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ORIGINAL PAPER

Rates of Co-occurring Psychiatric Disorders in Autism Spectrum Disorder Using the Mini International Neuropsychiatric Interview

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Abstract

Individuals with autism spectrum disorder (ASD) often meet criteria for at least one additional psychiatric disorder. The present study evaluated the utility of the Mini International Neuropsychiatric Interview (MINI) in assessing co-occurring psychiatric disorders in children, adolescents, and young adults with ASD. Ninety-one percent of children/adolescents and thirty-one percent of young adults were diagnosed with one or more co-occurring diagnoses using the MINI. MINI diagnostic rates were comparable to those found in the literature on children/adolescents with ASD; however, in young adults, MINI diagnostic rates were lower relative to rates found in the literature on young adults with ASD. Implications for treatment, transitioning to adulthood, and the need for instruments developed specifically to diagnose co-occurring disorders in ASD are discussed.

Keywords Autism spectrum disorder · Assessment · Co-occurring · Comorbidity

Individuals with autism spectrum disorder (ASD) often meet criteria for at least one additional psychiatric disorder (Rosen et al. 2018). Common co-occurring psychiatric disorders in individuals with ASD include anxiety disorders, mood disorders, attention deficit hyperactivity disorder (ADHD), obsessive–compulsive disorder (OCD), and oppositional defiant disorder (ODD; Buck et al. 2014; Di Martino et al. 2017; Joshi et al. 2010; Leyfer et al. 2006; Simonoff et al. 2008). These high rates of co-occurring psychiatric disorders have significant clinical implications for individuals with ASD. The presence of one or more concurrent disorders can mask the expression of ASD symptoms and delay the diagnosis of ASD until later in childhood or early adolescence (Mazefsky et al. 2012), and the treatment of co-occurring disorders often requires additional psychosocial and pharmacological treatments (de Bruin et al. 2007; Joshi et al. 2010; Leyfer et al. 2006). Further, co-occurring psychiatric disorders may exacerbate ASD symptoms (de Bruin et al. 2007; Leyfer et al. 2006), interfere with optimal outcomes for ASD treatments (Joshi et al. 2010; McDougle et al. 2003), and predict worse long-term outcomes in individuals with ASD (Kamio et al. 2013; Kraper et al. 2017).

Previously reported prevalence rates indicate that between 70 and 95% of children and adolescents with ASD have at least one co-occurring psychiatric disorder (Gjevik et al. 2011; Joshi et al. 2010; Leyfer et al. 2006; Simonoff et al. 2008), 41% to 60% of children and adolescents with ASD have two or more co-occurring disorders, and as many as 24% of children and adolescents with ASD have three or more co-occurring disorders (Di Martino et al. 2017; Simonoff et al. 2008). Similarly, between 73 and 81% of adults with ASD meet criteria for at least one current co-occurring psychiatric disorder (Buck et al. 2014; Hofvander et al. 2009; Joshi et al. 2013; Vohra et al. 2016).

Although there is no consensus regarding the optimal instrument for measuring co-occurring psychiatric disorders

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in ASD, several studies have explored the use of structured or semi-structured interviews originally developed to assess childhood psychopathology outside the context of neurodevelopmental disorders. Structured interviews that have been used in the context of ASD include the Structured Clinical Interview for DSM-IV (SCID; Joshi et al. 2013), the Kiddie Schedule for Affective Disorders and Schizophrenia (K-SADS; e.g., Gjevik et al. 2011; Kaufman et al. 1997; Leyfer et al. 2006), the Diagnostic Interview Schedule for Children-Parent (DISC-IV; e.g., de Bruin et al. 2007; Muris et al. 1998), and the Child and Adolescent Psychiatric Assessment (CAPA), Parent version (Simonoff et al. 2008).

The aim of the current study was to evaluate the utility of the Mini International Neuropsychiatric Interview (MINI; Sheehan et al. 1998, 2010) by using it to estimate rates of co-occurring psychiatric disorders in ASD and compare to reported rates using other non-ASD specific, structured or semi-structured instruments. The MINI is a semi-structured psychiatric diagnostic interview that is widely used outside the field of ASD research. It was designed for use with individuals 8 to 25 years old and was chosen for the current study due to its brevity (20–30 min) relative to the SCID (45–60 min) and the K-SADS (75–90 min) and because it has been cross-validated with the K-SADS (Sheehan et al. 1998, 2010). One prior study examined co-occurring disorders in ASD using the caregiver-report version of the MINI (MINI-KID-P; Sheehan et al. 1998; Stadnick et al. 2017a, b) in a sample of children with ASD ages 4–14 years old, and reported that 92% of the sample had at least one co-occurring psychiatric disorder. The primary objective of the current study was to extend the work of Stadnick et al. (2017a, b) by exploring the use of the MINI in a wider age range of individuals with ASD. An additional, exploratory objective of the current study was to compare MINI-derived co-occurring diagnoses to community-derived co-occurring diagnoses. We also explored the impact of age, intellectual functioning, ASD symptom severity, medication status, and gender on rates of co-occurring disorders.

Method

Participants

Sixty-seven individuals with ASD ranging from eight to 25 years of age ($M = 16.97$, $SD = 3.75$) consented to a protocol approved by the institutional review board at UNC-Chapel Hill. Of the 67 participants, 35 were children or adolescents (i.e., 18 years of age or younger) and 32 participants were young adults (i.e., older than 18 years of age). Participants had fluent phrase speech and nonverbal IQ > 70 and had no known sensory deficits or diagnoses of intellectual disability. Participants were recruited via the UNC Autism Research Registry, a resource at the Carolina Institute for Developmental Disabilities. Recruitment materials did not specify that this was a study of co-occurring disorders in ASD.

Table 1 Sample demographics

	Children and adolescents ($n = 35$)	Adults ($n = 32$)
Age	14.03 (1.95)	20.19 (2.29)
Male:female ratio	29:6	7:1
Race		
White	91% (32)	93% (30)
African American	3% (1)	7% (2)
Multiracial	6% (2)	0%
Ethnicity: Hispanic/Latino	9% (3)	0%
Socioeconomic status	49.59 (13.01)	45.27 (14.70)
Verbal IQ (VIQ)	102.32 (16.23)	106.29 (16.95)
Performance IQ (PIQ)	98.41 (17.15)	106.39 (12.87)
Full scale IQ (FSIQ)	100.85 (17.18)	107.00 (13.99)
ADOS-2 CSS	8.60 (1.34), 6-10	8.03 (1.31), 6–10
SRS-2 total *t* score	80.06 (9.00)	71.56 (12.29)
Number of MINI-KID-P/MINI co-occurring diagnoses	1.97 (1.10)	0.38 (0.61)

Data presented as the following: mean (SD), range, or % (*n*). Socioeconomic status measured by Hollingshead Four Factor Index

IQ intellectual quotient, *CSS* calibrated severity score

Table 1 provides participant demographic information. Socioeconomic status (SES) was calculated using the Hollingshead Four Factor Index of social status, an index of SES based on parental education, occupation, sex, and marital status (Hollingshead 1975); raw scores range from 8 to 66, with higher scores indicating higher SES. SES was calculated based on caregiver information for both age groups, given that all young adult participants reported that they were financially supported by one or both caregivers at the time of the study. Clinical diagnoses of ASD were based on a history of clinical diagnosis confirmed via Modules 3 or 4 of the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2; Gotham et al. 2012) administered by a research reliable assessor and using standard algorithm cutoffs for ASD; ADOS-2 calibrated severity scores (CSS) are reported (Gotham et al. 2009; Hus et al. 2014). Intellectual functioning was assessed using the Wechsler Abbreviated Scale of Intelligence (WASI) for participants 18–20 years old or the Kaufman Brief Intelligence Test, Second Edition (KBIT-II) for participants 12–17 years old, both reliable brief measures of intelligence that can be administered in approximately 30 min to derive Verbal IQ, Performance IQ, and Full Scale IQ scores. Both have been used in ASD

samples (Bardikoff and McGonigle-Chalmers 2014; Elison et al. 2012; Mosner et al. 2017).

Procedure

Following consent, the diagnostic, demographic and symptom assessments, and cognitive tests were administered. Symptom questionnaires were completed on a computer using Qualtrics survey software. Participants received a base rate of $10, plus $10 per hour for the 2- to 4-h testing session.

Materials and Measures

ASD Symptoms

The Social Responsiveness Scale (SRS) is an instrument that provides a dimensional measure of ASD impairments. The 65-item rating scale measures the severity of social-communicative ASD symptoms as they occur in natural social settings (Constantino et al. 2003). Participants responded on a four-point Likert scale, representing a range from "not true" to "almost always true." *T* scores from 60 to 75 are considered to be in the mild to moderate range while scores above 76 are considered to be in the severe range of impaired social functioning. Young adult participants completed the self-report version of the SRS (SRS-SR); caregivers completed the caregiver-report version of the SRS (SRS-CR) for participants younger than 18 years old.

Co-occurring Psychiatric Disorders

To assess for current Axis I psychopathology, caregivers of the children and adolescent group completed the MINI for Children and Adolescents, parent version (MINI-KID-P), and the young adult group completed the MINI. The MINI and the MINI-KID-P are semi-structured clinical diagnostic interviews that evaluate the presence of DSM-IV and ICD-10 psychiatric disorders in children and adolescents ages 6 to 18 via parent interview and via self-report in young adults over the age of 18 years, respectively (Sheehan et al. 1998, 2010).

During the assessment, caregivers of the child and adolescent group and the young adult group also completed a background form asking about current community mental health diagnoses other than ASD ("additional diagnoses") provided by community-based clinicians as well as current psychiatric medications and prior treatments. Mood stabilizing and anticonvulsant medications were categorized as psychotropic if emotional and/or behavioral symptoms were being targeted and if there was no reported seizure disorder (Buck et al. 2014).

Data Analytic Plan

Prevalence rates of co-occurring psychiatric disorders are reported via descriptive statistics, and correlations and Chi square tests were conducted to assess the relationships among MINI diagnoses, gender, IQ, and ASD symptom severity. A summary code strategy modeled after Mazefsky et al. (2012) was used to improve compatibility with community diagnoses. Summary codes for children and adolescents were created for depressive disorders (major depression and dysthymic disorder) and anxiety disorders (generalized anxiety disorder (GAD), separation anxiety disorder, panic disorder, agoraphobia, social phobia, and specific phobia); obsessive–compulsive disorder (OCD) was kept separate. Therefore, MINI-KID-P diagnostic categories included in analyses were any depressive disorder, bipolar disorder, any anxiety disorder, OCD, Tourette's disorder, ADHD, ODD, and conduct disorder (CD). Also modeled after Mazefsky et al. (2012), composites codes were created for internalizing (i.e., depression, anxiety, bipolar, OCD) and externalizing (i.e., ADHD, ODD, substance use disorders) disorders. Summary codes for young adults were similarly created to improve compatibility with self-reported community diagnoses, and included the following: any depressive disorder, bipolar disorder, any anxiety disorder, and OCD. Inter-rater reliability (Cohen's kappa) assessed concordance between MINI (MINI-KID-P or MINI) diagnoses and the (caregiver- or self-) reported community diagnoses.

Results

Prevalence Rates: Children and Adolescents

MINI-KID-P

Thirty-two out of 35 children and adolescents (91% of the sample) were diagnosed with one or more co-occurring diagnoses based on results from the caregiver-report version of the MINI (i.e., the MINI-KID-P). All co-occurring diagnoses reported on the MINI-KID-P indicate current severity (i.e., present in the past 1 to 12 months).

The most commonly reported co-occurring disorder based on findings from the MINI-KID-P was ADHD, with 25 out of 35 children and adolescents (71% of the sample) meeting criteria for any ADHD presentation (see Table 2). Across ADHD presentation types, 15 out of 35 participants (43% of the sample) met criteria for inattentive-type and 10 out of 35 participants (29% of the sample) met criteria for combined-type; none met criteria for hyperactive-impulsive type. Ten out of 35 children and adolescents (29% of the sample) met criteria for a co-occurring depressive episode on the MINI-KID-P, with half of those participants (n = 5)

Table 2 Co-occurring psychiatric disorders reported via the MINI-KID-P and caregiver report

Number of diagnoses	MINI-KID-P % (*n*)	Caregiver report % (*n*)
None	8.6% (3)	37.1% (13)
One	25.7% (9)	40.0% (14)
Two	31.4% (11)	14.3% (5)
Three	20% (7)	8.6% (3)
Four or more	14.3% (5)	0%
Diagnostic category	MINI-KID-P % (*n*)	Caregiver report % (*n*)[a]
Depression	28.6% (10)	8.6% (3)
Past episode	14. 3% (5)	–
Recurrent	14. 3% (5)	–
Anxiety	34.3% (12)	25.7% (9)
Panic disorder	2.9% (1)	–
Agoraphobia	2.9% (1)	–
Separation anxiety	2.9% (1)	–
Social phobia	17.1% (6)	–
Specific phobia	2.9% (1)	–
GAD	17.1% (6)	–
ADHD	71.4% (25)	34.3% (12)
Inattentive type	42.9% (15)	–
Hyperactive-impulsive type	0%	–
Combined type	28.6% (10)	–
OCD	11.4% (4)	17.1% (6)
Tourette's disorder	5.7% (2)	2.9% (1)
Conduct disorder	5.7% (2)	0%
ODD	40.0% (14)	0%
Internalizing disorder (at least one)	54.3% (19)	40.0% (14)
Externalizing disorder (at least one)	74.3% (26)	37.1% (13)

Caregiver-reported diagnoses not measured via the MINI-KID-P included Sensory Integration Disorder ($n=1$) and Dysgraphia ($n=1$)

[a]Caregiver-reported diagnoses of depression, anxiety, and ADHD did not include specifications about subtypes

meeting for a past depressive episode and half (n = 5) meeting for a recurrent depressive episode. No participants met diagnostic criteria for current dysthymia. Twelve out of 35 participants (34% of the sample) met criteria on the MINI-KID-P for at least one anxiety disorder when collapsing across anxiety subtypes. Of those 12 participants, four participants met for two separate anxiety disorders (11% of the sample). For panic disorder, agoraphobia, separation anxiety, and specific phobia, one participant met criteria for each. Six participants out of 35 (17% of the sample) met criteria for social phobia and six out of 35 participants (17% of the sample) met for GAD. Of the participants who met criteria for two anxiety disorders, three (9% of the sample) met for both social phobia and GAD while the fourth met for both agoraphobia and GAD. Results from the MINI-KID-P also indicated that four out of 35 children and adolescents (11% of the sample) met criteria for co-occurring OCD, two participants (6% of the sample) met for CD, and 14 participants (40% of the sample) met for ODD. Finally, two participants out of 35 (6% of the sample) met criteria for Tourette's disorder.

When grouping disorders into internalizing (depression, anxiety, and OCD) and externalizing (ADHD, CD, and ODD) disorder categories, 19 out of 35 participants (54% of the sample) met criteria for at least one co-occurring internalizing disorder and 26 out of 35 participants (74% of the sample) met criteria for at least one co-occurring externalizing disorder.

Exploratory Comparisons Between MINI-KID-P and Community Diagnoses

There was poor agreement between the MINI-KID-P and community diagnoses in children and adolescents, with Cohen's kappas ranging from no agreement to substantial agreement (0 to 0.65, respectively; see Table 3). Compared to MINI-KID-P reported diagnoses, community diagnoses indicated that 63% ($n=22$) of children and adolescents met

Table 3 Comparison of co-occurring psychiatric disorders between the MINI-KID-P diagnoses and caregiver-reported diagnoses

		Caregiver reported diagnoses % (n)								
		Depression	Anxiety	OCD	ADHD	Tourette's	ODD	CD	Intern	Extern	Kappa
MINI-KID-P diagnoses % (n)		8.6 (3)	25.7 (9)	17.1 (6)	34.3 (12)	2.9 (1)	0	0	40.0 (14)	37.1 (13)	
	Depression	28.6 (10)	70.0% (7/10)								0.38
	Anxiety	34.3 (12)		25.0% (3/12)							0.26
	OCD	11.4 (4)			100.0% (4/4)						0.54
					33.3% (2/6)[a]						
	ADHD	71.4 (25)				52.0% (13/25)					0.24
	Tourette's	5.7 (2)					50.0% (1/2)				0.65
	ODD	40.0 (14)						0% (0/14)			0
	CD	5.7 (2)							0.0% (0/2)		0
	Intern	54.3 (19)								26.3% (5/19)	0.39
	Extern	74.3 (26)								50.0% (13/26)	0.03

[a]Number of diagnoses reported via caregiver report and missed via the MINI-KID-P

criteria for one or more co-occurring diagnoses. Overall, 55% (38 of 69) of MINI-KID-P current co-occurring diagnoses were not supported by community diagnoses and 8% (2 of 23) of community diagnoses were not supported by the MINI-KID-P. Specifically, 70% (seven of ten) of depressive disorders reported on the MINI-KID-P were not supported by community diagnoses and 52% (13 of 25) of ADHD diagnoses reported via the MINI-KID-P were not supported by community diagnoses. The highest agreement between the MINI-KID-P and community diagnoses was for Tourette's disorder, with one additional participant meeting criteria for Tourette's (2 out of 32, 6%) via the MINI-KID-P compared to only one participant meeting criteria per community diagnoses. For anxiety disorders, 25% (3 of 12) of anxiety disorders reported on the MINI-KID-P were not supported by community diagnoses. No current community diagnoses of conduct disorder (CD) or oppositional defiant disorder (ODD) were reported, compared to two participants meeting criteria for CD and 14 meeting criteria for ODD based on the MINI-KID-P. In contrast, 33% (two of six) of OCD community diagnoses were not supported by the MINI-KID-P. When comparing internalizing and externalizing diagnoses, 26% (5 of 19) of internalizing disorders and 50% (13 of 26) of externalizing disorders reported via the MINI-KID-P were not supported by community diagnoses.

Medication Status and Prior Treatment

Twenty-two out of 35 children and adolescents (63% of the sample) were taking psychiatric medications (see Table 4). Of these, 21 were taking a psychostimulant. Other medications included selective serotonin reuptake inhibitors (SSRIs; e.g., Zoloft), atypical antidepressant medications (e.g., Mirtazapine), antipsychotics (e.g., Risperidone), and other mood-stabilizers (e.g., Lithium).

Twenty two out of 35 children and adolescents (63% of the sample) endorsed participating in prior treatment (see Table 4). The most common types of prior treatment included psychotherapy (37% of the sample), occupational therapy (31% of the sample), speech therapy (26% of the sample) and social skills group (11% of the sample). Other forms of therapy included physical therapy (9% of the sample), play therapy (3% of the sample), and sensory integration therapy (3% of the sample).

Relations Between Rates of Co-occurring Disorders and ASD Severity

There was a significant inverse correlation between the total number of current co-occurring disorders reported in children and adolescents on the MINI-KID-P and the ADOS-2 CSS, $r(34) = -0.36$, $p = 0.04$, such that participants with fewer co-occurring disorders had greater ASD symptom

Table 4 Prevalence of rates of psychiatric medications and prior treatments among children and adolescents

	% (*n*)
Number of diagnoses	
None	37.1% (13)
One	31.4% (11)
Two	17.1% (6)
Three or more	14.3% (5)
Medication type	
Stimulant or other ADHD medication	60.0% (21)
Antipsychotic	8.6% (3)
SSRI or antidepressant	34.3% (12)
Other mood stabilizer	8.6% (3)
Prior treatment type	
Psychotherapy (individual and/or parent-training)	37.1% (13)
Social skills group	11.4% (4)
Speech therapy	25.7% (9)
Physical therapy	8.6% (3)
Occupational therapy	31.4% (11)
Sensory integration therapy	2.9% (1)
Other	5.7% (2)

from the MINI-KID-P in children and adolescents, 86% of male participants (26 of 29) and 100% of female participants (six of six) met criteria for one or more current co-occurring diagnoses (see Table 5). Only male participants met criteria for co-occurring OCD (14% of the male sample, $n=4$) and Tourette's syndrome (7%, $n=2$). For both genders, the most prevalent current disorder diagnosed via the MINI-KID-P was ADHD, with all female participants ($n=6$) meeting criteria for co-occurring ADHD and 66% males ($n=19$) meeting current criteria. Chi square tests revealed no significant differences between genders in the proportion of MINI-KID-P-reported current co-occurring disorders (p's > 0.05).

According to community diagnoses, 64% of male participants (18 of 29) and 66% of female participants (four of six) were diagnosed with one or more current co-occurring diagnoses (see Table 6). Only male participants had current community diagnoses of OCD (21% of the male sample, $n=6$), Tourette's syndrome (3%, $n=1$), Sensory Integration Disorder (3%, $n=1$), and dysgraphia (3%, $n=1$). There was a significant difference in the proportion of female participants who met criteria for current co-occurring depression based on community diagnoses (33%, $n=2$) relative to the proportion of male participants (3%, $n=1$), $\chi^2(1)=5.67$, $p=0.02$. Chi square tests revealed no other significant gender differences in proportions of current community-derived co-occurring disorders (p's > 0.05).

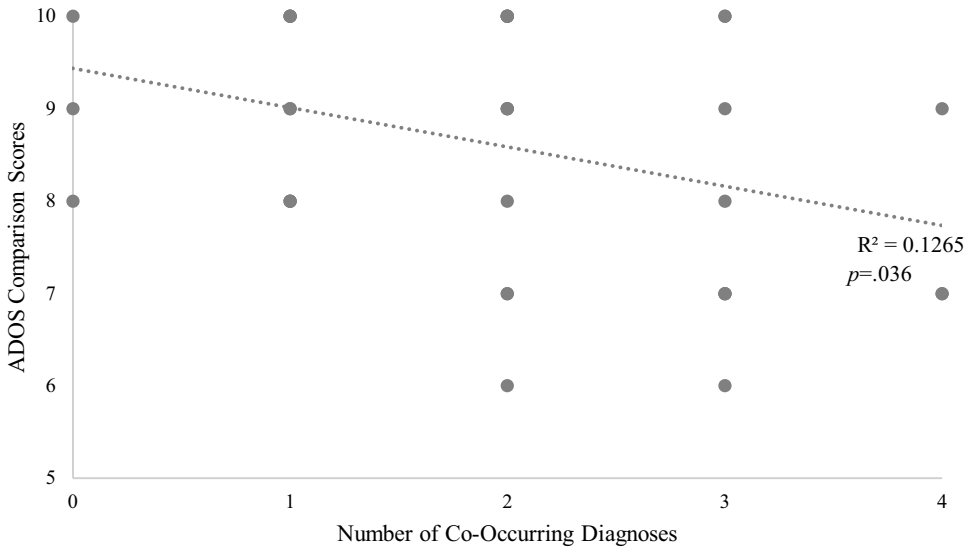

Fig. 1 Correlation between the total number of co-occurring psychiatric diagnoses (from the MINI-KID-P) and ADOS comparison scores

severity scores (see Fig. 1). There were no significant correlations between the total number of co-occurring disorders reported on the MINI-KID-P and age ($r(34)=0.22$, $p=0.20$), FSIQ ($r(34)=0.05$, $p=0.76$), SRS scores ($r(34)=0.11$, $p=0.53$), or number of current psychiatric medications ($r(34)=0.25$, $p=0.14$).

Gender Differences

Given the limited number of female participants in the present study, gender analyses are exploratory. Based on results

Prevalence Rates: Young Adults

MINI

According to MINI-reported diagnoses by young adults, 10 out of 32 young adults (31% of the sample) met criteria for

Table 5 Gender differences in co-occurring psychiatric disorders reported via the MINI-KID-P

	Males (N = 29), % (*n*)	Females, (N = 6), % (*n*)	$\chi(1)^2$	*P* value
Number of diagnoses				
None	10.3% (3)	0%	0.68	0.41
One	27.6% (8)	16.7% (1)	0.31	0.58
Two	31.0% (9)	33.3% (2)	0.01	0.91
Three	17.2% (5)	33.3% (2)	0.81	0.37
Four or more	13.8% (4)	16.7% (1)	0.03	0.85
Diagnostic category				
Depression	24.1% (7)	50.0% (3)	1.63	0.20
Anxiety	48.3 (14)	16.7% (1)	2.03	0.15
ADHD	65.5% (19)	100% (6)	2.90	0.09
OCD	13.8% (4)	0%	0.93	0.33
Tourette's disorder	6.9% (2)	0%	0.44	0.51
Conduct disorder	3.4% (1)	16.7% (1)	1.61	0.20
ODD	37.9% (11)	50.0% (3)	0.30	0.58

one or more current (i.e., present in the past 1–12 months) co-occurring diagnoses.

The most commonly reported co-occurring disorder based on findings from the MINI was depressive disorder (25% of the sample, $n = 8$), with 6 out of 32 participants meeting criteria for a past episode (19% of the sample) and two participants meeting criteria for recurrent depression (6% of the sample; see Table 7). Four out of 32 participants met criteria for an anxiety disorder (13% of the sample), with three of the four participants meeting criteria for social phobia and one participant meeting criteria for panic disorder. Participants did not endorse externalizing disorders on the MINI (i.e., substance use disorder); however, in contrast to the MINI-KID-P, the MINI does not assess for a variety of externalizing disorders frequently reported in young adults with ASD, most notably ADHD.

Exploratory Comparisons Between MINI and Community Diagnoses

There was poor agreement between the MINI and community diagnoses for young adults, with Cohen's kappas ranging from no agreement to fair agreement (0 to 0.47, respectively; see Table 8). Compared to MINI-reported diagnoses, community diagnoses indicated that 41% ($n = 13$) of young adults met criteria for one or more co-occurring diagnoses. Overall, 58% (7 of 12) of MINI current co-occurring diagnoses were not supported by community-derived co-occurring diagnoses. Specifically, 63% of depressive disorders reported on the MINI were not supported by community diagnoses, while 25% (one of four) of anxiety disorders reported on the MINI were not supported by community diagnoses. Seventy-five percent (15 of 20) of community-derived co-occurring diagnoses were not supported by the MINI; however, among these community diagnoses were ADHD (endorsed by nine participants) and Tourette's disorder (endorsed by 1 participant), which are not directly assessed via the MINI. Therefore, when considering co-occurring disorders measured via the MINI, 40% (four of ten) of community-derived co-occurring diagnoses were not supported by the MINI; four individuals reported a community-derived co-occurring diagnosis of OCD but did not meet criteria for OCD via the MINI. Approximately 17% (2 of 12) of internalizing disorders reported on the MINI were not supported by community diagnoses. Externalizing disorders were only reported via community diagnoses (i.e., ADHD).

Table 6 Gender differences in co-occurring psychiatric disorders reported via community diagnoses for children and adolescents

	Males (N = 29), % (*n*)	Females, (N = 6), % (*n*)	$\chi(1)^2$	P values
Number of diagnoses				
None	39.3% (11)	50% (2)	0.05	0.83
One	42.9% (12)	33.3% (2)	0.13	0.71
Two	17.9% (5)	0% (0)	1.21	0.27
Three	3.4% (1)	33.3% (2)	5.67	0.02*
Diagnostic category				
Depression	3.4% (1)	33.3% (2)	5.67	0.02*
Anxiety	2.4% (7)	33.3% (2)	0.22	0.64
ADHD	31.0% (9)	50.0% (3)	0.79	0.37
OCD	20.7% (6)	0%	1.50	0.22
Tourette's disorder	3.4% (1)	0%	0.21	0.64
Sensory integration disorder	3.4% (1)	0%	0.21	0.64
Dysgraphia	3.4% (1)	0%	0.21	0.64

Table 7 Co-occurring psychiatric disorders reported via the MINI and self-report

Number of diagnoses	MINI % (*n*)	Self-report % (*n*)
None	68.8% (22)	59.4% (19)
One	25.0% (8)	25.0% (8)
Two	6.3% (2)	9.4% (3)
Three	0%	6.3% (2)
Diagnostic category	MINI % (*n*)	Self-report % (*n*)
Depression	25.0% (8)	9.4% (3)
Past episode	18.8% (6)	–
Recurrent	6.3% (2)	–
Anxiety	12.5% (4)	9.4% (3)
Panic disorder	3.1% (1)	–
Agoraphobia	0%	–
Separation anxiety	0%	–
Social phobia	9.4% (3)	–
Specific phobia	0%	–
GAD	0%	–
OCD	0%	12.5% (4)
Internalizing disorder (at least one)	37.5% (12)	31.3% (10)
Externalizing disorder (at least one)	0%	28.1% (9)

Self-reported diagnoses not measured via the MINI included ADHD (29.1%, $n=9$) and Tourette's disorder (3.1%, $n=1$)

[a]Self-reported diagnoses of depression and anxiety did not include specifications about subtypes

Table 8 Comparison of co-occurring psychiatric disorders between the MINI diagnoses and self-reported diagnoses

			Self-reported diagnoses % (n)					Kappa
			Depression	Anxiety	OCD	Intern	Extern[a]	
			8.6 (3)	9.4 (3)	12.5 (4)	31.3 (10)	28.1 (9)	
MINI diagnoses % (n)	Depression	25.0 (8)	62.5% (5/8)					0.47
	Anxiety	12.5 (4)		25.0% (1/4)				0.20
	OCD	0.0 (0)			0.0% (4/4)*			0.00
	Intern	37.5 (12)				16.7% (2/12)		0.45
	Extern[a]	0.0 (0)					0.0% (9/9)*	0.00

*Number of community diagnoses reported and missed via the MINI

[a]Externalizing disorders were only reported via self-report and included disorders not assessed via the MINI (i.e., ADHD and Tourette's Disorder)

Medication Status and Prior Treatment

Twelve young adults (38% of the sample) were currently taking one or more psychiatric medications (see Table 9). Of the 12 participants, eight were taking an SSRI (e.g., Prozac) or other mood stabilizer (e.g., Lamotrigine), seven were taking a stimulant (e.g., Concerta), three were taking an antipsychotic medication (e.g., Abilify), and one was taking an anxiolytic (i.e., Xanax).

Nine out of 32 young adults (28% of the sample) endorsed participating in prior treatment (see Table 9). The types of prior treatment endorsed included psychotherapy (13% of the sample), speech therapy (6% of the sample), social skills group (6% of the sample), and sensory integration therapy (3% of the sample).

Relations Between Rates of Co-occurring Disorders and ASD Severity

There were no significant correlations between the total number of current co-occurring disorders in young adults reported on the MINI and age ($r(28)=0.05$, $p=0.78$),

Table 9 Prevalence rates of psychiatric medications and prior treatments among young adults

	% (*n*)
Number of diagnoses	
None	62.5% (20)
One	12.5% (4)
Two	25.0% (8)
Medication type	
Stimulant or other ADHD medication	21.9% (7)
Antipsychotic	9.4% (3)
SSRI or antidepressant	25.0% (8)
Anxiolytic	3.1% (1)
Prior treatment type	
Psychotherapy (individual and/or parent-training)	12.5% (4)
Social skills group	6.3% (2)
Speech therapy	6.3% (2)
Occupational therapy	3.1% (1)
Sensory integration therapy	3.1% (1)

FSIQ ($r(28) = 0.02$, $p = 0.92$), ADOS-2 CSS ($r(28) = 0.19$, $p = 0.30$), or number of current psychiatric medications ($r(28) = 0.33$, $p = 0.06$). There was a significant correlation between the total number of current co-occurring disorders reported on the MINI and SRS *t* scores ($r(28) = 0.42$, $p = 0.02$), such that participants with a greater number of current co-occurring disorders reported higher levels of ASD symptoms. However, this correlation was driven by the two participants (of 30) who met for more than one co-occurring disorder: after removing these outliers, the correlation was no longer significant ($p > 0.05$).

Gender Differences

Based on results from the MINI in young adults, exploratory gender analyses revealed that 25% of male and 25% of female participants (20 of 28 and one of four, respectively) met criteria for at least one current co-occurring diagnosis (Table 10). Chi square tests revealed no significant gender differences in proportions of current co-occurring MINI diagnoses (p's > 0.05).

In contrast, according to community-derived co-occurring disorders, 36% of male participants (10 of 28) were diagnosed with one or more current co-occurring diagnoses, while 75% of female participants (three of four) were diagnosed with only one current co-occurring diagnosis (see Table 11). Only male participants endorsed previous diagnoses of depression (11% of the male sample, $n = 3$), ADHD (32%, $n = 9$), and Tourette's syndrome (4%, $n = 1$). There was a significant difference in the proportion of female participants who met criteria for co-occurring anxiety via self-report (50%, $n = 2$) relative to the proportion of male participants (3%, $n = 1$), $\chi^2(1) = 8.88$, $p = 0.003$. Chi square tests revealed no other significant gender differences in proportions of current co-occurring diagnoses (p's > 0.05).

Table 10 Gender differences in co-occurring psychiatric disorders reported via the MINI

	Males (N = 28), % (*n*)	Females, (N = 4), % (*n*)	$\chi(1)^2$	P value
Number of diagnoses				
None	71.4% (20)	50% (2)	0.75	0.39
One	25.0% (7)	25.0% (1)	0.00	0.99
Two	3.6% (1)	25.0% (1)	2.74	0.10
Diagnostic category				
Depression	21.4% (6)	50.0% (2)	1.52	0.22
Anxiety	10.7% (3)	25.0% (1)	0.65	0.42

Table 11 Gender differences in co-occurring psychiatric disorders reported via community diagnoses for young adults

	Males (N = 28), % (*n*)	Females, (N = 4), % (*n*)	$\chi(1)^2$	P value
Number of diagnoses				
None	64.3 (18)	25.0% (1)	2.24	0.13
One	17.9% (5)	75.0% (3)	6.10	0.01*
Two	10.7% (3)	0% (0)	0.47	0.49
Three	7.1% (2)	0% (0)	0.31	0.58
Diagnostic category				
Depression	10.7% (3)	0% (0)	0.47	0.49
Anxiety	3.6% (1)	50.0% (2)	8.88	0.003*
ADHD	32.1% (9)	25.0% (1)	0.08	0.77
OCD	10.7% (3)	0%	0.47	0.49
Tourette's disorder	3.6% (1)	0%	0.15	0.70

*Significant at $p \leq .01$

Discussion

The goal of the present study was to evaluate the utility of the MINI-KID-P and the MINI in assessing co-occurring psychiatric disorders in children, adolescents, and young adults with ASD. Overall, using a briefer measure relative to previously employed semi-structured interviews, our results support previous findings of prevalence rates in children and adolescents with ASD.

Children and Adolescent Findings

Our results using the MINI-KID-P confirm previous findings of high rates of co-occurring psychiatric disorders in

children and adolescents with ASD using other measures. Ninety-one percent of children and adolescents with ASD met criteria for at least one co-occurring diagnosis. Based on the MINI-KID-P, ADHD and anxiety disorders were among the most prevalent co-occurring disorders in children and adolescents, and these rates were comparable to previous findings (e.g., Gjevik et al. 2011; Soke et al. 2018; Stadnick et al. 2017a; van Steensel et al. 2011). The rates of depressive disorder, OCD, CD, and ODD in the present sample were similarly comparable to prior studies (de Bruin et al. 2007; Gjevik et al. 2011; Hudson et al. 2018; Simonoff et al. 2008). The MINI-K-P prevalence rates of internalizing disorders were consistent with results from Mazefsky et al. (2012); however, the MINI-KID-P-derived rate of externalizing co-occurring disorders was significantly greater than previously reported, with nearly three-fourths of the sample meeting criteria for a co-occurring externalizing disorder.

Our findings using the MINI-KID-P are consistent with the findings of Stadnick et al. (2017a) and demonstrated prevalence rates comparable to prior studies using other semi-structured instruments (e.g., Gjevik et al. 2011; Joshi et al. 2013). Due to brevity and ease of administration, the MINI may be an appropriate instrument for measuring co-occurring psychiatric disorders in children and adolescents with ASD. Based on the current study, we also demonstrated the utility of the MINI-KID-P in a research setting for identifying a range of internalizing disorders (e.g., depression, anxiety, and OCD) and externalizing disorders (e.g., ADHD, ODD) in children and adolescents with ASD. However, the exploratory objective to investigate diagnostic agreement between the MINI-KID-P and community diagnoses indicated poor agreement. Across all but one diagnostic category (i.e., OCD), the prevalence rates of co-occurring diagnoses (e.g., major depressive disorder, anxiety disorders) were significantly greater for MINI-KID-P-reported diagnoses compared to community diagnoses. This lack of concordance highlights the need to gather additional information regarding how community diagnoses were derived.[1] This additional information could elucidate whether this discord exists due to a lack of formal assessment of psychiatric diagnoses using semi-structured instruments, or other measurement-related distinctions.

Young Adult Findings

To our knowledge, the present study is the first to use the MINI in young adults with ASD. The present findings revealed that only 31% of young adults met criteria for one or more co-occurring diagnoses based on self-reported symptoms on the MINI. These rates are lower than prior rates which indicate that almost three-fourths of young adults meet criteria for an additional co-occurring psychiatric disorder (Buck et al. 2014; Hofvander et al. 2009; Joshi et al. 2013; Vohra et al. 2016). The most common psychiatric diagnosis based on self-reported symptoms on the MINI was depression (25% of the sample), followed by anxiety disorders (12% of the sample), consistent with some previous reports (Buck et al. 2014; Joshi et al. 2013). In our sample, no participants met criteria for bipolar disorder, OCD, or psychosis based on the self-report MINI, in contrast with previous findings using parent report (Buck et al. 2014) and self-report (Joshi et al. 2013). Similar to the findings in the children and adolescent sample, agreement between the MINI and community diagnoses was poor; in contrast to the findings in children and adolescents, community-derived co-occurring disorders rates in young adults (41%) were greater than MINI-derived co-occurring disorders (31%). However, this poor agreement may reflect not only the limitations of the current sampling methods but also the fact that the MINI does not query for certain externalizing disorders in young adults, most notably ADHD and Tourette's disorder, both of which were endorsed via community diagnoses (31% of the sample). When ADHD diagnoses were excluded from community-derived co-occurring disorders, rates in young adults (34%) were comparable to MINI-derived co-occurring disorders (31%). Given the reported community diagnoses of ADHD and previously reported prevalence rates of ADHD among adults with ASD (Joshi et al. 2013), this is an important limitation of the MINI's use in an adult ASD sample.

Limitations and Future Directions

Future studies should compare the use of the MINI-KID-P to the MINI-KID, a caregiver interview in which the child or adolescent is concurrently interviewed (i.e., adolescents can opt to be interviewed separate from parent; Sheehan et al. 2010), in children and adolescents with ASD to determine child-caregiver agreement in an ASD sample and to allow comparisons to rates in young adults. Similarly, given our low prevalence rates in young adults and evidence of questionable self-report in ASD (Mazefsky et al. 2011), future studies are needed that compare caregiver-report for young adults with ASD to self-report to assess whether young adults are accurately reporting co-occurring symptoms or whether the MINI is an appropriate measure for samples of young adults with ASD more generally. Further, direct comparisons of prevalence rates across development may shed light on previous reports highlighting potential age-related differences among co-occurring psychiatric disorders (Gadke et al. 2016; Joshi et al. 2013; Kessler et al. 2007).

It is also important to note the relatively small sample size in the present study, particularly in comparison

[1] We thank the reviewer for raising this important point and allowing us the opportunity to clarify

to other studies examining co-occurring conditions (e.g., Buck et al. 2014; Joshi et al. 2013; Vohra et al. 2016). Additionally, the current study used a convenience sample which resulted in a predominantly Caucasian and high SES sample. Future studies should extend this work to more heterogeneous samples given significant evidence of ethnic, racial, and SES disparities in the diagnosis and prevalence of ASD (Durkin et al. 2017; Mandell et al. 2009). Finally, future studies are needed to collect more detailed information and additional documentation to verify community-derived diagnoses in order to make more nuanced comparisons with diagnoses derived via semi-structured instruments such as the MINI.

We did not observe any significant associations between numbers of co-occurring psychiatric disorders and age. Previous studies have shown that, in children with ASD, behavioral disorders decreased with age (Mattila et al. 2010) while co-occurring OCD appears to be more common in older children (Gjevik et al. 2011). Therefore, future studies with larger sample sizes would have more power to detect possible influences of age (among other factors) on the presence of co-occurring disorders. The current study found that higher ASD severity scores were associated with fewer co-occurring psychiatric disorders in children and adolescents with ASD, in contrast with previous studies indicating that greater ASD symptom severity is associated with greater levels of co-occurring psychiatric symptoms (e.g., Gadke et al. 2016). Results revealed no significant relationship between ASD severity and number of co-occurring psychiatric disorders in young adults with ASD. Therefore, further research is needed to explore the influences of ASD severity on the occurrence of co-occurring disorders across development.

Due to the limited number of female participants, gender differences in the present study should be interpreted with caution. Nevertheless, these exploratory findings revealed higher prevalence rates among females relative to males, among children and adolescents, particularly in relation to externalizing disorders (e.g., ADHD, ODD, CD), in contrast to previous findings that indicate boys exhibit greater externalizing behaviors (Hiller et al. 2014). More recent evidence suggests there are fewer gender differences across several factors including cognitive profiles or symptom severity compared to previous reports (Mussey et al. 2017). These inconsistencies highlight the importance of future studies examining the presentation of co-occurring psychiatric disorders in females with ASD.

Of note, the present study only focused on individuals with fluent phrase speech and IQ > 70 given that the MINI was initially validated on individuals without intellectual impairment. Therefore, the current findings cannot be generalized to individuals with intellectual impairment. Future studies should explore methods for evaluating co-occurring psychiatric disorders in individuals with a wide range of functioning.

Implications

High rates of co-occurring psychiatric disorders in individuals with ASD have significant implications for treatment. Many pharmacological treatments for individuals with ASD target co-occurring symptoms or disorders and not ASD symptoms themselves (Joshi et al. 2010). In line with previous research, the present study found high rates of psychiatric medication use among individuals with ASD, particularly in children and adolescents (e.g., Aman 2005; Buck et al. 2014). The most commonly reported medications included stimulants and SSRIs. A greater proportion of children and adolescents were taking at least one psychiatric medication relative to young adults; these findings contrast with previous studies that have demonstrated an increase in psychotropic medications with greater age (Aman 2005; Coury et al. 2012; Esbensen et al. 2009). Given that pharmacological treatment plays a major role in the management of co-occurring emotional (e.g., anxiety) and behavioral problems (e.g., aggression) for individuals with ASD, a brief and validated way to identify co-occurring psychiatric disorders in ASD could likely improve pharmacological management in this population.

For young adults with ASD, accurate identification of co-occurring psychiatric disorders can also have implications for the transition to adulthood and optimizing quality of life (Buck et al. 2014; Gadke et al. 2016). Young adults with ASD work fewer hours and are less likely to be employed relative to individuals with typical development (Burgess and Cimera 2014) and co-occurring psychiatric disorders make this transition period even more difficult (Gadke et al. 2016). Co-occurring psychiatric disorders (e.g., anxiety, depression, ADHD) have been linked to lower adaptive functioning (Kraper et al. 2017), as well as lower quality of life in adults with ASD (Kamio et al. 2013).

The high rates of variability of co-occurring psychiatric disorders in ASD indicate the need for an instrument developed specifically to diagnose co-occurring disorders in ASD. In many prior studies, researchers adapted the original clinical measures to address the unique needs of individuals with ASD (e.g., de Bruin et al. 2007; Joshi et al. 2010; Leyfer et al. 2006), and found comparable prevalence rates to previous studies. In contrast, Lainhart et al. (2003) created the Autism Comorbidity Interview (ACI), an instrument modified from the K-SADS, to assess co-occurring psychiatric disorders specifically in individuals with ASD (Lainhart et al. 2003; Leyfer et al. 2006; Mazefsky et al. 2012). Results from the ACI revealed lower prevalence rates of co-occurring psychiatric disorders (i.e., 51% of children had at least one co-occurring psychiatric disorder; Mazefsky et al. 2012)

relative to studies using other diagnostic instruments (e.g., Gjevik et al. 2011; Simonoff et al. 2008). This highlights the potential discrepancies between an ASD-specific instrument and other standardized diagnostic tools.

It is important to acknowledge the continued challenge of assessing co-occurring psychiatric disorders in ASD. Given that diagnostic overlap is common in ASD across a number of co-occurring disorders (Drabick and Kendall 2010; Kerns and Kendall 2012), distinguishing between two disorders is essential to ensure it is not simply poor differential diagnosis. Kerns and Kendall (2012) provide a thorough review of the many complications inherent to differentiating and classifying anxiety in ASD. In particular, they outline conflicting support for both a true co-occurring condition as well as anxiety symptoms closely related to core features of ASD, further complicated by support for shared etiology across disorders (e.g., shared genetic and environmental risk factors). These considerations, in combination with the current findings, support the need for validated instruments created to better detect whether co-occurring disorders in ASD result directly or indirectly from ASD symptomology.

Conclusions

There are a number of clinical instruments that are commonly used to diagnose co-occurring psychiatric disorders in ASD (e.g., de Bruin et al. 2007; Gjevik et al. 2011; Joshi et al. 2013) and the present findings demonstrate the utility of the MINI, given its brevity and ease of administration, in individuals with ASD, particularly children and adolescents. Prevalence rates reported in the young adult sample were lower relative to rates found in the literature on young adults with ASD, highlighting the need for future research assessing whether young adults are accurately reporting co-occurring symptoms or whether the MINI is an appropriate measure for this age range more generally. Nonetheless, the high prevalence rates reported in the current study (i.e., 91% of children and adolescents) along with the growing body of research indicating that ASD most typically presents with at least one co-occurring psychiatric disorder underscore the need to evaluate co-occurring psychiatric disorders in ASD research. Further, considering the significant impact of co-occurring disorders on symptom presentation, severity, and treatment strategies, it is essential to conduct comprehensive, semi-structured assessments of co-occurring psychiatric disorders across a wide range of clinical settings.

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Compliance with Ethical Standards

Conflict of interest All authors declare that 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. This article does not contain any studies with animals performed by any of the authors.

Informed Consent Informed consent was obtained from all individual participants included in the study.

References

Aman, M. G. (2005). Treatment planning for patients with autism spectrum disorders. *Journal of Clinical Psychiatry, 66*(Suppl 10), 38–45.

Bardikoff, N., & McGonigle-Chalmers, M. (2014). Testing nonverbal IQ in children with Autism Spectrum Disorders. *Research in Autism Spectrum Disorders*, *8*(9), 1200–1207.

Buck, T. R., Viskochil, J., Farley, M., Coon, H., McMahon, W. M., Morgan, J., et al. (2014). Psychiatric comorbidity and medication use in adults with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 44*(12), 3063–3071. https://doi.org/10.1007/s10803-014-2170-2.

Burgess, S., & Cimera, R. E. (2014). Employment outcomes of transition-aged adults with autism spectrum disorders: A state of the States report. *American Journal on Intellectual and Developmental Disabilities, 119*(1), 64–83. https://doi.org/10.1352/1944-7558-119.1.64.

Constantino, J. N., Davis, S. A., Todd, R. D., Schindler, M. K., Gross, M. M., Brophy, S. L., et al. (2003). Validation of a brief quantitative measure of autistic traits: Comparison of the social responsiveness scale with the autism diagnostic interview-revised. *Journal of Autism and Developmental Disorders, 33*(4), 427–433.

Coury, D. L., Anagnostou, E., Manning-Courtney, P., Reynolds, A., Cole, L., McCoy, R., et al. (2012). Use of psychotropic medication in children and adolescents with autism spectrum disorders. *Pediatrics, 130*(Suppl 2), S69–76. https://doi.org/10.1542/peds.2012-0900D.

de Bruin, E. I., Ferdinand, R. F., Meester, S., de Nijs, P. F., & Verheij, F. (2007). High rates of psychiatric co-morbidity in PDD-NOS. *Journal of Autism and Developmental Disorders, 37*(5), 877–886. https://doi.org/10.1007/s10803-006-0215-x.

Di Martino, A., O'Connor, D., Chen, B., Alaerts, K., Anderson, J. S., Assaf, M., et al. (2017). Enhancing studies of the connectome in autism using the autism brain imaging data exchange II. *Scientific Data, 4,* 170010. https://doi.org/10.1038/sdata.2017.10.

Drabick, D. A., & Kendall, P. C. (2010). Developmental psychopathology and the diagnosis of mental health problems among youth. *Clinical Psychology (New York), 17*(4), 272–280. https://doi.org/10.1111/j.1468-2850.2010.01219.x.

Durkin, M. S., Maenner, M. J., Baio, J., Christensen, D., Daniels, J., Fitzgerald, R., et al. (2017). Autism spectrum disorder among US children (2002–2010): Socioeconomic, racial, and ethnic

disparities. *American Journal of Public Health, 107*(11), 1818–1826. https://doi.org/10.2105/AJPH.2017.304032.

Elison, J. T., Sasson, N. J., Turner-Brown, L. M., Dichter, G., & Bodfish, J. W. (2012). Age trends in visual exploration of social and nonsocial information in children with autism. *Research in Autism Spectrum Disorders, 6*(2), 842–851. https://doi.org/10.1016/j.rasd.2011.11.005.

Esbensen, A. J., Greenberg, J. S., Seltzer, M. M., & Aman, M. G. (2009). A longitudinal investigation of psychotropic and non-psychotropic medication use among adolescents and adults with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 39*(9), 1339–1349. https://doi.org/10.1007/s10803-009-0750-3.

Gadke, D. L., McKinney, C., & Oliveros, A. (2016). Autism spectrum disorder symptoms and comorbidity in emerging adults. *Child Psychiatry and Human Development, 47*(2), 194–201. https://doi.org/10.1007/s10578-015-0556-9.

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

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

Gotham, K., Pickles, A., & Lord, C. (2012). Trajectories of autism severity in children using standardized ADOS scores. *Pediatrics, 130*(5), e1278–1284. https://doi.org/10.1542/peds.2011-3668.

Hiller, R. M., Young, R. L., & Weber, N. (2014). Sex differences in autism spectrum disorder based on DSM-5 criteria: Evidence from clinician and teacher reporting. *Journal of Abnormal Child Psychology, 42*(8), 1381–1393. https://doi.org/10.1007/s10802-014-9881-x.

Hofvander, B., Delorme, R., Chaste, P., Nyden, A., Wentz, E., Stahlberg, O., et al. (2009). Psychiatric and psychosocial problems in adults with normal-intelligence autism spectrum disorders. *BMC Psychiatry, 9,* 35. https://doi.org/10.1186/1471-244X-9-35.

Hollingshead, A. B. (1975). *Four factor index of social status*. New Heaven, CT: Yale University.

Hudson, C. C., Hall, L., & Harkness, K. L. (2018). Prevalence of depressive disorders in individuals with autism spectrum disorder: A meta-analysis. *Journal of Abnormal Child Psychology*. https://doi.org/10.1007/s10802-018-0402-1.

Hus, V., Gotham, K., & Lord, C. (2014). Standardizing ADOS domain scores: Separating severity of social affect and restricted and repetitive behaviors. *Journal of Autism and Developmental Disorders, 44*(10), 2400–2412. https://doi.org/10.1007/s10803-012-1719-1.

Joshi, G., Petty, C., Wozniak, J., Henin, A., Fried, R., Galdo, M., et al. (2010). The heavy burden of psychiatric comorbidity in youth with autism spectrum disorders: A large comparative study of a psychiatrically referred population. *Journal of Autism and Developmental Disorders, 40*(11), 1361–1370. https://doi.org/10.1007/s10803-010-0996-9.

Joshi, G., Wozniak, J., Petty, C., Martelon, M. K., Fried, R., Bolfek, A., et al. (2013). Psychiatric comorbidity and functioning in a clinically referred population of adults with autism spectrum disorders: A comparative study. *Journal of Autism and Developmental Disorders, 43*(6), 1314–1325. https://doi.org/10.1007/s10803-012-1679-5.

Kamio, Y., Inada, N., & Koyama, T. (2013). A nationwide survey on quality of life and associated factors of adults with high-functioning autism spectrum disorders. *Autism, 17*(1), 15–26. https://doi.org/10.1177/1362361312436848.

Kaufman, J., Birmaher, B., Brent, D., Rao, U., Flynn, C., Moreci, P., et al. (1997). Schedule for affective disorders and schizophrenia for school-age children-present and lifetime version (K-SADS-PL): Initial reliability and validity data. *Journal of the American Academy of Child and Adolescent Psychiatry, 36*(7), 980–988. https://doi.org/10.1097/00004583-199707000-00021.

Kerns, C. M., & Kendall, P. C. (2012). The presentation and classification of anxiety in autism spectrum disorder. *Clinical Psychology: Science and Practice, 19*(4), 323–347.

Kessler, R. C., Amminger, G. P., Aguilar-Gaxiola, S., Alonso, J., Lee, S., & Ustun, T. B. (2007). Age of onset of mental disorders: A review of recent literature. *Current Opinion in Psychiatry, 20*(4), 359–364. https://doi.org/10.1097/YCO.0b013e32816ebc8c.

Kraper, C. K., Kenworthy, L., Popal, H., Martin, A., & Wallace, G. L. (2017). The gap between adaptive behavior and intelligence in autism persists into young adulthood and is linked to psychiatric co-morbidities. *Journal of Autism and Developmental Disorders, 47*(10), 3007–3017. https://doi.org/10.1007/s10803-017-3213-2.

Lainhart, J. E., Leyfer, O. T., & Folstein, S. E. (2003). Autism comorbidity Interview—Present and lifetime version (ACI-PL). Salt Lake City: University of Utah.

Leyfer, O. T., Folstein, S. E., Bacalman, S., Davis, N. O., Dinh, E., Morgan, J., et al. (2006). Comorbid psychiatric disorders in children with autism: Interview development and rates of disorders. *Journal of Autism and Developmental Disorders, 36*(7), 849–861. https://doi.org/10.1007/s10803-006-0123-0.

Mandell, D. S., Wiggins, L. D., Carpenter, L. A., Daniels, J., DiGuiseppi, C., Durkin, M. S., et al. (2009). Racial/ethnic disparities in the identification of children with autism spectrum disorders. *American Journal of Public Health, 99*(3), 493–498. https://doi.org/10.2105/AJPH.2007.131243.

Mattila, M. L., Hurtig, T., Haapsamo, H., Jussila, K., Kuusikko-Gauffin, S., Kielinen, M., et al. (2010). Comorbid psychiatric disorders associated with Asperger syndrome/high-functioning autism: A community- and clinic-based study. *Journal of Autism and Developmental Disorders, 40*(9), 1080–1093. https://doi.org/10.1007/s10803-010-0958-2.

Mazefsky, C. A., Kao, J., & Oswald, D. P. (2011). Preliminary evidence suggesting caution in the use of psychiatric self-report measures with adolescents with high-functioning autism spectrum disorders. *Research in Autism Spectrum Disorders, 5*(1), 164–174. https://doi.org/10.1016/j.rasd.2010.03.006.

Mazefsky, C. A., Oswald, D. P., Day, T. N., Eack, S. M., Minshew, N. J., & Lainhart, J. E. (2012). ASD, a psychiatric disorder, or both? Psychiatric diagnoses in adolescents with high-functioning ASD. *Journal of Clinical Child & Adolescent Psychology, 41*(4), 516–523. https://doi.org/10.1080/15374416.2012.686102.

McDougle, C. J., Stigler, K. A., & Posey, D. J. (2003). Treatment of aggression in children and adolescents with autism and conduct disorder. *Journal of Clinical Psychiatry, 64*(Suppl 4), 16–25.

Mosner, M. G., Kinard, J. L., McWeeny, S., Shah, J. S., Markiewitz, N. D., Damiano-Goodwin, C. R., et al. (2017). Vicarious effort-based decision-making in autism spectrum disorders. *Journal of Autism and Developmental Disorders*. https://doi.org/10.1007/s10803-017-3220-3.

Muris, P., Steerneman, P., Merckelbach, H., Holdrinet, I., & Meesters, C. (1998). Comorbid anxiety symptoms in children with pervasive developmental disorders. *Journal of Anxiety Disorders, 12*(4), 387–393.

Mussey, J. L., Ginn, N. C., & Klinger, L. G. (2017). Are males and females with autism spectrum disorder more similar than we thought? *Autism, 21*(6), 733–737. https://doi.org/10.1177/1362361316682621.

Rosen, T. E., Mazefsky, C. A., Vasa, R. A., & Lerner, M. D. (2018). Co-occurring psychiatric conditions in autism spectrum disorder.

International Review of Psychiatry, 30(1), 40–61. https://doi.org/10.1080/09540261.2018.1450229.

Sheehan, D. V., Lecrubier, Y., Sheehan, K. H., Amorim, P., Janavs, J., Weiller, E., et al. (1998). The Mini-International Neuropsychiatric Interview (M.I.N.I.): The development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *The Journal of Clinical Psychiatry, 59*(Suppl 20), 22–33. **quiz 34–57**.

Sheehan, D. V., Sheehan, K. H., Shytle, R. D., Janavs, J., Bannon, Y., Rogers, J. E., et al. (2010). Reliability and validity of the Mini International Neuropsychiatric Interview for Children and Adolescents (MINI-KID). *Journal of Clinical Psychiatry, 71*(3), 313–326. https://doi.org/10.4088/JCP.09m05305whi.

Simonoff, E., Pickles, A., Charman, T., Chandler, S., Loucas, T., & Baird, G. (2008). Psychiatric disorders in children with autism spectrum disorders: Prevalence, comorbidity, and associated factors in a population-derived sample. *Journal of the American Academy of Child and Adolescent Psychiatry, 47*(8), 921–929. https://doi.org/10.1097/CHI.0b013e318179964f.

Soke, G. N., Maenner, M. J., Christensen, D., Kurzius-Spencer, M., & Schieve, L. A. (2018). Prevalence of co-occurring medical and behavioral conditions/symptoms among 4- and 8-year-old children with autism spectrum disorder in selected areas of the United States in 2010. *Journal of Autism and Developmental Disorders*. https://doi.org/10.1007/s10803-018-3521-1.

Stadnick, N., Chlebowski, C., Baker-Ericzen, M., Dyson, M., Garland, A., & Brookman-Frazee, L. (2017a). Psychiatric comorbidity in autism spectrum disorder: Correspondence between mental health clinician report and structured parent interview. *Autism, 21*(7), 841–851. https://doi.org/10.1177/1362361316654083.

Stadnick, N., Chlebowski, C., & Brookman-Frazee, L. (2017b). Caregiver-teacher concordance of challenging behaviors in children with autism spectrum disorder served in community mental health settings. *Journal of Autism and Developmental Disorders, 47*(6), 1780–1790. https://doi.org/10.1007/s10803-017-3101-9.

van Steensel, F. J., Bogels, S. M., & Perrin, S. (2011). Anxiety disorders in children and adolescents with autistic spectrum disorders: A meta-analysis. *Clinical Child and Family Psychology Review, 14*(3), 302–317. https://doi.org/10.1007/s10567-011-0097-0.

Vohra, R., Madhavan, S., & Sambamoorthi, U. (2016). Comorbidity prevalence, healthcare utilization, and expenditures of Medicaid enrolled adults with autism spectrum disorders. *Autism*. https://doi.org/10.1177/1362361316665222.