

More than Leisure: Organized Activity Participation and Socio-Emotional Adjustment Among Adolescents with Autism Spectrum Disorder

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Abstract Adolescents with high-functioning Autism Spectrum Disorder (HFASD) experience difficulties with socio-emotional adjustment, including compromised friendships, feelings of loneliness, and depression. Using a sample of 127 adolescents with HFASD and their parents, this study is first to examine: (1) relations between organized activity (OA) involvement and adjustment and (2) whether these relations were moderated by social impairment and executive functions. Results indicated that greater intensity, breadth, and academic OA involvement were associated with fewer depressive symptoms. OA intensity was also associated with less loneliness. For adolescents with better emotional control, greater intensity was associated with better friendship quality. Results suggest that for adolescents with HFASD, more involvement in OA is associated with better socio-emotional adjustment even after accounting for risk factors.

Keywords Autism spectrum disorder · Organized activity · Social adjustment

Introduction

Adolescence is a time of increased risk for socio-emotional difficulties, and this developmental period can be particularly challenging for cognitively intact adolescents with Autism Spectrum Disorder (ASD; hereafter referred to as

high-functioning Autism Spectrum Disorder or HFASD). Given their intact cognitive and language abilities (Volkmar and Klin 2005), adolescents with HFASD possess greater self-awareness of their social impairments, which leads to frustration about their differences and often unsuccessful social interactions (Klin et al. 2005). Indeed, youth with HFASD have more socio-emotional difficulties as compared to a neurotypical population including higher levels of depressive symptoms and loneliness as well as poorer friendship quality (e.g., Ghaziuddin et al. 2002; Klin et al. 2005; Locke et al. 2010; Lopata et al. 2010; Strang et al. 2012; Volkmar and Klin 2005).

More specifically, comorbidity rates between ASD and depressive symptoms have been shown to be as high as 53–54 % amongst adolescents with HFASD, which is much higher than rates found in typically developing youth, which are closer to 4–5 % (Kim et al. 2000; Mayes et al. 2011; Ghaziuddin et al. 1998; Solomon et al. 2012; Thapar et al. 2012). In fact, one study found that, in their sample of young adults with HFASD (previously Asperger's Disorder), 70 % reported at least one major depressive episode (Lugnegard et al. 2011) in comparison to the 11.4 % calculated in the 2014 Substance Abuse and Mental Health Services Administration (SAMHSA) national survey on drug use and health (Center for Behavioral Health Statistics and Quality 2015). Research has also consistently found that youth with HFASD report more loneliness than their typically developing peers (Bauminger et al. 2003; Locke et al. 2010; Whitehouse et al. 2009). Friendship quality is thought to become an increasingly valued aspect of friendship during adolescence (Howard et al. 2006). Although research has demonstrated that adolescents with HFASD may have some friends, they typically have fewer friends, and their friendships may be more strained and not always reciprocated (Bauminger and Kasari 2000;

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Bauminger et al. 2003; Kuo et al. 2013). Moreover, studies examining friendship quality specifically have demonstrated that youth with HFASD have lower friendship quality in comparison to neurotypical peers (Bauminger and Kasari 2000; Kasari et al. 2011; Locke et al. 2010). In addition, Pouw et al. (2013) found that peer victimization and negative friendship interactions was higher among adolescent boys with ASD as compared with a neurotypical population, and these negative peer experiences were associated with higher levels of self-reported depressive symptoms. Given the risk of depressive symptoms, loneliness, and poor quality friendships among youth with HFASD, it is especially important to identify normative developmental contexts, such as organized activities (OA), that may facilitate better socio-emotional adjustment.

Organized activities refer to voluntary activities that have regularly scheduled meetings, maintain expectations and rules for participants, involve several participants, offer supervision and guidance from adults, and are organized around developing particular skills or achieving goals (Mahoney et al. 2005). Research with typically developing youth has shown that OA involvement has been linked with positive effects on social and emotional adjustment, including fewer depressive symptoms and less loneliness (e.g., Bohnert and Garber 2007; Fredricks and Eccles 2005; Mahoney et al. 2005; Randall and Bohnert 2009). OAs provide contexts in which adolescents can interact with like-minded peers and feel socially accepted (Bohnert et al. 2013). Indeed, OA involvement allows youth to develop more extensive networks of friends (Feldman and Matjasko 2005). As such, OA participants may feel more socially accepted and experience increased friendship quality (Mahoney et al. 2003; Schaefer et al. 2011). Although most of this prior research has been conducted with neurotypical youth, these findings suggest that OAs may provide structured social opportunities for youth to form and maintain friendships. This may be particularly beneficial for adolescents with HFASD to protect against depressive symptoms and loneliness by providing opportunities to feel socially accepted and connected with peers.

Evidence from prior studies with youth and adults with developmental disabilities suggests potential benefits of OA involvement. For instance, school-based activity participation among youth with developmental disabilities was associated with the development of social skills, increased social interaction, and cooperation with non-disabled peers (Rynders et al. 1993). Similarly, participation in a small group recreational activity intervention (e.g., visiting museums, playing board games, cooking, boating) was associated with increased quality of life among adults with ASD (Hesselmark et al. 2014). McMahon et al. (2013)

review of group-based social skills interventions for individuals with ASD suggested the importance of considering structured activities as a context for social skill development. Finally, there is evidence that adolescents with ASD who spend time with their friends reported greater companionship and higher friendship quality than those who did not spend time with friends (Kuo et al. 2013), suggesting a potential mechanism that explains how involvement in OAs may promote socio-emotional functioning. Given that none of these studies specifically include OA participation with neurotypical peers and adolescents with ASD, the first aim of this study was to describe OA involvement relying on multiple dimensions (i.e., intensity, breadth, and categories of involvement) among adolescents with ASD.

The differential relevance of these various dimensions of OA involvement with typically developing youth has also been well-documented (e.g., Fredricks and Eccles 2006; Bohnert et al. 2010). For example, the more hours a youth spends in OAs (i.e., intensity) the more exposure they have to the positive components of an activity and allows individuals to master skills they have acquired (Hansen and Larson 2007). In contrast, youth who participate in a greater range of different OA (i.e., breadth) gain greater exposure to challenging activities and more opportunities to learn different skills and develop relationships (Hansen and Larson 2007; Bohnert et al. 2010). As is true for neurotypical children, adolescents with HFASD should benefit from both greater OA intensity, which would provide frequent exposure and interactions with typically developing peers and opportunities to build friendships and build social skills, as well as greater breadth of OA involvement which would allow for exposure to a wider variety of peers to build relationships. In addition to these broad indices of involvement, recent work has suggested the importance of examining different types or categories of involvement (i.e., religious, academic, performance, sports, and community/social), as they may provide unique contexts in which to acquire skills and interact with peers (Bohnert et al. 2013). Thus, relying on multiple dimensions of OA involvement, the primary objective of the current study is to examine relations between intensity, breadth, and categories of OA participation and several indices of socio-emotional adjustment (i.e., depressive symptoms, loneliness, and friendship quality).

This study also examined whether the relation between OA involvement and adjustment is moderated by adolescents' degree of social impairment or executive function (EF) capacities, specifically inhibition and emotional control. One of the hallmark features of ASD is social impairment. As a result, youth with ASD often have fewer

social interactions in comparison to their same-aged peers (e.g., Lord and Magill-Evans 1995). A recent review of 235 adults and adolescents with ASD found that only 8.1 % reported interacting with same-aged friends on a weekly basis outside of an OA and 46.6 % of the sample reported having no same-aged friends (Orsmond et al. 2004). In addition, research has consistently shown that youth with HFASD demonstrate impairments in EF in comparison to neurotypical peers (Akshoomoff 2005; Hughes 2011; Russo et al. 2007; Semrud-Clikeman et al. 2014; Verte et al. 2006) and those with Attention-Deficit/Hyperactivity Disorder (ADHD; e.g., Semrud-Clikeman et al. 2010; Hughes 2011). EF include a variety of higher order cognitive skills, but inhibition and emotional control are thought to be especially pertinent to social and emotional functioning (Padmanabhan et al. 2014; Riggs et al. 2006). Indeed, existing literature suggests that deficits in inhibition and emotional control have been reported among children and adolescents with ASD (Konstantareas and Stewart 2006; Verte et al. 2006; Narzisi et al. 2013). Thus, in the present study, a model will be tested in which the relation between OA and socio-emotional adjustment is moderated by social impairment and two forms of EF (i.e., inhibition and emotional control).

Study Aims

Building on work with neurotypical adolescents, this paper describes patterns of OA involvement among a sample of adolescents with HFASD. Next, associations between OA involvement and socio-emotional difficulties among this population were examined. In addition to considering relations between OA involvement and socio-emotional adjustment, the possibility that levels of social impairment and EF (e.g., inhibition and emotional control) moderate the relations between OAs and socio-emotional adjustment in adolescents with HFASD was considered.

Method

Participants and Procedure

Parent and adolescent dyads were recruited through online support groups (e.g., autism focused Yahoo groups), advocacy groups (e.g., Autism Speaks), and clinics throughout the United States. Similar to the method employed by Kuo et al. (2013), the majority of dyads were recruited with the assistance of the Interactive Autism Network (IAN) Research Database at the Kennedy Krieger

Institute and Johns Hopkins Medicine–Baltimore, sponsored by the Autism Speaks Foundation. There was at least one dyad successfully recruited from 40 out of the 50 states. The following inclusion criteria were used: (a) have a DSM-IV-TR diagnosis of ASD (autism, Asperger's Disorder, or Pervasive Developmental Disorder Not Otherwise Specified) made by a qualified professional (e.g., psychiatrist, psychologist, multidisciplinary/developmental team); (b) be between 12 and 17 years of age; (c) be reading at a sixth grade reading level (per parent report, in order to complete the questionnaires); and (d) be able to verbally communicate on a regular basis with family and peers. Additionally, examination of T-scores from the Social Responsiveness Scale, an assessment of social impairment, indicated that all participants had total T-scores ≥ 60 , above which indicates mild to moderate impairment considered typical for children with mild or "high functioning" ASD. 79 % of the sample had T-scores ≥ 76 , which is considered the severe range of impairment and is strongly associated with a clinical diagnosis of ASD (Constantino et al. 2003).

Based on these procedures, 152 families were enrolled in the study; however, families were excluded if at least one of the dyad skipped more than three items on any questionnaire. As such, the final analytic sample included 127 (103 males, 24 females) adolescents previously diagnosed with ASD and their parents/caregivers. There were no significant differences between the analytic and overall sample on demographic and primary study variables ($F_s > 0.25$, $p_s > 0.19$). Of the parents completing the questionnaires, 92.1 % were biological mothers, 5.5 % were biological fathers, 1.6 % were grandmothers, and 0.8 % were adoptive mothers. The average age of the youth was 13.95 (SD = 1.60) with a range of 12–17. The average Full Scale Intelligence Quotient (IQ) was 104.76 (SD = 20.24) based on parent-report of prior IQ testing. The majority of adolescents were Caucasian (86.6 %), followed by Hispanic (4.7 %), Biracial (3.9 %), African American (3.1 %), and Asian (1.6 %). Family income ranged from under \$10,000 to over \$200,000 with the greatest percentage (19.7 %) of families reporting \$40,000–\$69,000. Additionally, within the sample, almost one-third of parents (28.4 %) reported finishing high school or having some college education. The majority of the adolescents' parents were married (61 %), while 23 % were divorced, 3 % were widowed/ered or never married and 10 % identified as "other". Almost one-third of the sample (29.9 %) chose to complete paper surveys and 70.1 % participated online via the Opinion online survey website. Paper measures were entered, checked, and coded by trained graduate and undergraduate students.

Measures

Demographic Information

Parents filled out demographic information including the age, gender, ethnicity, diagnoses, diagnosis date, and most recent IQ score available from test data of their child. Other demographic information included socioeconomic status (SES), parent level of education, and previous psychological testing information including test name, professional who conducted the testing, date of administration, and scores (e.g., IQ, speech and language testing).

Depressive Symptoms

Parents and adolescents completed 15 items from the Achenbach Child Behavior Checklist and the Achenbach Youth Self Report that have been shown to assess parent and self-reported depressive symptoms (CBCL-D and YSR-D: Clarke et al. 1992). Participants read each statement and are instructed to rate whether it is not true (0), somewhat true (1), or very true (2). Statements include “feels worthless or inferior” and “withdrawn, uninvolved with others.” The current study omitted the two questions regarding suicidality (i.e., harms self or attempts suicide, talks about killing self). Raw scores ranged from 0 to 30. Prior studies suggest that the CBCL-D and YSR-D have strong psychometric properties including good internal consistency (Clarke et al. 1992) which is consistent with what was found in the current study ($\alpha = .79$ for both the CBCL-D and YSR-D). Higher scores on these scales indicate higher levels of depressive symptoms. Raw scores were used in all models.

Loneliness

Parents and adolescents completed the Loneliness Scale (LS). Both the adolescent self-report (LS) and parent version (LS-P) include 24 items that assess loneliness. Participants were asked to rate each statement on a 5-point scale from 1 = “not true at all” to 5 = “always true” based on how they have been feeling or think their child has been feeling over the last few weeks. Sixteen of the items are related to loneliness. Examples of statements include “I/My child have/has nobody to talk to.” There are also eight filler items, which include “I like to read.” Raw scores ranged from 16 to 80. Bauminger and Kasari’s (2000) review of the psychometric properties noted an internal consistency of $\alpha = .90$ and this measure has also been specifically used for youth with ASD. The reliability for the current sample was $\alpha = .91$ for the LS and $\alpha = .84$ for the LS-P. Higher scores on the LS indicate higher levels of loneliness.

Friendship Quality

Parents completed the Friendship Quality Questionnaire-Abbreviated Parent edition (FQQ-AP) and adolescents completed the Friendship Quality Questionnaire-Abbreviated edition (FQQ-A). These 21-items assess the quality of an adolescent’s friendship with his or her best friend from either the adolescent or parent perspective. Adolescents and their parents are asked to rate each statement on a 5-point scale from 0 = “not at all true” to 4 = “really true” while thinking of their/their child’s relationship with their best friend. Examples of statements include “my (child’s) best friend makes me (him/her) feel good about my (his/her) ideas.” Raw scores ranged from 0 to 84. The current study also included questions about the number of friends the youth has, how many hours per week/he spends with friends outside of school, as well as the name and age of the youth’s best friend. Previous examination of the original FQQ demonstrates an internal consistency of $\alpha = .91$ (Parker and Asher 1993), which is consistent with what was found in the current study ($\alpha = .89$ for the FQQ-A, $\alpha = .91$ for the FQQ-AP). Higher scores on these measures indicate better quality of friendship.

Organized Activity Involvement

Parents filled out the Organized Activities Inventory (OAI) to assess their child’s current level of participation in OA (i.e., within the last calendar year). For each activity, parents were asked to record the average number of hours the child participates per week in the activity, the number of months they participated in that activity, and whether the activity includes interactions with neurotypical youth or not. Only activities that were considered structured, OA were included. Activities including summer camp or therapeutic activities designed especially for individuals with ASD or other special needs (such as speech and language or occupational therapy) were not included in the final count. As such, all activities were ones that were available to and included neurotypical adolescents. Using established coding schemes (i.e., Bohnert et al. 2013), each OA was coded into one of five mutually-exclusive categories—Religious, Academic, Performance/Fine Arts, Sports, and Community/Service. In total, seven indices of OA involvement were calculated including: overall OA intensity (i.e., average number of hours per week divided by total months of participation), intensity of OA involvement in each category (i.e., number of hours per week in each activity category divided by months of participation), and breadth of OA participation (i.e., number of different categories of involvement).

Social Impairment

Parents completed the Social Responsiveness Scale (SRS) to assess severity of their child's social impairment. The SRS includes 65 items that are rated on a 4-point scale ranging from “not true” to “almost always true.” Parents were instructed to identify how true each statement is, based on their child's behavior over the last 6 months. Examples of items include “would rather be alone than with others,” “plays appropriately with children his/her age”, and “knows when he/she is too close to someone or is invading someone's space.” Composite scores were calculated based on all items included in the SRS. Previous examination of the psychometric properties of the SRS has demonstrated an internal consistency of $\alpha = .83$ over a 27-month period (Constantino et al. 2003), and results were similar in this study ($\alpha = .80$). Higher scores indicated more impairment. Raw scores were used for all models.

Executive Function

Parents completed the Emotional Control and Inhibition subscales of the Behavior Rating Inventory of Executive Function, Parent Report (BRIEF). The Emotional Control and Inhibition indices are 10-item scales where the parent is asked to identify whether each statement is “never,” “sometimes,” or “often true.” Sample items include: “has explosive angry outbursts” and “blurts things out.” Higher scores indicated more problems with emotional control and inhibition. Previous examination of the psychometric properties of the BRIEF subscales have demonstrated a good internal consistency for these two subscales ranging from $\alpha = .92$ to $.94$ in a clinical sample and $\alpha = .89$ to $.91$ in a normative sample (Gioia et al. 2000). This was similar to the reliability for the current sample which ranged from $\alpha = .83$ to $.92$. Raw scores were used for all models.

Results

Descriptive Statistics and Correlations

Missing data were imputed via sample means using PRELIS 2.80 in LISREL 8.80. Data was imputed only if a participant skipped 3 or fewer questions within a measure. Examination of the means and standard deviations for all study variables revealed that all indices of OA intensity (overall and five categories) were significantly skewed. Based on previous literature and recommendations (Howell 2010), a square root transformation was computed and used in all subsequent analyses, which resulted in acceptable levels of skewness.

Descriptive data for parent and adolescent reports of each social-emotional outcome is listed in Table 1, and scores are suggestive of compromised socio-emotional adjustment. In addition, parents and children generally agreed (70 % agreement) on whether the child had a best friend and who the best friend was. Due to the high correlations between parent and adolescent reports (r s ranging from 0.45 to 0.61) for the measures of socio-emotional adjustment, parent and adolescents reports were averaged for depressive symptoms, loneliness and friendship quality, and these composites were used for all subsequent analyses.

Means, standard deviations, and correlations between composite and other study variables are listed in Table 2. Parents reported that their children participated in an average of 1.86 activities ($SD = 1.43$) with an average intensity of 1.96 h per week ($SD = 2.16$) and an average breadth of 1.61 activity categories ($SD = .92$). As has been found in neurotypical populations, adolescents were most likely to participate in sports, with almost half the sample participating in at least one sport for an average of 0.72 h per week. Religious, Academic, Performance/Fine Arts, and Community/Service activities all had lower rates of participation (see Fig. 1).

Using comparisons from research with neurotypical adolescents, adolescents' depressive symptoms were mildly elevated ($M = 0.7$; range 0–2), as were adolescents' levels of loneliness ($M = 27.73$; range 16–80); however, friendship quality was high ($M = 68.32$; range 0–84). In addition, 88 % ($N = 112$) of the adolescents reported having a best friend, and 70 % of the parent–child dyads reported agreement on the child's best friend. Adolescents' social impairment, emotional control, and inhibition all fell within the clinical range (i.e., T-scores ≥ 60).

Significant gender differences emerged only for social impairment and friendship quality. Parents rated females as being significantly more socially impaired ($t = -3.68$, $p < .01$). Conversely, females were rated as having better friendship quality compared to males ($t = -2.89$, $p < .01$). Furthermore, there were significant differences based on mode of participation (online vs paper) for the loneliness and depressive symptoms measures. Participants who completed the paper measures had significantly higher levels of loneliness ($t = -2.14$, $p < .05$) and depressive symptoms ($t = -2.65$, $p < .01$).

Correlational analyses were conducted to examine basic relations among study variables. To correct for multiple comparisons, a more stringent p value of $p < .01$ was used to interpret the results. Correlational analyses suggested several significant associations (see Table 2). Youth with higher levels of loneliness experienced more depressive symptoms and lower levels of friendship quality. Inhibition, emotional control, and social impairment were all

Table 1 Parent and adolescent reports of socio-emotional adjustment

	M	SD	<i>r</i>
Depressive symptoms			
Parent	0.71	0.39	0.61**
Adolescent	0.70	0.39	
Loneliness			
Parent	31.73	9.37	0.50**
Adolescent	23.57	12.00	
Friendship quality—total score			
Parent	64.57	16.59	0.45**
Adolescent	72.00	14.53	
	%		% agreement
Friendship quality—best friend ^a			
Parent	87.40	–	70.00
Adolescent	88.19	–	

^a % of respondents reporting a best friend

* Significant at the 0.05 level, ** significant at the 0.01 level, *** significant at the 0.001 level (2-tailed)

significantly positively associated with each other. Additionally, problems with inhibition, emotional control, and social impairment were all positively associated with depressive symptoms. Emotional control and social impairment were also positively associated with loneliness. Emotional control and social impairment were also negatively associated with friendship quality. These findings suggest that youth who were more socially impaired and had greater EF deficits exhibited poorer socio-emotional adjustment. Age, reported IQ, SES, parent education, and ethnicity were not significantly associated with any of the primary variables. Thus, all subsequent analyses were conducted controlling for gender and mode of participation.

Organized Activities and Socio-Emotional Adjustment

Hierarchical multiple regression analyses were conducted to investigate the relation between OA involvement and socio-emotional adjustment outcomes (i.e., depressive symptoms, loneliness, and friendship quality) and whether these relations were moderated by social impairment and EF (i.e., inhibition and emotional control). Two covariates (gender and mode of participation) were entered as the first step of the regression. The main effect of the moderator (i.e., social impairment, inhibition or emotional control) was entered as the second step. The OA variables (i.e., intensity, breadth and OA category intensity) were entered as the third step of the regression allowing for determination of OAs effects on social and emotional adjustment

after accounting for adolescents' social impairment or EF difficulties. The interaction terms (OA X social impairment or EF variables) were entered as the fourth and final step. Separate regressions were conducted for each socio-emotional indicator and for each moderator. All continuous variables in the model were centered prior to analysis and simple slope analyses were conducted for all significant interactions according to recommendations by Holmbeck (1997, 2002) and Aiken and West (1991).

Depressive Symptoms

Main effects of social impairment, emotional control, and inhibition on depressive symptoms were found (see Table 3). This suggests that those with higher levels of social impairment, and more difficulties with emotional control and inhibition reported more depressive symptoms. OA intensity, breadth, and academic intensity were significantly negatively associated with depressive symptoms, even after controlling for social impairment, emotional control, and inhibition (see Table 3). Thus, even after accounting for adolescents' degree of social impairment and EF difficulties, more intense and varied OA participation and more involvement in academic activities was associated with fewer depressive symptoms. As shown in Table 3, a main effect for sport intensity on depressive symptoms was also observed after controlling for emotional control, suggesting that even after accounting for adolescents' difficulties with emotional control, more involvement in sport activities was associated with fewer depressive symptoms. Effect size computations for the overall effect of OA variables on depression were small (Cohen's $d = .02-.09$). In addition, there were no significant interactions between OA (intensity, breadth, or category) and either social impairment or EF, suggesting that the relation between OA and depressive symptoms did not vary based on adolescents' level of social impairment or executive function deficits.

Loneliness

A main effect of social impairment and emotional control on loneliness (see Table 4) was detected, suggesting that those with higher levels of social impairment and more difficulties with emotional control reported more loneliness. As shown in Table 4, OA intensity was negatively associated with loneliness, even after controlling for social impairment, emotional control, and inhibition. OA breadth was also negatively associated with loneliness after controlling for social impairment and inhibition. Additionally, after controlling for emotional control, sport intensity was negatively associated with loneliness (see Table 4). These results suggest that increased participation in OAs, greater

Table 2 Means, standard deviations, and bivariate correlations between study variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Gender	–															
2. Age	–0.07	–														
3. FSIQ (parent-reported)	0.11	0.20	–													
4. Inhibition	0.09	0.11	–0.06	–												
5. Emotional control	0.11	–0.13	–0.04	0.62***	–											
6. Social impairment	–0.08	–0.12	–0.08	0.53***	0.52***	–										
7. Loneliness	0.05	–0.20	0.20	0.18*	0.45***	0.42***	–									
8. Depressive symptoms	0.18*	–0.09	–0.01	0.32***	0.54***	0.41***	0.61***	–								
9. Friendship quality	0.24**	0.13	0.20	–0.16	–0.24**	–0.29**	–0.39***	–0.12	–							
10. OA breadth	0.01	0.10	0.03	–0.14	–0.18*	–0.11	–0.22*	–0.25*	0.15	–						
11. OA intensity ^b	–0.02	0.14	0.03	–0.09	–0.12	–0.20*	–0.25**	–0.26**	0.09	0.41***	–					
12. Religious ^b	0.02	0.03	0.04	–0.08	–0.11	–0.02	–0.09	–0.10	–0.05	0.28**	–0.03	–				
13. Academic ^b	0.05	–0.01	0.06	–0.16	–0.17	–0.09	–0.22*	–0.24**	0.09	0.18*	0.54	–0.04	–			
14. Performance ^b	0.10	0.05	0.01	–0.02	–0.02	–0.08	–0.03	–0.02	0.12	0.13	0.36***	–0.04	–0.07	–		
15. Sport ^b	–0.10	0.10	–0.04	0.03	0.02	–0.10	–0.12	–0.14	–0.08	0.27**	0.63***	–0.15	–0.02	–0.10	–	
16. Community/Service ^b	0.04	0.06	–0.05	0.10	0.08	–0.08	0.08	–0.06	0.05	0.27**	0.15	0.17	–0.07	0.20*	–0.04	–
<i>M</i>	81.1 ^c	13.95	104.76	73.08	65.50	81.45	27.73	0.70	68.32	1.61	1.96	0.08	0.35	0.21	0.72	0.11
<i>SD</i>	–	1.60	20.24	7.07	2.12	8.54	9.17	0.35	13.00	0.90	2.16	0.18	1.24	0.67	1.47	0.34

Higher scores on the social impairment and EF variables represent greater impairment

^a Spearman correlation

^b Square root transformation used for analyses

^c Percent male

* Significant at the 0.05 level, ** significant at the 0.01 level, *** significant at the 0.001 level (2-tailed)

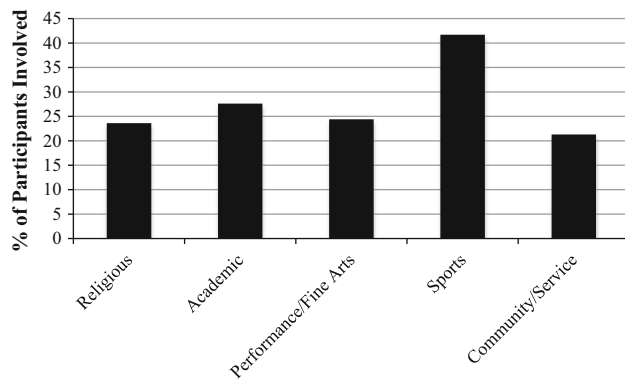


Fig. 1 Rates of participation by organized activity type

variety of activity participation, and increased participation in sports activities were associated with lower levels of loneliness, even after controlling for adolescents' social impairments and deficits in emotional control and inhibition. Effect size computations for the overall effect of OA variables on loneliness were small (Cohen's $d = .02-.09$). In addition, there were no significant OA (intensity, breadth, or category) X social impairment or EF interactions for loneliness, suggesting that the relation between OA and loneliness did not vary based on adolescents' level of social impairment.

Friendship Quality

There was a significant main effect of social impairment and emotional control on friendship quality (see Table 5), suggesting that those with higher levels of social impairment and more difficulties with emotional control reported lower levels of friendship quality. None of the OA variables were significantly associated with friendship quality, after controlling for social impairment, emotional control, and inhibition. However, there was a significant interaction between OA intensity and emotional control, such that for adolescents with better emotional control, increased intensity of OA participation was associated with better friendship quality, while for adolescents with poorer emotional control, the relation between OA and friendship quality was not significant (see Fig. 2).

Discussion

The primary goal of this study was to gain a better understanding of how OA participation relates to socio-emotional adjustment among adolescents with HFASD. In particular, it is beneficial to examine OAs because they are a normative developmental context that are widely available and support a variety of interests and talents.

Increasingly, there is evidence that OA involvement is beneficial for neurotypical youths' socio-emotional adjustment (see Bohnert et al. 2013), but this involvement may be particularly important for adolescents with HFASD as they appear to suffer disproportionately from depressive symptoms, loneliness, and impaired friendship quality (Locke et al. 2010; Lopata et al. 2010; Mayes et al. 2011). Moreover, adolescents with HFASD have an awareness that they are different from others which can contribute to feelings of isolation, depression, and loneliness (Klin et al. 2005; Volkmar and Klin 2005). This study expands on current knowledge of socio-emotional adjustment among adolescents with HFASD and the potential role of OA in several important ways.

First, this study corroborated prior research demonstrating that adolescents with HFASD experienced elevated levels of depressive symptoms, significant social impairments, and executive function deficits, specifically inhibition and emotional control (e.g., Klin et al. 2005; Hughes 2011; Locke et al. 2010). This study though was one of the first to consider links between social impairments, executive functions deficits, and adjustment outcomes, particularly depressive symptoms (see Pouw et al. 2013 for an exception). Difficulties with inhibition and emotional control, as well as social impairment were all associated with higher levels of depressive symptoms. Similarly, greater social impairment and emotional control difficulties were also associated with higher levels of loneliness and decreased friendship quality. These findings suggest the importance of these skills to socio-emotional adjustment and vice versa. Although inhibition deficits characterize children with ASD (Padmanabhan et al. 2014) which was corroborated in this study, these deficits were only associated with one form of socio-emotional adjustment (i.e., depressive symptoms) in the current study.

Consistent with much of the research on OAs, a second important finding was that adolescents with HFASD who were more intensely involved in activities reported fewer socio-emotional adjustment problems, specifically less depressive symptoms and loneliness. In addition, greater breadth of OA involvement was associated with better socio-emotional adjustment. There were also robust findings suggesting that more intense involvement in academic activities was associated with fewer depressive symptoms. Additionally, participation in sports was associated with fewer depressive symptoms and less loneliness when emotional control deficits were controlled. Similar to studies of neurotypical adolescents, adolescents with HFASD were most involved in sports and academic activities. Thus, socio-emotional adjustment findings may be due in part to higher levels of involvement in these types of activities. Alternatively, it may be that academic clubs allow adolescents with HFASD to interact with like-

Table 3 Hierarchical regression analyses predicting depressive symptoms

Variables	Social Impairment (SI)				Emotional Control (EC)				Inhibition (I)			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
	b (SE)	b (SE)	b (SE)	b (SE)	b (SE)	b (SE)	b (SE)	b (SE)	b (SE)	b (SE)	b (SE)	b (SE)
Gender	0.16* (0.08)	0.18* (0.07)	0.17* (0.07)	0.18* (0.07)	0.16* (0.08)	0.11 (0.07)	0.11 (0.07)	0.12 (0.07)	0.16* (0.08)	0.19* (0.07)	0.18* (0.07)	0.21** (0.08)
Mode of Participation	0.14* (0.07)	0.11 (0.06)	0.09 (0.06)	0.10 (0.06)	0.14* (0.07)	0.09 (0.06)	0.09 (0.06)	0.08 (0.06)	0.14* (0.07)	0.12 (0.06)	0.09 (0.06)	0.08 (0.07)
Moderator (SI, EC, or I)	0.01*** (0.01)	0.01*** (0.01)	0.01*** (0.01)	-0.02 (0.03)	0.03*** (0.01)	0.03*** (0.01)	0.03*** (0.01)	0.03** (0.01)	0.02*** (0.01)	0.02*** (0.01)	0.02** (0.01)	-0.07 (0.13)
Intensity ^a			-0.08* (0.04)	-0.23 (0.22)				-0.15 (0.15)				-0.32* (0.14)
Breadth			-0.07* (0.03)	-0.22 (0.17)				-0.06* (0.03)				-0.17* (0.10)
Religious ^a			-0.50 (0.35)	-1.92 (2.81)				-0.27 (0.33)				-0.43 (0.36)
Academic ^a			-0.23** (0.09)	-0.08 (0.75)				-0.19* (0.08)				-0.22* (0.09)
Performance/ Fine Arts (P/ FA) ^a			-0.06 (0.13)	0.34 (0.76)				-0.06 (0.12)				-0.09 (0.13)
Sports ^a			-0.08 (0.07)	-0.18 (0.38)				-0.12* (0.06)				-0.72 (0.36)
Community/ Service (C/ S) ^a			-0.03 (0.22)	-1.77 (1.32)				-0.22 (0.21)				-1.31 (1.68)
Intensity X Mod ^b			0.01 (0.01)	0.01 (0.01)				0.01 (0.01)				0.01 (0.01)
Breadth X Mod			0.01 (0.01)	0.01 (0.01)				0.01 (0.01)				0.01 (0.01)
Religious X Mod			0.01 (0.03)	0.01 (0.03)				0.06 (0.07)				0.02 (0.09)
Academic X Mod			-0.01 (0.01)	-0.01 (0.01)				-0.03 (0.02)				-0.03 (0.03)
P/FA X Mod			-0.01 (0.01)	-0.01 (0.01)				-0.01 (0.04)				0.01 (0.04)
Sports X Mod			0.01 (0.01)	0.01 (0.01)				0.01 (0.01)				0.03 (0.02)
C/S X Mod			0.02 (0.02)	0.02 (0.02)				0.08 (0.06)				0.05 (0.07)
R ²	0.07	0.24	0.30	0.32	0.07	0.32	0.38	0.40	0.07	0.17	0.24	0.27

^a Square root transformation used for analyses

^b Mod moderator for the analysis (social impairment, emotional control, or inhibition)

* Significant at the 0.05 level, ** significant at the 0.01 level, *** significant at the 0.001 level (2-tailed)

Table 4 Hierarchical regression analyses predicting loneliness

Variables	Social Impairment (SI)				Emotional Control (EC)				Inhibition (I)			
	Model 1 b (SE)	Model 2 b (SE)	Model 3 b (SE)	Model 4 b (SE)	Model 1 b (SE)	Model 2 b (SE)	Model 3 b (SE)	Model 4 b (SE)	Model 1 b (SE)	Model 2 b (SE)	Model 3 b (SE)	Model 4 b (SE)
Gender	0.74 (2.07)	1.36 (1.87)	0.94 (1.87)	1.29 (1.90)	0.74 (2.07)	-0.34 (1.87)	-0.26 (1.86)	-0.08 (1.86)	0.74 (2.07)	1.15 (2.05)	0.67 (2.03)	0.13 (2.08)
Mode of Participation	3.69* (1.77)	2.85 (1.62)	2.73 (1.61)	2.88 (1.63)	3.69* (1.77)	2.59 (1.61)	2.45 (1.59)	2.24 (1.60)	3.69* (1.77)	3.33 (1.76)	3.12 (1.74)	3.94 (1.79)
Moderator (SI, EC, or I)		0.23*** (0.05)	0.21*** (0.05)	-1.23 (0.85)		0.75*** (0.14)	0.71*** (0.14)	0.48 (0.22)		0.29 (0.15)	0.21 (0.15)	-4.75 (3.45)
Intensity ^a			-2.12* (0.97)	-7.60 (5.92)			-2.39* (0.93)	-9.04* (4.12)			-2.94** (0.99)	-7.23 (3.98)
Breadth			-1.54* (0.73)	-5.84 (4.57)			-1.24 (0.73)	-5.23 (2.98)			-1.71* (0.79)	-3.80 (2.77)
Religious ^a			-15.82 (9.24)	-67.69 (74.13)			-11.39 (9.28)	-90.80 (38.34)			-16.30 (10.05)	-17.65 (6.53)
Academic ^a			-4.13 (2.27)	-6.76 (19.74)			-3.40 (2.28)	-12.36 (9.93)			-4.64 (2.48)	-0.01 (11.21)
Performance/ Fine Arts (P/ FA) ^b			-2.26 (3.45)	-16.64 (20.11)			-2.49 (3.44)	-45.80 (19.83)			-3.33 (3.73)	-21.16 (20.02)
Sports ^a			-2.53 (1.75)	-4.64 (10.03)			-3.51* (1.73)	-4.16 (8.90)			-3.65 (1.88)	0.12 (10.07)
Community/ Service (C/S) ^b			11.08 (5.86)	-48.72 (34.77)			6.78 (5.87)	61.58 (38.69)			8.84 (6.39)	26.72 (46.50)
Intensity X Mod ^b				0.06 (0.06)				0.31 (0.19)				0.22 (0.20)
Breadth X Mod				0.04 (0.05)				0.19 (0.14)				0.11 (0.14)
Religious X Mod				0.49 (0.76)				3.76 (1.80)				5.27 (2.35)
Academic X Mod				0.03 (0.22)				0.53 (0.57)				-0.29 (0.70)
P/FA X Mod				0.16 (0.22)				2.19 (0.98)				0.99 (1.07)
Sports X Mod				0.02 (0.10)				0.03 (0.40)				-0.17 (0.48)
C/S X Mod				0.69 (0.40)				-2.56 (1.68)				-0.95 (2.05)
R ²	0.04	0.20	0.27	0.30	0.04	0.22	0.27	0.34	0.04	0.07	0.14	0.19

^a Square root transformation used for analyses

^b Mod moderator for the analysis (social impairment, emotional control, or inhibition)

* Significant at the 0.05 level, ** significant at the 0.01 level, *** significant at the 0.001 level (2-tailed)

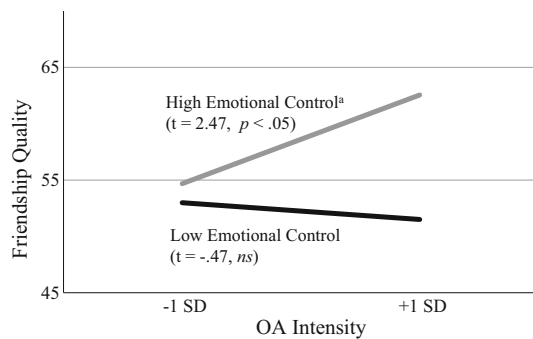
Table 5 Hierarchical regression analyses predicting friendship quality

Variables	Social Impairment (SI)				Emotional Control (EC)				Inhibition (I)			
	Model 1 b (SE)	Model 2 b (SE)	Model 3 b (SE)	Model 4 b (SE)	Model 1 b (SE)	Model 2 b (SE)	Model 3 b (SE)	Model 4 b (SE)	Model 1 b (SE)	Model 2 b (SE)	Model 3 b (SE)	Model 4 b (SE)
Gender	8.44** (2.89)	7.84** (2.79)	7.45** (2.84)	8.30** (2.88)	8.44** (2.89)	9.38** (2.80)	9.30** (2.80)	9.27** (2.81)	8.44** (2.89)	7.98** (2.88)	7.56* (2.95)	7.28* (3.07)
Mode of Participation	-1.53 (2.47)	-0.73 (2.39)	-0.52 (2.44)	-1.72 (2.48)	-1.53 (2.47)	-0.56 (2.40)	-0.47 (2.40)	-0.42 (2.42)	-1.53 (2.47)	-1.14 (2.47)	-0.80 (2.53)	-0.93 (2.64)
Moderator (SI, EC, or I)		-0.22** (0.07)	-0.22* (0.07)	0.17 (1.29)		-0.66** (0.21)	-0.62** (0.21)	-0.57 (0.33)		-0.33 (0.21)	-0.32 (0.22)	1.69 (5.09)
Intensity ^a			1.71 (1.41)	-4.53 (8.64)			1.97 (1.38)	14.00 (6.09)			2.35 (1.40)	6.74 (5.59)
Breadth			1.52 (1.08)	-4.86 (6.80)			1.30 (1.09)	2.07 (4.51)			1.66 (1.12)	0.31 (3.94)
Religious ^a			-9.87 (14.04)	19.95 (12.55)			-14.19 (14.19)	28.53 (19.37)			-10.23 (14.58)	73.34 (68.64)
Academic ^a			2.64 (3.45)	-23.75 (29.97)			1.96 (3.49)	11.49 (15.38)			2.88 (3.60)	2.97 (16.54)
Performance/ Fine Arts (P/ FA) ^a			3.97 (5.25)	-36.08 (30.54)			4.25 (5.25)	-2.11 (30.72)			4.95 (5.41)	-12.76 (29.53)
Sports ^a			-2.38 (2.67)	-27.30 (15.23)			-1.37 (2.64)	17.68 (13.79)			-1.23 (2.73)	4.39 (14.86)
Community/ Service (C/ S) ^a			0.87 (8.91)	36.22 (52.79)			5.15 (8.97)	-52.19 (59.91)			3.76 (9.27)	-33.70 (68.60)
Intensity X Mod ^b				0.07 (0.09)				-0.56* (0.28)				-0.22 (0.28)
Breadth X Mod				0.07 (0.07)				-0.04 (0.21)				0.07 (0.20)
Religious X Mod				-1.06 (1.15)				-6.70 (2.78)				-4.26 (3.46)
Academic X Mod				0.29 (0.33)				-0.56 (0.88)				-0.03 (1.03)
P/FA X Mod				0.44 (0.34)				0.32 (1.52)				0.94 (1.58)
Sports X Mod				0.26 (0.16)				-0.83 (0.60)				-0.27 (0.71)
C/S X Mod				-0.41 (0.60)				2.44 (2.60)				1.68 (3.02)
R ²	0.07	0.14	0.16	0.20	0.07	0.14	0.16	0.21	0.07	0.08	0.10	0.12

^a Square root transformation used for analyses

^b Mod moderator for the analysis (social impairment, emotional control, or inhibition)

* Significant at the 0.05 level, ** significant at the 0.01 level, *** significant at the 0.001 level (2-tailed)



^a High levels of emotional control indicates more problems

Fig. 2 Simple slope analyses of OA intensity X emotional control predicting friendship quality.

minded peers around areas of interest or areas for which they have stronger skills, and sports may be beneficial because they pair social interaction with physical activity in a highly structured and goal-oriented setting. Again, the cross-sectional nature of this study does not allow for determination of the direction of these effects, and it is not possible to determine whether more involvement is associated with better outcomes or whether more well-adjusted adolescents get more involved in activities. Additionally, there may be another factor that positively impacts the relation between sports involvement and depressive symptoms, such as a person's positive self-concept related to sports ability or team/school spirit or connectedness. However, the fact that associations between OA and social and emotional adjustment existed, even after controlling for adolescents' degree of social impairment and EF difficulties, suggests that there may be more than selection effects at work. Although more definitive evidence of the direct and specific positive effects of OA involvement on adjustment will come from longitudinal studies, findings from the current study suggest the possibility of small but significant benefits for OA involvement in terms of depressive symptoms and loneliness for adolescents with HFASD should be further investigated.

Notably, associations between OA involvement and friendship quality were not significant. Although OAs have been shown to develop and maintain friendships (e.g., Schaefer et al. 2011), participation in OAs was not associated with better friendship quality with a best friend. Indeed, it may be that OA involvement allows youth to develop more extensive networks of friends (Feldman and Matjasko 2005; Bohnert et al. 2013), but may be less helpful in influencing the qualities of one specific friendship among adolescents with HFASD. Findings from the present study suggest that social impairment and EF deficits account for much of the variance in friendship quality with OA involvement offering little in terms of additional unique explanatory variance. Future work should consider

whether an adolescent's best friend was enrolled in activities with them, and include broader indices of social outcomes, including size of networks, social acceptance to determine if involvement may have beneficial social effects beyond friendship quality with a best friend.

Contrary to expectation, findings from this work do not suggest that the more impaired adolescents benefit more from involvement. Much of the developmental literature on OA involvement has found that more impaired or at-risk youth may benefit more from involvement (Bohnert et al. 2007; Mahoney 2000; Marsh and Kleitman 2002). In fact, only one moderation model was significant and not in the anticipated direction. In this instance, adolescents who had fewer problems with emotional control exhibited better friendship quality if they were more intensely involved in OAs. One possible explanation for the lack of findings is that adolescents with poorer EF and social impairments may be too impaired to reap the benefits of activity participation. Pouw et al. (2013) reported that avoidant coping strategies appear to benefit youth with ASD. Alternately, this finding could represent a selection effect in which more impaired adolescents may be less involved in activities to begin with. Their time may be taken up by participating in therapies and structured activities related to improving their skills (e.g., social skills training, speech therapy), which may limit the time they have to participate in OA with neurotypical youth. Thus, HFASD adolescents with better EF and social skills may be able to be more involved in activities and therefore benefit more. Correlational evidence provides limited support of this premise though as OA breadth was positively associated only with emotional control deficits, and OA intensity was positively associated only with social impairments. Another possible explanation for these contrary findings is that other factors such as bullying or exclusion by classmates may lead to youth with HFASD having a different (and less positive) OA experience than their peers. Additionally, the extent to which the OA mentors understand ASD and the extent to which they support the HFASD child and actively include them in activities may impact the HFASD child's OA experience, especially for those with greater impairments. Furthermore, the severity of ASD symptoms may also impact a child's experience of OAs and the benefit that s/he reaps from activities. The current research focused on OAs that were readily available to all adolescent populations rather than activities designed specifically with therapeutic intent. This is the first step toward understanding the OA experience of HFASD youth and whether their participation and benefits are similar to their neurotypical peers. Future research will need to explore whether additional activity constructs such as group therapies provide positive outcomes beyond their intended therapeutic targets, and whether any benefits depend on ASD symptom severity

level. Given the focus on inclusion, especially in academic settings, it will important to clarify activity experiences that provide the greatest benefit to HFASD youth and the role that neurotypical peers play in that experience.

Finally, although not a central aim of the study, the high correlation between parent and self-report of adjustment was also noteworthy. Much of the prior research has often assessed adjustment using either parent report (e.g., Kim et al. 2000) or self-report (e.g., Pouw et al. 2013), but the current study utilizes both parent and self-report to assess adjustment. Surprisingly, although research suggests that adolescents with HFASD may have less awareness of themselves and their psychological states (see Williams 2010), and researchers have suggested caution in the use of self-report measures with adolescents with HFASD (Mazefsky et al. 2011), the parent and self-reports in the current study were highly correlated suggesting consistent perceptions of participants' adjustment. However, this should be interpreted with caution given the primarily online nature of data collection, which does not allow for assurances that parents and children each filled out their questionnaires independently despite our requests that they do so. Therefore, future research should continue to address the question of consistency between parent and child reports of adjustment, as well as the potential clinical implications of these differences.

Limitations and Future Directions

Several limitations of this study need to be acknowledged. First, males were overrepresented in the sample. Although ASD is diagnosed significantly more frequently in males than in females, the high percentage of males in the current study make it difficult to generalize the findings to a female ASD population. In addition, the high percentage of Caucasians in the study makes results less generalizable to other ethnic groups. Future studies should continue to recruit females with ASD as well as those from a variety of ethnic backgrounds. Furthermore, the current study only evaluated adolescents with ASD and was not able to compare the results to a typically developing population or to other genetic/developmental disabilities (e.g., intellectual disability, Down syndrome). Therefore, it is important for future research to address whether these findings are unique to the ASD population or whether it is a consistent pattern among youth with other developmental disabilities.

Another limitation of the study was the inability to confirm ASD diagnoses. Although a majority of the participants were recruited through IAN, which screens for ASD diagnosis, the nature of the study did not allow for researchers to independently screen all youth to confirm a diagnosis. However, all parents reported that their child received a diagnosis from a qualified provider, and levels of

social impairment are consistent with a diagnosis of ASD. Thus, we can be fairly certain that participants all qualified for an ASD diagnosis, but future work should utilize structured interviews and/or testing to verify diagnoses. Furthermore, although inclusion criteria assume higher-functioning status, many children with ASD have histories of or current difficulties with primary language, which was not assessed or controlled for in the current study. The extent to which a child's language skills may impact their ability to successfully participate in OAs or benefit from them is an area of future research. Children that can engage more comfortably in back and forth conversation and can keep up with sharing and expressing ideas and OA-related concepts (e.g., a series of plays in football, a set of theories in math club, multi-set instructions for a volunteer project) may have better outcomes; or, those with better language skills may be more confident in their abilities to participate in OA and therefore may be more intensely involved.

As mentioned previously, the cross-sectional design does not allow for a determination of the directionality of these findings, and therefore, cannot rule out selection effects in interpreting the results. Therefore, future research should utilize a longitudinal design, which can assess the development of emotional control, inhibition, social impairment, friendship quality, and adjustment over time. It is also important to evaluate OA participation over time to allow for a better understanding of the impact of continued activity involvement in this population and to establish whether increased activity participation is impacting adjustment or whether a person's adjustment level is determining how much s/he participates. Furthermore, since much of the OA research has demonstrated the unique effects of different profiles or clusters of activities (e.g., Bartko and Eccles 2003; Linver et al. 2009) future research should attempt to elucidate whether there are certain patterns of involvement that lead to better adjustment in youth with ASD. Additional variables such as ASD-specific activities (such as social skills groups), and ASD-symptom severity (including language skills) are variables that should also be included in future research.

Despite the study limitations, current results indicating that OA involvement was associated with better adjustment after accounting for the effect of social impairment and EF impairment on youth's adjustment is promising. More work is needed to better understand how adolescents with HFASD experience OA and benefit from involvement. Work with neurotypical youth suggests that OAs provide opportunities to interact with peers who can model appropriate social interactions, which may promote skill development allowing children to feel better about their social skills and establish friendships (Fredricks and Simpkins 2013). For adolescents with HFASD, OAs may provide a unique structured setting that may promote better socio-emotional adjustment. Findings from this study should act as a catalyst for future

research to further examine the potential benefits of OA involvement for youth with HFASD.

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Author Contributions AB conceived of the study, provided oversight in its design, interpreted the data, and drafted the manuscript. RL conceived of the study, coordinated its design, performed the statistical analyses, interpreted the data, and drafted the manuscript. NA performed the statistical analyses, interpreted the data, and drafted the manuscript. All authors read and approved the final manuscript.

Compliance with Ethical Standards

Conflict of Interest The authors declare they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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