded to the completion of youth and parent groups, but participants continued with school consultation throughout the ensuing year. End of academic year corresponded to end of all treatment.

Analytic Plan

Prior to conducting data analyses, data preparation and screening procedures were completed using SPSS version 29. Data analyses were conducted on JASP 0.19.3 (Apple Silicon). For CU traits, there was 0% missing data. For covariates, missing data ranged from 0% for gender, treatment group, parent-rated ADHD symptoms at baseline to 1.4% for grade and teacher-rated ADHD symptoms at baseline. For outcome variables, missing data ranged from 6.9% for treatment engagement to 23.6% for teacher-rated reliable improvement from end of summer to end of year. Missingness was treated with listwise deletion. Screening identified 0-2 outliers. Analyses were conducted with and without the outliers. When results generally followed the same pattern with and without outliers, outliers were retained in the model. When results

differed with and without outliers, the model was reported without the outlier(s). As such, for 2 out of 9 models (i.e., teacher-rated reliable improvement from baseline to end of summer and baseline to end of year), the outliers were removed.

For aim 1a, two multiple regression analyses were conducted to determine how CU traits predicted end of year parent-rated ADHD symptoms and teacher rated ADHD symptoms separately. The predictors included in the model were: treatment group, grade, gender, medication status, baseline ADHD symptoms, and baseline CU traits.

For aim 1b, reliable change indices were calculated for each pair of timepoints (i.e., baseline to end of summer, end of summer to end of year, and baseline to end of year) using formulas from Horswill (n.d.) and Jacobson and Truax (1991)[1]. These indices were calculated for parent- and teacher-rated ADHD data. A cutoff of 1.96 was used to indicate reliable improvement, as it equates to the 95% confidence interval (Iverson, 2019). Thus, those who obtained a score greater than 1.96 were considered to have reliably improved and were coded as '1', and those who scored less than or equal to 1.96 were coded as '0'. Then, six binary logistic regression analyses were computed in which the reliable improvement indices were the dependent variables. The same independent variables were used as in aim 1a, except for baseline ADHD symptoms as it is included in the calculation of reliable improvement.

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[1] [1]The formulas to calculate RCI were the following: $SE_{difference} = SD\sqrt{(2 - r1 - r2)}$ and $RC = \frac{X_2 - X_1}{SE_{difference}}$, where $SE_{difference} = Standard\ error\ of\ the\ difference, SD = Standard\ deviation, r1\ \&\ r2\ reliability\ of\ ADHD\ symptom\ scale\ at\ different\ time\ points, RC = Reliable\ clinical\ index, and\ X1\ \&\ X2 = Mean\ scores\ of\ tests$

For aim 2, a multiple regression analysis was conducted with baseline CU traits as the predictor and end of year treatment engagement as the outcome, including treatment group, grade, gender, medication status, and baseline ADHD symptoms as covariates.

When homoscedasticity and normality of residuals were violated for multiple regression or when linearity of a continuous variable with the logit of the dependent variable was violated, variables were logarithm-transformed. Overall, in 2 of 3 multiple regression analyses (i.e., parent-rated ADHD symptoms and treatment engagement), the outcome variable was log-transformed. For one of six binary logistic regression analyses (i.e., parent-rated reliable improvement from end of summer to end of year), CU traits were log-transformed. For all analyses, covariates were coded as follows. For treatment group, low-intensity was coded as '0' and high-intensity was coded as '1'. For grade, rising 6th graders were coded as '0' and rising 9th graders were coded as '1'. Additionally, females were coded as '0' and males were coded as '1'. Lastly, those who did not take stimulant medication were coded as '0' and those who took stimulant medication were coded as '1'.

Results

CU Traits Predicting End of Year ADHD Symptoms

Parent-Rated ADHD Symptoms

The overall regression model was significant, $F(6,54) = 5.548$, $p < .001$ (See Table 2). The model explained 38.1% of the variance in log-transformed parent-rated ADHD symptoms. Only parent-rated baseline ADHD symptoms were found to significantly predict parent-rated end of year ADHD symptoms ($b = 0.053$, $p < .001$), such that higher baseline ADHD symptoms predicted higher end of year ADHD symptoms. Baseline CU traits did not significantly predict end of year ADHD symptoms.

Table 2

Multiple Linear Regression Predicting End of Year ADHD Severity and Treatment Engagement.

	Parent-Rated ADHD Symptoms			Teacher-Rated ADHD Symptoms			Treatment Engagement		
Predictor	*b*	*p*	95% *CI*	*b*	*p*	95% *CI*	*b*	*p*	95% *CI*
Treatment group	-0.006	.947	[-0.189, 0.201]	-0.907	.434	[-3.210, 1.397]	0.235	.001**	[0.095, 0.375]
Grade	0.035	.723	[-0.162, 0.232]	1.543	.192	[-0.797, 3.884]	0.143	.045*	[0.003, 0.284]
Gender	0.133	.220	[-0.082, 0.348]	1.421	.261	[-1.086, 3.928]	0.034	.655	[-0.119, 0.187]
Medication status	-0.006	0.952	[-0.207, 0.195]	-0.030	0.980	[-2.401, 2.342]	0.005	.942	[-0.144, 0.155]
Baseline ADHD symptoms	0.053	<.001***	[0.032, 0.074]	0.361	.005**	[0.113, 0.608]	$4.169x10^{-4}$	.956	[-0.015, 0.015]
Baseline CU traits	-0.003	.509	[-0.013, 0.007]	0.020	.712	[-0.087, 0.127]	-0.002	.663	[-0.009, 0.005]
	$F(6,54) = 5.548$, $p < .001$***, $R^2 = 38.1\%$			$F(6,55) = 1.847$, $p = .107$, $R^2 = 16.8\%$			$F(6,59) = 2.716$, $p = .021$*, $R^2 = 21.6\%$		

Note

b represents unstandardized regression coefficients. *CI* represents the confidence interval. Baseline ADHD symptoms is the same informant that is used for the outcome in the particular model. The outcomes of parent-rated ADHD symptoms and treatment engagement were log transformed due to violations of homoscedasticity and normality of residuals, respectively. For the treatment group predictor, participants were coded as 0 for 'low intensity summer treatments' and 1 for 'high intensity summer treatments'. Gender is coded as 0 'female', 1 'male'. Medication status is coded as 0 'no medication, and 1 'on medication'.

***p<.001, ** p < .01, * p < .05 (2-tailed).

Teacher-Rated ADHD Symptoms

The overall regression model was not statistically significant, $F(6,55) = 1.847$, $p = .107$ (see Table 2). All of the predictors explained 16.8% of the variance in end of year teacher-rated ADHD symptoms. When examining individual predictors, only teacher-rated baseline ADHD symptoms significantly predicted end of year teacher-rated ADHD symptoms ($b = 0.361$, $p = .005$). Specifically, higher baseline ADHD symptoms predicted higher end of year ADHD symptoms. Baseline CU traits did not significantly predict end of year ADHD symptoms.

CU Traits Predicting Reliable Clinical Improvement in ADHD Symptoms

Parent-Rated ADHD Symptoms

Baseline to End of Summer. The logistic regression model was not statistically significant, $\chi^2(5) = 6.304$, $p = .278$ (See Table 3). The model explained 13.1% (Nagelkerke R^2) of the variance in parent-rated reliable improvement of ADHD symptoms. Of the five predictors, only baseline CU traits were statistically significant. Increasing CU traits was associated with an increased likelihood of reliably improving in parent-rated ADHD symptoms (i.e., a reduction in symptoms) over time. The higher the score on CU traits at baseline, the odds of exhibiting reliable improvement increase by a factor of 1.053.

Table 3

Logistic Regression Predicting Reliable Improvement of Parent-Rated ADHD Symptoms at Different Timepoints.

	Reliable Clinical Improvement											
	Baseline to End of Summer				End of Summer to End of Year				Baseline to End of Year			
Predictor	*b*	*p*	*95% CI*	*OR*	*b*	*p*	*95% CI*	*OR*	*b*	*p*	*95% CI*	*OR*
Treatment group	0.361	.506	[-0.702, 1.423]	1.434	-0.664	.403	[-2.222, 0.894]	0.515	0.147	.783	[-0.896, 1.190]	1.158
Grade	-0.514	.358	[-1.611, 0.583]	0.598	1.094	.173	[-0.478, 2.666]	2.986	-0.266	.625	[-1.330, 0.799]	0.767
Gender	-0.257	.671	[-1.444, 0.930]	0.773	0.339	.701	[-1.393, 2.071]	1.403	-0.450	.442	[-1.599, 0.698]	0.637
Medication status	-0.634	.271	[-1.764, 0.496]	0.530	0.071	.930	[-1.532, 1.675]	1.074	-0.235	.671	[-1.318, 0.849]	0.791
Baseline CU traits	0.051	.048*	[0.001, 0.102]	1.053	-0.301	.868	[-3.858, 3.255]	0.740	0.033	.191	[-0.017, 0.083]	1.034
	$\chi^2(5) = 6.304$, $p = .278$, Nagelkurke $R^2 = 13.1\%$				$\chi^2(5) = 3.299$, $p = .654$, Nagelkurke $R^2 = 9.7\%$				$\chi^2(5) = 2.672$, $p = .750$, Nagelkurke $R^2 = 5.7\%$			

Note

b represents unstandardized regression coefficients. *CI* represents the confidence interval. Odds ratios (OR) are calculated as the likelihood for an individual to demonstrate reliable change from one timepoint to another based on a specific predictor. For the End of Summer to End of Year outcome, CU traits at baseline were log transformed due to a violation of an assumption for a binary logistic regression. For the treatment group predictor, participants were coded as 0 for 'low intensity summer treatments' and 1 for 'high intensity summer treatments'. Gender is coded as 0 'female', 1 'male'. Medication status is coded as 0 'no medication, and 1 'on medication'.

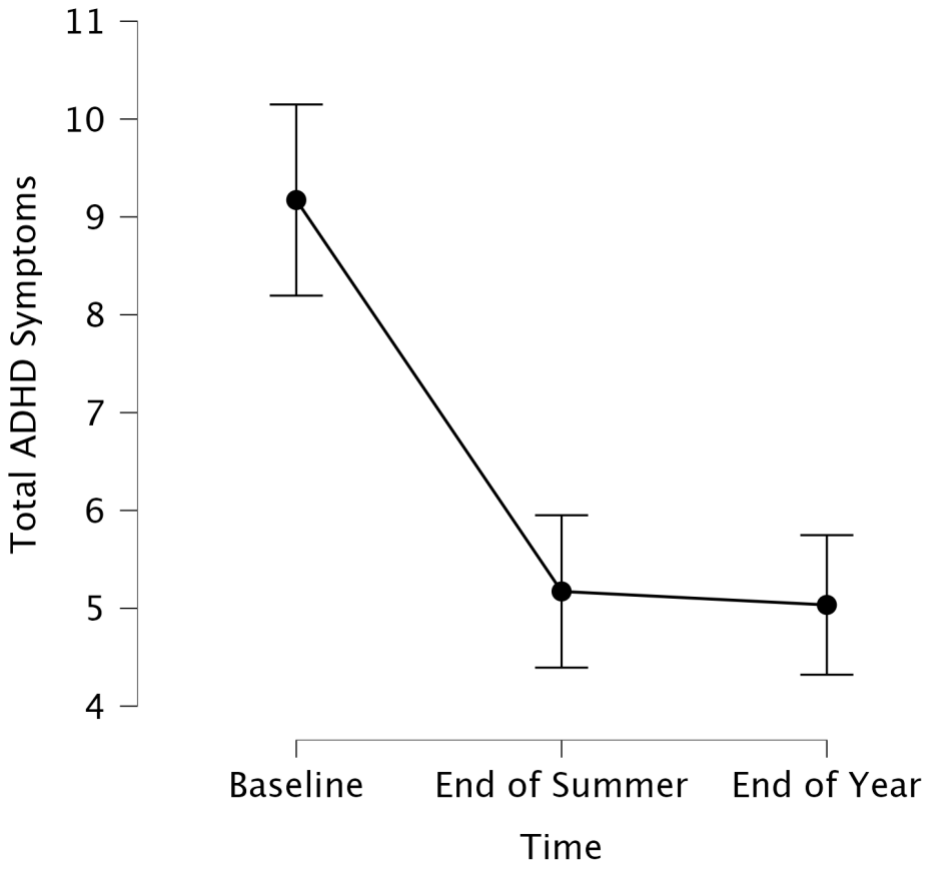
** $p < .01$, * $p < .05$ (2-tailed).

End of Summer to End of Year. The logistic regression model was not statistically significant, $\chi^2(5) = 3.299$, $p = .654$ (See Table 3). The model explained 9.7 % (Nagelkerke R^2) of the variance in parent-rated reliable improvement of ADHD symptoms. None of the predictors were found to be statistically significant. Log-transformed CU traits did not predict reliable improvement in parent-rated ADHD symptoms from end of summer to end of year.

Baseline to End of Year. The logistic regression model was not statistically significant, $\chi^2(5) = 2.672$, $p = .750$ and explained 5.7% (Nagelkerke R^2) of the variance in parent-rated reliable improvement of ADHD symptoms (See Table 3). Nevertheless, none of the predictors were found to be statistically significant. CU traits did not predict reliable improvement in ADHD symptoms from baseline to end of year. The trajectories of parent-rated ADHD symptoms throughout STP-A are shown in Figure 1.

Figure 1

Parent-Rated ADHD Symptom Trajectories throughout STP-A.



Note. Error bars represent the 95% confidence intervals.

Teacher-Rated ADHD Symptoms

Baseline to End of Summer. The logistic regression model was not statistically significant, $\chi^2(5) = 9.262$, $p = .099$ (See Table 4). The model explained 20.7% (Nagelkerke R^2) of the variance in teacher-rated reliable improvement of ADHD symptoms. Of the five predictors, grade was found to be statistically significant. Being a rising 9th grader was associated with a decreased odds of reliably improving in teacher-rated ADHD symptoms compared to a rising 6th grader by a factor of 0.281. CU traits did not predict reliable improvement in teacher-rated ADHD from baseline to end of summer.

Table 4

Logistic Regression Predicting Reliable Improvement of Teacher-Rated ADHD Symptoms at Different Timepoints.

	Reliable Clinical Improvement											
	Baseline to End of Summer				End of Summer to End of Year				Baseline to End of Year			
Predictor	*b*	*p*	*95% CI*	*OR*	*b*	*p*	*95% CI*	*OR*	*b*	*p*	*95% CI*	*OR*
Treatment group	-0.807	.192	[-2.021, 0.406]	0.446	-0.594	.464	[-2.182, 0.994]	0.552	.602	.287	[.506, 1.710]	1.826
Grade	-1.270	.041*	[-2.490, -0.051]	0.281	0.298	.714	[-1.294, 1.890]	1.347	-1.225	.035*	[-2.365, -0.084]	0.294
Gender	0.104	.878	[-1.437, 1.229]	0.901	-0.440	.598	[-2.074, 1.195]	0.644	-1.186	.063	[-2.437, 0.064]	0.305
Medication status	0.774	.229	[-0.487, 2.035]	2.169	-1.015	.272	[-2.827, 0.797]	0.362	-0.280	.631	[-1.424, 0.864]	0.756
Baseline CU traits	-0.046	.099	[-0.100, 0.009]	0.955	0.025	.504	[-0.047, 0.096]	1.025	0.011	.681	[-0.040, 0.062]	1.011
	$\chi^2(5) = 9.262$, $p = .099$, Nagelkurke $R^2 = 20.7\%$				$\chi^2(5) = 2.520$, $p = .773$, Nagelkurke $R^2 = 8.0\%$				$\chi^2(5) = 8.647$, $p = .124$., Nagelkurke $R^2 = 17.6\%$			

Note

b represents standardized regression coefficients. *CI* represents the confidence interval. Odds ratios (OR) are calculated as the likelihood for an individual to demonstrate reliable change from one timepoint to another based on a specific predictor. For the Baseline to End of Summer and Baseline to End of Year outcome, the model is reported without outliers (one was removed from each analysis). For the treatment group predictor, participants were coded as 0 for 'low intensity summer treatments' and 1 for 'high intensity summer treatments'. Gender is coded as 0 'female', 1 'male'. Medication status is coded as 0 'no medication, and 1 'on medication'.

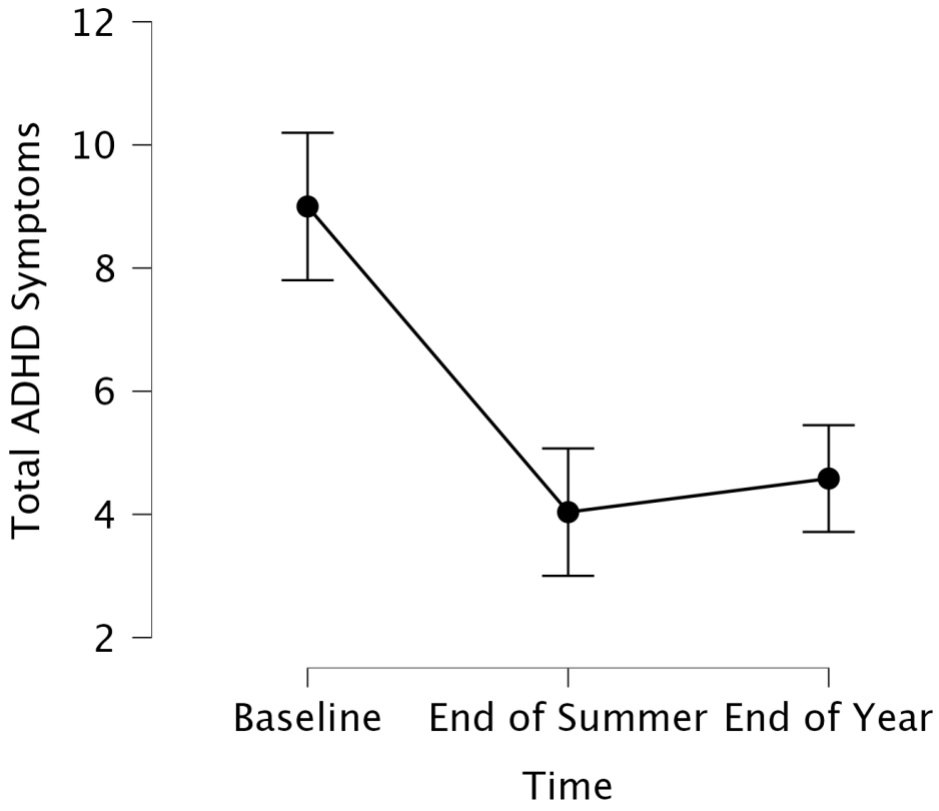
** $p < .01$, * $p < .05$ (2-tailed).

End of Summer to End of Year. The logistic regression model was not statistically significant, $\chi^2(5) = 2.520$, $p = .773$, and explained 8.0% (Nagelkerke R^2) of the variance in reliable improvement of ADHD symptoms (See Table 4). None of the predictors were statistically significant. CU traits did not predict reliable improvement in ADHD symptoms from end of summer to end of year.

Baseline to End of Year. The logistic regression model was not statistically significant, $\chi^2(5) = 8.647$, $p = .124$ (See Table 4). The model explained 17.6% (Nagelkerke R^2) of the variance in reliable improvement of ADHD symptoms. Of the five predictors, only grade was found to be statistically significant. Being a rising 9th grader was associated with a decreased odds of reliably improving in teacher-rated ADHD symptoms compared to a rising 6th grader by a factor of 0.294. CU traits did not significantly predict teacher-rated improvement of ADHD symptoms from baseline to end of year. The trajectories of teacher-rated ADHD symptoms throughout STP-A are shown in Figure 2.

Figure 2

Teacher-Rated ADHD Symptom Trajectories throughout STP-A.



Note. Error bars represent the 95% confidence intervals.

Reliable Improvement in ADHD Symptoms based on CU Cutoffs

For post hoc analyses, normative CU cutoffs were used to split our sample into low versus high CU traits. See Table 5 for a cross tabulation of the frequencies of participants who exhibited reliable improvement at different times based on high versus low CU traits. Overall, the percentages of youth who reliably improved were comparable across high and low CU groups across time, except for baseline to end of summer, in which a greater percentage of high CU youth improved. Generally, the number of high CU youth who reliably improved is lower for teacher-rated ADHD relative to parent-rated ADHD. For both parent- and teacher-rated ADHD, a similar number of youths reliably improved from baseline to end of summer and from baseline to end of year. In contrast, much fewer youth displayed reliable improvement from end of summer to end of year. This pattern was similar for both high and low CU groups.

Table 5

Reliable Improvement in Parent- and Teacher-Rated ADHD Symptoms Based on CU Cutoffs.

	Reliable Clinical Improvement – Parent Rated ADHD					
	Baseline to End of Summer		End of Summer to End of Year		Baseline to End of Year	
	No RI	RI	No RI	RI	No RI	RI
Low CU traits, *n* (%)	25 (75.8)	16 (55.2)	33 (67.3)	5 (55.6)	21 (72.4)	20 (60.6)
High CU traits, *n* (%)	8 (24.2)	13 (44.8)	16 (32.7)	4 (44.4)	8 (27.6)	13 (39.4)
	Reliable Clinical Improvement – Teacher Rated ADHD					
	Baseline to End of Summer		End of Summer to End of Year		Baseline to End of Year	
	No RI	RI	No RI	RI	No RI	RI
Low CU traits, *n* (%)	15 (62.5)	23 (67.6)	29 (63.0)	7 (77.8)	21 (65.6)	20 (64.5)
High CU traits, *n* (%)	9 (37.5)	11 (32.4)	17 (37.0)	2 (22.2)	11 (34.4)	11 (35.5)

Note

n represents the number of participants that meet each criterion. % represents the valid percentage of participants who have improved or not that have high or low CU traits. RI represents reliable improvement. Overall, based on the cutoffs, 25 children demonstrated high CU traits and 47 demonstrated low CU traits.

CU Traits Predicting Treatment Engagement

Treatment engagement was log transformed due to a violation of normality of residuals. The overall model significantly predicted end of year treatment engagement, $F(6,59) = 2.716$, $p = .021$ (See Table 2). The predictors explained 21.6% of the variance in the outcome. Both treatment group and grade were statistically significant predictors. Adolescents who participated in high intensity treatment had higher treatment engagement ($b = 0.235$, $p = .001$), relative to adolescents who participated in low intensity treatment. Additionally, rising 9th grade students had higher treatment engagement ($b = 0.143$, $p = .045$), relative to rising 6th grade students. Baseline CU traits did not significantly predict end of year treatment engagement.

Discussion

The purpose of this study is to explore the relation between CU traits, ADHD, and treatment engagement, outcome, and response in youth who participated in STP-A. This topic warrants an in-depth exploration given the lack of research on comorbid ADHD and CU traits, as well as their interference with adolescents' everyday functioning. This study has two aims. First, I sought to examine how CU traits predict post-treatment ADHD symptoms and reliable improvement in ADHD symptoms across phases of treatment. Second, I sought to investigate how CU traits predict treatment engagement. The findings demonstrate that CU traits did not significantly predict parent- or teacher-rated ADHD symptoms post-treatment. Baseline CU traits significantly predicted reliable improvement for parent-rated ADHD symptoms from baseline to end of summer treatment. Finally, CU traits did not predict treatment engagement.

Based on Perlstein and colleagues' (2023) and Waschbusch and colleagues' (2025) findings that youth with CU traits exhibited more severe disruptive behaviour symptoms before and after treatment compared to those with only DBDs, I hypothesized that higher baseline CU

traits would be associated with higher end of year ADHD symptoms. Contrary to the hypothesis, CU traits did not predict end of year parent- or teacher-rated ADHD symptoms. A potential explanation for the null findings is that the contingency management in the intervention (i.e., the reward schedule based on appropriate behaviour) successfully contributed to a decrease in ADHD symptoms, even for adolescents with CU traits. Research demonstrates that youths with CU traits are less responsive to punishment and more responsive to reward (Dadds & Salmon, 2003; Haas et al., 2011; Perlstein et al., 2023). Given that youth with CU traits are biased towards reward cues, the focus of rewarding good behaviour in STP-A was likely beneficial.

Beyond the reward system of STP-A, the intensity of the intervention may have contributed to similar progress for adolescents with and without CU traits. As part of STP-A, all adolescents received multimodal treatment, which consisted of social skills training, parent training, and as-needed school consultation. Multimodal treatments have been found to be associated with better treatment outcomes for youths with CU traits, especially when parents are involved in treatment (Hawes et al., 2014; Perlstein et al., 2023; Waller et al., 2013). Similarly, the nature of STP is different from most DBD treatments that have been empirically studied. STP-A features a higher frequency and duration that makes it more intense than other interventions such as parent–child interaction therapy (PCIT) and functional family therapy, among others. Moreover, STP-A occurs in academic and social contexts, allowing youths to generalize the skills they learned. In Perlstein and colleagues' (2023) meta-analysis, less than half of the studies included (23/60; 38.33%) involved both child and parent components, or a family component, and only seven studies implemented interventions in naturalistic settings. Due to the increased intensity and naturalistic setting of STP-A, youth with varying levels of CU traits may especially benefit from treatment. Contrastingly, it is possible that CU traits may

predict worse post-treatment ADHD symptoms in other interventions that are less intensive or are single modality.

It is possible that CU traits do predict post-treatment ADHD symptoms, but I was unable to detect this effect in my study. Given the small sample size (parent data: $n = 61$; teacher data: $n = 62$) and the number of predictors included in the models (6), I was underpowered to detect an effect. When I computed post-hoc power analyses, low power was confirmed for parent-rated (0.54) and teacher-rated (0.55) data. Alternatively, there was a limited distribution of scores on the ICU (ranging from 4-49 out of a possible 72), which may have influenced association between CU traits and ADHD symptoms. In sum, it will be important for subsequent research exploring CU traits and ADHD symptoms to address methodological considerations related to power and distribution of data.

Regarding improvements in ADHD symptoms over time, I hypothesized that higher baseline CU traits would predict less improvement in ADHD symptoms. Contrary to hypothesis, baseline CU traits positively predicted parent-rated reliable improvement from baseline to end of treatment. In other words, having higher CU traits was associated with a greater likelihood of showing reliable improvement in terms of parent-rated ADHD symptoms than having lower CU traits. This finding is corroborated by examining the frequencies of youth who showed reliable improvement based on high versus low CU traits. I found that 52% of youth who have high CU traits ($n = 13$) improved while 34% of those who have low CU traits ($n = 16$) improved. It is possible that due to greater severity of symptoms for youths with higher CU traits, youths had more room to improve. The current study's results suggest that youth with CU traits are in fact not resistant to treatment, which aligns with more recent research on treatment response for youth with CU traits. For example, the work of Perlstein and colleagues (2023) and Waschbusch

and colleagues (2025) demonstrates that STP and other multimodal or parent-focused interventions can improve behavioural outcomes for youth with CU traits. More specifically, in a study that looked at patterns and predictors of treatment response for youth with severe behavioural and mental health challenges, adolescents with CU traits improved most in behavioural problems in the shortest time (Pasalich et al., 2022). Although counter to hypothesis, these findings add to the body of literature suggesting that youth with CU traits can benefit from treatment. Thus, this study's findings support the effectiveness of STP-A, even for those with high CU traits, given the high percentage of youth with high CU traits (52%) who reliably improved and the statistical significance of the relation between CU traits and reliable improvement immediately after summer treatment.

While CU traits predicted parent-rated reliable improvement from baseline to end of summer, no association was found from end of summer to end of year, or from baseline to end of year. In the current study, families receive consultation as needed throughout the year, but adolescent treatment, parent training, and daily phone calls stop at the end of summer. The decline in treatment intensity after summer may contribute to the pattern of observed ADHD symptoms from end of summer to end of year. Participants' ADHD symptoms generally decreased from baseline to end of summer, but symptoms fluctuated from end of summer to end of year. This drop-off in treatment gains coincides with a reduction of treatment intensity at the end of summer. This pattern has been seen in previous research on interventions for youth living with ADHD. For example, in the Multimodal Treatment Study of Children with ADHD (MTA), all children exhibited post-treatment improvements (i.e., after 14 months of intervention; Jensen et al., 2007). Nevertheless, the participants lost half of their treatment gains within two years of the start of the intervention (MTA Cooperative Group, 2004) and lost all their treatment gains

within three years (Jensen et al., 2007). Therefore, these data suggest that youth's greatest improvements in ADHD symptoms typically occur at the end of intensive treatment, and then symptoms change gradually in the years after treatment.

Alternatively, adolescents in the study may have plateaued in treatment gains by the end of summer and not demonstrate further improvements during the year, contributing to a lack of association between CU traits and reliable improvements in subsequent time points. The as-needed teacher consultation throughout the year may help adolescents maintain treatment gains after the summer. This pattern may be especially pertinent for youth with CU traits who already had elevated symptoms. Given the similar frequencies of parent-rated reliable improvement in ADHD symptoms from baseline to end of summer and baseline to end of year, the data suggest that at a group level, those who improved in the initial intensive summer treatment phase typically maintained their treatment gains throughout the year. Taken together, these findings highlight the importance of follow-up services for the maintenance of treatment gains in youth with comorbid ADHD and CU traits.

Furthermore, the current study found that CU traits predicted parent-rated but not teacher-rated reliable improvement in ADHD symptoms. The discrepant findings between raters align with those of Sibley and colleagues (2018), who found significant improvements in ADHD symptom trajectories based on parent-rated but not teacher-rated data. These results agree with previous research that parent and teacher ratings are often discrepant and have low to moderate correlations (Antrop et al., 2002; Mitsis et al., 2000; Murray et al., 2007; Sollie et al., 2013; Willcutt et al., 2012; Wolraich et al., 2004). Several factors may explain this observed difference in the current study. First, parents may be more heavily involved in their adolescents' treatment compared to teachers. Parents participate in parent training, communicate regularly with

teachers, and are emotionally invested in their adolescents' wellbeing. Accordingly, parents may be motivated to look for changes in their adolescents' behaviour and symptoms, and they may observe these changes more readily than teachers. In a similar vein, parent training may lead parents to more positive attributions of their adolescent's behaviours, which subsequently influence ratings. Second, teachers have the responsibility to monitor many adolescents' behaviours at once, whereas parents tend only to monitor their own adolescents' behaviours. As such, teachers might only notice or respond to behaviours that stand out or deviate from the norm. Contrastingly, parents may scrutinize their adolescents' behaviours regularly with the goal of monitoring behaviour change. Thus, the close attention that parents pay to their adolescents' behaviours may account for the observed effect of CU traits on parent-rated but not teacher-rated reliable improvement. Overall, despite the discordance between parent and teacher reports, data from both parents and teachers contribute to a rich account of youths' experiences of ADHD and CU traits in different contexts (De Los Reyes, 2009) and should be included in future research.

The finding that CU traits did not predict teacher-rated reliable improvement in ADHD symptoms warrants further exploration. It is possible that adolescents with elevated CU traits did not improve at all or improved at the same rate as those with low CU traits. By cross-tabulating reliable improvement in ADHD symptoms based on CU cutoffs, it appears that youth with low and high CU traits improved at a similar rate. Specifically, 60.53% of youth with low CU traits improved (i.e., 23 out of 38 youths) compared to 55% of youth with high CU traits (i.e., 11 out of 20 youths). The similar rate of improvement between adolescents with low and high CU traits may have limited the effect of CU traits on ADHD treatment response. Perhaps more importantly, the high percentage (i.e., 55%) of participants with high CU traits who reliably

improved in their ADHD symptoms shows promise for the effectiveness of STP-A as a treatment for youth with comorbid ADHD and CU traits.

With regards to treatment engagement, contrary to the hypothesis, CU traits were not a statistically significant predictor. The null finding was surprising given that youth with CU traits often lack concern about their own performance. However, the operational definition of CU traits focuses on a lack of care about rules and laws as well as engaging in antisocial behaviours (Frick & Dickens, 2006). This definition may not extend to personally relevant activities such as therapy. Additionally, as the STP-A intervention actively involves parents and emphasizes parent-teen collaboration, treatment engagement may have been optimized, even for youth with CU traits. Furthermore, it is possible that all participants learned new skills at the beginning of treatment, which may have increased their self-efficacy and promoted their engagement in the rest of the treatment program. This relation has been described in previous studies of behaviour therapy for ADHD (e.g., Evans et al., 2009; Langberg et al., 2013). In relation to the components of the intervention, the rewards involved in STP-A may have helped to engage youth with CU traits. Given that youth with CU traits may be hypersensitive to rewards (Dadds & Salmon, 2003; Haas et al., 2011; Perlstein et al., 2023), the emphasis on rewarding goal-oriented behaviours in STP-A may have contributed to higher overall treatment engagement.

Limitations and Future Directions

Like all studies, this research had some limitations that must be discussed. First, a small sample size and low power may have masked effects that existed. Relatedly, the number of predictors included in the models was restricted by the sample size. Additional predictors such as comorbidities (i.e., ODD and CD diagnoses), ethnicity, and parent or family factors were not included. These variables and their interactions may contribute significantly to the variance in

post-treatment ADHD symptoms, reliable improvement in ADHD symptoms, and treatment engagement. Future research should explore the effects of these variables on STP-A. Similarly, the intention was to conduct latent growth curve models for my statistical analysis for aim 1. However, the models did not converge, and the analytic plan was adapted. Future studies can use latent growth models to better understand the trajectories of ADHD symptoms for adolescents who participate in STP-A, as well as how CU traits will predict these symptom trajectories. Including a control group would also allow for a comparison of the STP-A compared to no treatment/waitlist among high and low CU youths.

Moreover, CU traits were only measured at baseline. Thus, it is unclear how or if the intervention led to changes in CU traits. Future research should collect data on CU traits throughout treatment (i.e., longitudinally) to be able to monitor treatment progress and assess how STP-A affects CU traits specifically. It would be interesting to examine whether resulting changes in CU traits are reliable and clinically meaningful. Given the heightened symptoms of youths with CU traits, future work is needed to determine whether STP-A needs to be tailored for youth with CU traits.

Additionally, participants may have received supplemental services outside of STP-A that may have influenced the results, such as therapy, support, groups, and continuity of medication. This project did not collect data on the services that adolescents and their families sought on their own, which may have impacted their symptoms. Documenting these services may be especially important once the initial, intensive phase of the intervention is complete, as additional services may influence the ability to maintain treatment gains.

Finally, findings of the currently study are limited by four factors that relate to the measurement of predictor and outcome variables. First, only parent-rated data on CU traits were

used in the study. Although parents are believed to be the better informants than youths during adolescence for rating ADHD symptoms (e.g., Du Rietz et al., 2017) and that the reliability of the CU measure in the sample was high ($\alpha = 0.877$), including a multi-informant approach may be beneficial in the future. For ADHD symptoms, inattention and hyperactive/ impulsive symptoms were combined to create a total symptom score. This combination of symptoms may mask the unique profiles associated with the ADHD subtypes. However, given that the majority of the sample had combined ADHD, the difference may have been negligible in this study. Second, findings from this study may be influenced by inconsistent informants in predictor and outcome variables. A shared method effect may contribute to parent-rated findings. CU traits were parent-rated, but ADHD symptoms included parent and teacher reports. Having the same informant in the predictor and the outcome may lead to an inflated observed association and a potential overestimation of the strength of the relation between CU and parent-rated reliable improvement in ADHD symptoms. Third, the measure of treatment engagement included items related to both caregiver and child engagement. Although the reliability of the measure was very high ($\alpha = 0.974$), suggesting that the items measure a unidimensional construct, it is important to look at adolescent and caregiver engagement strategies separately in future studies. Different strategies may be needed to engage different stakeholders of treatment. Fourth, it is also possible that the time at which treatment engagement was measured may have influenced the results. Treatment engagement was measured at the end of the academic year, which is about 10 months after the initial treatment phase was completed, or about one year after the beginning of treatment. In future studies, researchers should consider measuring treatment engagement longitudinally throughout treatment phases. These data could be used to advance knowledge of

how treatment engagement evolves over the course of treatment for adolescents with co-occurring ADHD and CU traits.

Conclusion

This study investigated whether CU traits predicted post-treatment and reliable improvement in ADHD symptoms and treatment engagement for adolescents who participated in STP-A. Findings revealed that CU traits did not predict post-treatment ADHD symptoms but positively predicted parent-rated reliable improvements in symptoms from baseline to end of summer treatment. Additionally, CU traits did not predict treatment engagement for participants. Given that roughly one third of participants had elevated CU traits at the start of treatment and 44-52% of those with high CU traits improved in terms of their ADHD symptoms from baseline to end of summer, results from this study suggest that STP-A is an effective treatment for adolescents with ADHD and CU traits. Overall, this study advances knowledge about the comorbidity between ADHD and CU traits as well as the promise of youth with CU traits to benefit from STP-A. It also contributes to the current literature on the effectiveness of STP for adolescents, which is a group that has not been well-studied. The findings from this study further contribute to recent work dispelling the notion that youths with CU traits are resistant to treatment.

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