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# Depressive symptoms and activity engagement in autistic adolescents and those with other developmental disabilities

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## Abstract

**Background:** Autistic adults and those with other developmental disabilities (DD) have increased depressive symptoms and decreased activity engagement when compared to those with no DD. Few studies explore activities related to depressive symptoms in autistic people and those with other DD during adolescence.

**Objective:** The objectives of this analysis were to describe depressive symptoms and activity engagement among autistic adolescents and those with other DD and no DD and explore types of activities associated with depressive symptoms, stratified by study group.

**Methods:** Parents of adolescents completed a multi-site case-control study of autism and other DD when their child was 2–5 years of age and a follow-up survey when their child was 12–16 years of age. Questions asked about the adolescent's current diagnoses, depressive symptoms (i.e., diagnosis, medication use, or symptoms), and engagement in club, social, sport, vocational, volunteer, and other organized activities.

**Results:** Autistic adolescents (N = 238) and those with other DD (N = 222) were significantly more likely to have depressive symptoms than adolescents with no DD (N = 406), (31.9 %, 30.6 %, and 15.0 % respectively). Lower percentages of autistic adolescents participated in activities than peers with other DD, who had lower percentages than peers with no DD. Participation in sports was associated with lower likelihood of depressive symptoms in all groups.

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CRediT authorship contribution statement

**Lisa D. Wiggins:** Conceptualization, Data curation, Methodology, Writing – original draft, Investigation. **Julie Daniels:** Investigation, Methodology, Writing – review & editing. **Katie Overwyk:** Formal analysis, Writing – review & editing. **Lisa Croen:** Investigation, Methodology, Writing – review & editing. **Carolyn DiGuiseppi:** Investigation, Methodology, Writing – review & editing. **Chyrise Bradley:** Methodology, Project administration, Writing – review & editing. **Patrick Powell:** Validation, Writing – review & editing. **Gabriel Dichter:** Writing – review & editing. **Eric Moody:** Writing – review & editing. **Karen Pazol:** Investigation, Supervision, Writing – review & editing.

**Conclusions:** Autistic adolescents and those with other DD are at increased risk for depressive symptoms and reduced activity engagement. Participation in sports may be especially important for adolescent mental health regardless of disability status. Implications for public health education and intervention are discussed.

### Keywords

Autism; Depression; Developmental disabilities; Activities; Sports

## 1. Introduction

Depression is a common mental health condition defined by pervasive feelings of sadness and/or loss of interest in rewarding activities. For some people, depression can affect the ability to eat, sleep, concentrate, or make decisions and can cause functional limitations in social, occupational, or other areas of life.[1] Depression often co-occurs with other mental health problems and increases risk for suicidal thoughts and behaviors.[1] The societal economic burden of depression is an estimated $326.2 billion per year, considering workplace costs, direct costs, and suicide-related costs.[2] These estimates do not include unmeasured emotional costs to individuals and families living with the disorder.

Autism spectrum disorder (ASD) is a developmental disability (DD) defined by social communication and interaction deficits and restricted and repetitive behaviors and interests.[1] Depression is more common in autistic adults than those from the general population.[3] Although estimates vary, the lifetime prevalence of depression is about 21 % in general population samples and 37 % in autistic samples.[3,4] The estimated prevalence of current depression (i.e., past 12 months) is 10 % in population samples and 23 % in autistic samples.[3,4] In comparison to adults without ASD, autistic adults are three times as likely to die by suicide and nine times as likely to attempt suicide.[5]

Risk factors for depression in autistic people and those with other DD include chronic health conditions, lack of supportive employment, few meaningful friendships, difficulty accessing needed services, and lack of engagement in recreational or other organized activities.[6-10] One protective factor is social supports.[11] In one study, Hedley and colleagues (2018) defined social supports as “feeling cared for, loved, and being a member of a larger social network.” They surveyed 194 college students regarding ASD traits, loneliness, social supports, suicidal ideation, and depressive symptoms. Social supports were inversely related to depression, loneliness, and suicidal ideation. Moreover, social supports partially mediated the relationship between ASD traits and depressive symptoms.

Increasing social supports may be especially important for people who are experiencing social isolation, which is common among autistic people. In one study, 48 % of autistic adults reported that they never talked to friends on the phone and were never invited to social activities with friends and 39 % reported that they never saw friends in the past 12 months.[12] A total of 24 % of autistic adults reported being totally socially isolated compared to 8 % of adults with other DD.[12] Social contacts counteract social isolation and lack of social supports, and are associated with fewer depressive symptoms.[13] Yet less than half of autistic people are engaged in activities that enhance social contacts.[12]

Previous research suggests that recreational and other organized activities are important for increasing social contacts and positive mental health outcomes. For instance, activity engagement is significantly and inversely associated with loneliness and depressive symptoms in autistic people. This relationship persists even after controlling for social impairment and poor behavioral and emotional control,[14] and may be more important than current employment or psychotherapy when managing symptoms of depression.[10] Sports have been found to mitigate loneliness and depressive symptoms among autistic people and those with other DD.[14,15] Finally, a recent systematic review suggested that social connections may serve as protective factors against suicidal thoughts and behaviors in autistic people.[16]

While the current body of evidence suggests that engagement in recreational and other organized activities could be an important strategy against both depression and suicide in autistic people, most research in this area has focused on adult populations. Little is known about the relationships between activities and mental health among autistic adolescents. The objectives of this analysis were to (1) describe depressive symptoms and activity engagement in autistic adolescents and those with other DD and no DD and (2) explore the types of activities associated with depressive symptoms in each study group.

## 2. Methods

Data for this analysis were from the Study to Explore Early Development Teen survey (SEED Teen). SEED Teen is a longitudinal follow-up of preschool aged children who enrolled at 2–5 years of age in the first phase of SEED (SEED1), a multi-site case-control study on autism spectrum disorder (ASD). Children in SEED were classified as ASD, other DD, or no DD at the time of the study based on recruitment source (e.g., healthcare providers, birth certificate records) and results of an in-person developmental evaluation. Details on SEED1 are described elsewhere.[17,18]

SEED Teen participants were recruited from four of the six SEED1 sites: Georgia, Maryland, North Carolina, and Pennsylvania. The North Carolina site assumed responsibility for collecting survey data from participants in Maryland, North Carolina, and Pennsylvania. The goals of the SEED Teen were to assess the health and healthcare needs of children enrolled in SEED1 as they transition into adolescence and to understand early childhood factors related to adolescent health outcomes. Parents of children enrolled in SEED1 completed the SEED Teen survey when their child was 12–16 years of age. Both SEED1 and SEED Teen were approved by Institutional Review Boards at each study site.

The SEED Teen survey topics were chosen by review of the literature and input from autistic people. Nearly all questions (97 %) in the SEED Teen survey were selected from existing national surveys or surveillance systems, like the National Health Interview Survey,[19] National Survey of Children's Health,[20] and National Longitudinal Transition Study-2.[21] Questions were chosen from existing surveys and systems because these questions have been extensively tested in pilot and field studies and were developed by experts who had experience with the topics under investigation.

### 2.1. ASD and other DD status in SEED teen

This study was most concerned about activities at the time of the follow-up survey and their association with concurrent mood states. Therefore, ASD and other DD status were defined by current diagnoses reported on the SEED Teen survey rather than study classifications assigned by SEED1 in early childhood. ASD status was defined as parent report that the child had a current diagnosis of ASD given by a doctor or other healthcare provider. Other DD was defined as a current diagnosis of attention deficit hyperactivity disorder (ADHD), cerebral palsy, epilepsy/seizure disorder, developmental delay, intellectual disability, learning disability, or speech/language disorder given by a doctor or other healthcare provider. No DD was defined as the absence of all these reported diagnoses on the follow-up survey.

### 2.2. Depressive symptoms and activity engagement in SEED teen

We evaluated both a broad and a narrow definition of depressive symptoms based on current diagnosis, prescription medication use, and parent-reported symptoms. The broad definition was comprised of four components. The adolescent had to meet one component to be defined as having depressive symptoms. The first component was a current diagnosis of depression reported on the SEED Teen survey. Specifically, caregivers were asked “Has a doctor or other healthcare provider ever told you that this child has depression?” If the respondent answered yes, they were asked “Does this child currently have depression?” This question aligns with the National Survey of Children’s Health.[20] The second component was use of prescription medication to treat depression in the past 12 months. Caregivers were asked “During the past 12 months has this child taken any prescription medication because of difficulties with depression?” This question aligns with questions on the National Health Interview Survey.[19] The third component was caregiver response to the statement that over the last 6 months the child was “often unhappy, depressed or tearful” rated as “*certainly true*,” and the fourth component was if this statement was rated “*sometimes true*.” This question aligns with the Strengths and Difficulties Questionnaire.[22]

The narrow definition of depressive symptoms included endorsement of one of the first three components but excluded the fourth component: “often unhappy, depressed or tearful” rated as “*sometimes true*.” This narrow definition was used to explore whether adolescent activity engagement differed when caregivers reported consistent depressive symptoms in their child.

To measure activity engagement, caregivers were asked to respond yes or no to a series of questions: “During the past 12 months did this child participate in.

- Any clubs or organizations after school or on weekends (CLUBS)?
- A sports team or did he or she take sports lessons after school or on weekends (SPORT)?
- Any work, including regular jobs as well as babysitting, cutting grass, or other occasional work (VOCATIONAL)?
- Any type of community service or volunteer work at school, church, or in the community (VOLUNTEER)?

- Any other organized activities or lessons, such as music, dance, language, or other arts (OTHER ORGANIZED)?

These questions align with questions on the National Survey of Children's Health.

Caregivers were also asked: "During the past 12 months has this child been invited by friends to social activities like over to their home or to a party?" This question aligns with on the National Longitudinal Transition Study-2.[21]

### 2.3. Statistical analyses

#### 2.3.1. Describe depressive symptoms and activity engagement (aim 1)—

Descriptive statistics were used to show the number and percent of adolescents with depressive symptoms and specific types of activity engagement in each study group. For depressive symptoms, analyses were conducted using the broad and narrowly defined variables as well as individual results for each component of those variables. Chi square analyses were used to compare differences between the following study groups: ASD vs DD, DD vs no DD, and ASD vs no DD. A p-value of $<0.05$ was considered statistically significant for these analyses.

#### 2.3.2. Explore types of activities associated with depressive symptoms (aim 2)—

Logistic regression analyses were used to assess the relationship between engagement in each of the specific types of activities assessed (yes/no) as the independent variable and depressive symptoms (yes/no) as the dependent variable. No engagement in each activity was the referent category. Models were adjusted for adolescent age, race/ethnicity, and sex; family income as percent of federal poverty level; and maternal education. Adjusted odds ratios (aOR) and 95 % confidence intervals (CI) were reported.

## 3. Results

Parents of 866 adolescents completed the SEED Teen survey. The mean age of the sample was 14.3 years (range 12–16 years) at SEED Teen enrollment and did not differ between study groups. Table 1 outlines characteristics of the study sample.

Of the 866 adolescents in the sample, 238 reported that their child had a current ASD diagnosis, 222 another DD diagnosis, and 406 no current DD diagnosis. Of those with another DD diagnosis, 61.7 % had ADHD, 50.4 % had learning disability, 36.0 % had developmental delay, 29.3 % had speech/language disorder, 17.6 % had intellectual disability, 4.5 % had cerebral palsy, and 4.5 % had epilepsy/seizure disorder. Autistic adolescents and those with other DD often had multiple DD diagnoses (Table 1)

Autistic adolescents did not differ significantly from adolescents with other DD when depressive symptoms were broadly defined (31.9 % and 30.6 %, respectively). Both study groups had significantly higher percentages of depressive symptoms than adolescents with no DD (15.0 %) (Table 2). Similar results were found when depressive symptoms were narrowly defined (15.6 % ASD, 12.6 % other DD, and 6.7 % no DD).

Autistic adolescents also did not differ significantly from adolescents with other DD in terms of their participation in clubs or other organized activities (46.2 % and 53.2 % for clubs and 35.3 % and 37.8 % for other organized activities). Both study groups had significantly lower participation in clubs or other activities than adolescents with no DD (73.9 % for clubs and 52.2 % for other organized activities).

Autistic adolescents participated in fewer sport, social, vocational, and volunteer activities than adolescents with other DD, and those with other DD participated in fewer of these activities than adolescents with no DD (Table 2). The largest absolute differences in activity engagement between autistic adolescents and others were with social invitations: only 49.2 % of autistic adolescents received a social invitation in the past year compared with 80.6 % of adolescents with other DD and 96.3 % of adolescents with no DD.

Logistic regression analyses showed the association between activity engagement and depressive symptoms defined more broadly, stratified by study group (Table 3). Participation in sports was significantly and inversely associated with the presence of depressive symptoms for autistic adolescents and those with no DD (aOR = 0.40; 95 % CI = 0.20,0.81 for ASD and aOR = 0.47; 95 % CI = 0.26,0.86 for no DD). No activities were significantly associated with depressive symptoms in the other DD group.

When depressive symptoms were defined more narrowly, participation in sports was significantly and inversely associated with depressive symptoms in adolescents with other DD and no DD (aOR = 0.33; 95 % CI = 0.12,0.92 for other DD and aOR = 0.34; 95 % CI = 0.14,0.83 for no DD) but not ASD (Table 4). Other organized activities were inversely associated with depressive symptoms in the ASD group when “Often unhappy, depressed, or tearful” rated *sometimes true* was excluded from the outcome definition (aOR = 0.37; 95 % CI = 0.14,0.98).

## 4. Discussion

Depression is a common and important public health issue. Individuals with depression are more likely to have poor emotional and physical health, and experience more suicidal thoughts and behaviors.[23] Depression in the adolescent years is associated with chronic depression in adulthood and can exacerbate other mental, physical, and social problems.[23] Results from this analysis showed that larger percentages of autistic adolescents and those with other DD experience depressive symptoms than adolescents with no DD. Further, autistic adolescents and those with other DD are significantly less likely to engage in many types of activities than adolescents with no DD. Engagement in sports was associated with a lower odds of depressive symptoms in adolescents in all groups depending on whether the outcome was broadly or narrowly defined. These findings have important implications for public health education and intervention efforts.

It is well documented that autistic adults experience depressive symptoms significantly more than those without ASD.[3] This study adds to our understanding of the prevalence of mental health concerns among adolescents diagnosed with ASD *and* other DD. Mental health screening and treatment can be hindered by difficulty accessing mental health care, few

qualified service providers, misconceptions about the disorder, and belief that mental health services have limited benefit for autistic people.[24-26] These barriers influence health seeking behaviors and provider comfort in treating autistic people for mental health issues.[25,26] Public health interventions that address these barriers, alongside identification of barriers to mental health services for people with other DD, could improve outcomes.

Previous research shows that autistic people participate in fewer activities than those in the general population.[27] This study expands upon these findings by showing that autistic adolescents are also significantly less likely to participate in most activities than adolescents with other DD. The largest absolute differences in activity engagement between autistic adolescents and those with other DD and no DD in this study were with social invitations. These findings support previous research[10] and highlight the considerable social isolation experienced by autistic adolescents.

Participation in sports was inversely associated with depressive symptoms in adolescents with no DD regardless of the outcome definition. Yet the outcome definition influenced results for autistic adolescents and those with other DD: when defined broadly, sports were inversely associated with depressive symptoms only in autistic adolescents and when defined narrowly, sports inversely were associated with depressive symptoms only in adolescents with other DD. These findings could be due to differences in unmeasured variables that might influence parent reporting of their child's depressive symptoms (e.g., measures of cognitive functioning). Future research could explore how other factors influence sports engagement and depressive symptoms in adolescents with developmental disabilities.

The inverse association between participation in sports and depressive symptoms in adolescents with no DD has been described in previous research.[28] Some researchers posit that the relationship between sports and lower likelihood of depressive symptoms in adolescents with no DD is related to increased social interaction and friendships, as well as life skills developed during group interactions (e.g., collaboration and cooperation).[29] Whether the same mechanisms apply to autistic adolescents and those with other DD is not known. More research is needed to understand the exact mechanisms that link sports participation and depressive symptoms in adolescents with developmental disabilities.

Despite the benefits of sports, autistic adolescents and those with other DD participate in sports less than their peers with no DD.[30] Reasons for lack of participation in sports among autistic adolescents and those with other DD include personal factors (e.g., social communication deficits, sensory deficits, and motor delays) and contextual factors (e.g., availability of adaptive programs, costs of adaptive programs, peer rejection, and lack of staff training).[30-34] Facilitators are parent and staff support and peer engagement.[32,33]

Autistic adolescents and those with other DD have identified ways to address these barriers.[31,35] Some strategies they recommend are developing programs that are easily accessible (e.g., available at school) and affordable, modifying programs to meet their individual and unique needs, and providing adaptive equipment. Other strategies identified are increasing awareness of ASD and other DD among activity staff and peers and encouraging "buddy systems" or peer-mediated activities to help improve staff training

and minimize peer rejection. Psychosocial interventions such as behavioral activation could also encourage adolescents with developmental disabilities and depressive symptoms to participate in activities meaningful to them.[36]

There are limitations of this study. The SEED Teen survey did not measure frequency or intensity of activity engagement, or activity engagement prior to one year before survey completion. Parents were surveyed about activity engagement and depressive symptoms of their adolescent child; adolescents did not report depressive symptoms themselves. Depressive symptoms were defined as endorsement of one of multiple survey questions rather than a standardized clinical measure. SEED Teen did not have a large enough sample size to explore the association between activity engagement and multiple vs. one component of depressive symptoms, or stratified by other variables (e.g., adolescent sex or intellectual disability). Most of the sample had family income ≥ 300 % of the federal poverty level and a college degree or higher, which may influence generalizability to households with lower socioeconomic status. Finally, the temporal relationship between activity engagement and depressive symptoms cannot be assessed given the cross-sectional nature of these data. Thus, it is possible that depressive symptoms change activity patterns, in addition to the potential for activity engagement to change depressive symptoms.

Regardless of these limitations, SEED Teen data was collected from multiple sites across the United States and included a comparison group of children with other DD and no DD. Results from this study align with those from previous research and add to the paucity of research on the relationship between specific types of activities and depressive symptoms in autistic adolescents and those with other DD. Findings could inform public health education efforts and intervention development.

## 5. Conclusions

In conclusion, this study found that autistic adolescents and those with other DD are more likely to experience depressive symptoms and less likely to engage in activities than adolescents with no DD. Participation in sports was associated with lower likelihood of depressive symptoms in all study groups; autistic adolescents were less likely to participate in sports than those with other DD; and adolescents with other DD were less likely to participate in sports than those with no DD. Creating accessible, safe, and welcoming environments for autistic adolescents and those with other DD may increase participation in sports. Moreover, programs that educate activity staff and peers about ASD and interventions that foster adaptive programming may also help increase participation in sports among adolescents with developmental disabilities. Future research could explore additional ways to improve activity engagement among autistic adolescents and those with other DD and the mechanisms that connect sports to fewer depressive symptoms in people with developmental disabilities.

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**Table 1**

Characteristics of the study sample, Study to Explore Early Development: Teen survey.

| | ASD N = 238 | Other DD N = 222 | No DD N = 406 |
|---|---|---|---|
| | N (%) | N (%) | N (%) |
| Adolescent race/ethnicity | | | |
| Non-Hispanic White | 133 (55.9) | 150 (67.6) | 291 (71.7) |
| Non-Hispanic Black | 60 (25.2) | 44 (19.8) | 47 (11.6) |
| Hispanic | 8 (3.4) | 4 (1.8) | 8 (2.0) |
| Non-Hispanic Other | 19 (8.0) | 8 (3.6) | 30 (7.4) |
| Non-Hispanic Multiracial | 18 (7.6) | 16 (7.2) | 30 (7.4) |
| Adolescent sex | | | |
| Male | 187 (78.6) | 138 (62.2) | 214 (52.7) |
| Female | 51 (21.4) | 84 (37.8) | 192 (47.3) |
| Family income as percent of federal poverty level | | | |
| <100 % | 25 (10.5) | 19 (8.6) | 18 (4.4) |
| 100- ≤ 200 % | 40 (16.8) | 26 (11.7) | 31 (7.6) |
| 200- ≤ 200 % | 33 (13.9) | 30 (13.5) | 42 (10.3) |
| ≥300 % | 129 (54.2) | 135 (60.8) | 299 (73.7) |
| Missing | 11 (4.6) | 12 (5.4) | 16 (3.9) |
| Maternal education | | | |
| High school or less | 21 (8.8) | 21 (9.5) | 16 (3.9) |
| Some college | 33 (13.9) | 24 (10.8) | 35 (8.6) |
| College or graduate degree | 178 (74.8) | 172 (77.5) | 348 (85.7) |
| Missing | 6 (2.5) | 5 (2.3) | 7 (1.7) |
| Number of adolescent co-occurring DD | | | |
| 3+ co-occurring DD | 106 (44.5) | 66 (29.7) | / |
| 1–2 co-occurring DD | 87 (36.6) | 154 (69.4) | / |
| ASD only or one DD only | 45 (18.9) | 2 (0.9) | / |
| Study site | | | |
| Georgia | 73 (30.7) | 66 (29.7) | 120 (29.6) |
| Maryland | 49 (20.6) | 44 (19.8) | 63 (15.5) |

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| | ASD N = 238 | Other DD N = 222 | No DD N = 406 |
|---|---|---|---|
| | N (%) | N (%) | N (%) |
| North Carolina | 60 (25.2) | 80 (36.0) | 138 (34.0) |
| Pennsylvania | 56 (23.5) | 32 (14.4) | 85 (20.9) |

Acronyms: autism spectrum disorder (ASD), developmental disability (DD).

**Table 2**

Group differences in depressive symptoms and activity engagement assessed with chi square analyses, Study to Explore Early Development: Teen survey.

| | **ASD N = 238** | **Other DD N = 222** | **No DD N = 406** | | | |
|---|---|---|---|---|---|---|
| | **N (%)** | **N (%)** | **N (%)** | **ASD vs Other DD p-value** | **ASD vs No DD p-value** | **Other DD vs No DD p-value** |
| Depressive symptoms (broadly defined)[a] | 76 (31.9) | 68 (30.6) | 61 (15.0) | 0.76 | <0.01 | <0.01 |
| Depressive symptoms (narrowly defined)[b] | 37 (15.6) | 28 (12.6) | 27 (6.7) | 0.37 | <0.01 | 0.01 |
| *Current diagnosis of Depression* | 21 (8.8) | 23 (10.4) | 19 (4.7) | 0.56 | 0.04 | <0.01 |
| *Prescription medication for depression, within last* 12 months | 25 (10.5) | 20 (9.0) | 10 (2.5) | 0.59 | <0.01 | <0.01 |
| "*Often unhappy, depressed, or tearful*" *certainly true* | 8 (3.4) | 10 (4.5) | 7 (1.7) | 0.53 | 0.18 | 0.04 |
| "*Often unhappy, depressed, or tearful*" *sometimes true* | 57 (23.9) | 56 (25.2) | 45 (11.1) | 0.75 | <0.01 | <0.01 |
| Clubs | 110 (46.2) | 118 (53.2) | 300 (73.9) | 0.14 | <0.01 | <0.01 |
| Social invitations | 117 (49.2) | 179 (80.6) | 391 (96.3) | <0.01 | <0.01 | <0.01 |
| Sport activities | 95 (39.9) | 131 (59.0) | 283 (69.7) | <0.01 | <0.01 | <0.01 |
| Vocational activities | 34 (14.3) | 68 (30.6) | 174 (42.9) | <0.01 | <0.01 | <0.01 |
| Volunteer activities | 90 (37.8) | 119 (53.6) | 274 (67.5) | <0.01 | <0.01 | <0.01 |
| Other organized activities | 84 (35.3) | 84 (37.8) | 212 (52.2) | 0.57 | <0.01 | <0.01 |

Acronyms: autism spectrum disorder (ASD), developmental disability (DD).

[a] "Often unhappy, depressed, or tearful" rated sometimes true included in the definition of depressive symptoms.

[b] "Often unhappy, depressed, or tearful" rated sometimes true excluded from the definition of depressive symptoms.

**Table 3**

Association between specific types of activities[a] and depressive symptoms when broadly defined[b] assessed via logistic regression, Study to Explore Early Development: Teen survey.

| | ASD | | Other DD | | No DD | |
|---|---|---|---|---|---|---|
| | aOR[c] (95 % CI) | p-value | aOR (95 % CI) | p-value | aOR (95 % CI) | p-value |
| Clubs | 1.62 (0.79, 3.31) | 0.190 | 1.53 (0.68, 3.42) | 0.303 | 0.83 (0.41, 1.69) | 0.607 |
| Social invitations | 1.68 (0.88, 3.21) | 0.113 | 0.44 (0.19, 1.02) | 0.056 | 1.32 (0.27, 6.63) | 0.733 |
| Sport activities | 0.40 (0.20, 0.81) | 0.011 | 0.68 (0.33, 1.37) | 0.278 | 0.47 (0.26, 0.86) | 0.014 |
| Vocational activities | 1.71 (0.20, 0.81) | 0.256 | 1.06 (0.52, 2.16) | 0.868 | 0.75 (0.40, 1.38) | 0.354 |
| Volunteer activities | 1.01 (0.51, 2.01) | 0.983 | 1.11 (0.54, 2.28) | 0.783 | 1.08 (0.54, 2.13) | 0.831 |
| Other organized activities | 0.97 (0.48, 1.94) | 0.923 | 1.06 (0.53, 2.10) | 0.878 | 1.07 (0.57, 2.00) | 0.836 |

Acronyms: autism spectrum disorder (ASD), developmental disability (DD), adjusted odds ratio (aOR), confidence interval (CI).

[a] No engagement in the activity was the referent category for analyses.

[b] "Often unhappy, depressed, or tearful" rated sometimes true included in the definition of depressive symptoms.

[c] Models adjusted for adolescent age, race/ethnicity, and sex; family income as percent of federal poverty level; and maternal education.

**Table 4**

Association between specific types of activities[a] and depressive symptoms when narrowly defined[b] assessed via logistic regression, Study to Explore Early Development: Teen survey.

| | ASD | | Other DD | | No DD | |
|---|---|---|---|---|---|---|
| | aOR[c] (95 % CI) | p-value | aOR (95 % CI) | p-value | aOR (95 % CI) | p-value |
| Clubs | 2.26 (0.93, 5.52) | 0.073 | 0.75 (0.23, 2.39) | 0.622 | 0.60 (0.22, 1.67) | 0.331 |
| Social invitations | 1.27 (0.57, 2.82) | 0.564 | 0.47 (0.15, 1.48) | 0.198 | *d* | *d* |
| Sport activities | 0.62 (0.27, 1.45) | 0.271 | 0.33 (0.12, 0.92) | 0.033 | 0.34 (0.14, 0.83) | 0.017 |
| Vocational activities | 2.46 (0.83, 7.29) | 0.101 | 1.19 (0.44, 3.24) | 0.730 | 1.41 (0.60, 3.32) | 0.433 |
| Volunteer activities | 1.22 (0.52, 2.87) | 0.653 | 2.29 (0.78, 6.71) | 0.132 | 1.11 (0.42, 2.99) | 0.831 |
| Other organized activities | 0.37 (0.14, 0.98) | 0.046 | 1.62 (0.62, 4.25) | 0.331 | 1.30 (0.52, 3.25) | 0.577 |

Acronyms: autism spectrum disorder (ASD), developmental disability (DD), adjusted odds ratio (aOR), confidence interval (CI).

[a] No engagement in the activity was the referent category for analyses.

[b] "Often unhappy, depressed, or tearful" rated sometimes true included in the definition of depressive symptoms.

[c] Models adjusted for adolescent age, race/ethnicity, and sex; family income as percent of federal poverty level; and maternal education.

[d] Estimate not reliable because model did not converge.