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The co-occurrence of autism spectrum disorder in children with ADHD

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Abstract

Objective—Children with attention-deficit/hyperactivity disorder (ADHD) frequently present with autism spectrum disorder (ASD) symptomatology, yet there is a notable gap in the treatment needs of this sub-population, including whether the presence of ASD may be associated with more severe ADHD symptoms.

Method—Data from the 2014 National Survey of the Diagnosis and Treatment of ADHD and Tourette Syndrome (n=2,464) was used to compare children diagnosed with ADHD and ASD to children with ADHD, but not ASD. Children were classified as needing treatment if it was received or their parents reported it was needed, but not received.

Results—Approximately 1-in-8 children currently diagnosed with ADHD were also diagnosed with ASD. Children diagnosed with both disorders had greater treatment needs, more co-occurring conditions, and were more likely to have a combined hyperactive/impulsive and inattentive ADHD subtype.

Conclusions—These findings highlight the complexity of children diagnosed with both ADHD and ASD.

The past twenty years have seen an increase in the prevalence of observed autism spectrum disorder (ASD) (Blumberg et al., 2013; CDC, 2014; Zablotsky et al., 2015). Coinciding with this increase has been an increase in the observed prevalence of ASD among children diagnosed with attention-deficit/hyperactivity disorder (ADHD). Indeed, unpublished estimates based on multiple years of the National Survey of Children's Health (NSCH) reveal that 3.3% of children ages 4-17 ever diagnosed with ADHD were also diagnosed with ASD in 2003, compared with 9.7% in 2007 and 10.8% in 2011 (Blumberg et al., 2005;

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Blumberg et al., 2012; CDC, 2013) [estimates available upon request]. An accompanying increase in ASD among children with ADHD is not surprising given the considerable overlap in symptom presentation (Gadow, DeVincent, & Pomeroy, 2006; Mulligan et al., 2009; Ronald et al., 2008). These two disorders have also been linked by shared additive genetic factors (Nijmeijer et al., 2010) and environmental risk factors, including preterm delivery and the mother's use of certain psychotropic medications (Taurines et al., 2012). It has further been hypothesized that these risk factors may mediate ASD symptoms among children with ADHD (Kroger et al., 2011), with recent studies also exploring causal and mediation pathways between the symptoms of the two disorders (Sokolova et al., 2017).

Despite the similarity between these disorders, there is a lack of in-depth population-based studies of ASD diagnosis among children with a clinical ADHD diagnosis. It is possible that the preclusion of a dual diagnosis of ASD and ADHD in the *Diagnostic and Statistical Manual of Mental Disorder (DSM-IV)* (APA, 2000) contributed to the absence of such a study. Instead, the vast majority of studies focused on either a sample of children with ADHD (Grzadzinski et al., 2011; Mulligan et al., 2009; Nijmeijer et al., 2009; Reisersen et al., 2007) or a sample of children with ASD (Anderson et al., 2013; Sinzig, Walter, & Doepfner, 2009; Suzumura, 2014) and explored the presence of symptomatology of the other disorder in the sample of interest.

The focus on diagnoses in the present research is not intended to minimize the value of information about symptomatology from scales or checklists. These can have high construct validity which can help to determine whether a child may meet clinical criteria for an ADHD diagnosis (Conners et al., 1998; DuPaul, 1981; Wolraich et al., 2003). These scales, which have been psychometrically tested, have high internal reliability, and can be administered in a short period of time to a large population. However, studies which rely exclusively on symptoms, without a focus on diagnoses, could lead to misclassifications given the high level of symptom overlap between ADHD and other conditions (Murphy & Tsuang, 1995), and may be overly influenced by a parent's awareness and perception of their child's behavior (Xiao et al., 2013).

A focus on diagnoses may help to update the literature dedicated to ADHD psychiatric comorbidities (Eiraldi, Power, & Nezu, 1997; Jensen, Martin & Cantwell, 1997). The investigation of ASD diagnoses among children diagnosed with ADHD may also expand our knowledge of the ADHD phenotype (Stevenson et al., 2005), making it possible to better understand the treatment needs of this growing population (Davis & Kollins, 2012; Mahajan et al., 2012), thereby allowing for further insight into the treatment guidelines regarding co-occurring psychiatric conditions as recommended by the American Academy of Pediatrics (AAP, 2001).

The literature to date has largely relied upon clinical samples, psychiatric clinics, or family registries, which may contain small or non-independent samples (Goldstein & Schwebach, 2004; Joshi et al., 2014; Lee & Ousley, 2006). The current study represents the first effort (to our knowledge) that examines the treatment of children diagnosed with ASD in a population of children diagnosed with ADHD utilizing a national population-based dataset. The data also provide the opportunity to determine if the presence of ASD is associated with more

severe ADHD symptomatology. It is hypothesized that children with ADHD and ASD will experience more severe ADHD symptomatology than children diagnosed with ADHD, but not ASD. Children with ADHD and ASD are further expected to be diagnosed with more co-occurring psychiatric disorders, and require greater treatment needs than children diagnosed with ADHD, but not ASD.

Method

Source

Data for the current study come from the 2014 National Survey of the Diagnosis and Treatment of Attention-Deficit/Hyperactivity Disorder and Tourette Syndrome (NS-DATA), a follow-up survey to the 2011-2012 National Survey of Children's Health (NSCH), a cross-sectional random-digit-dial telephone survey (landlines and cell phones) of US households with at least one child aged 0 to 17 years at the time of interview. NS-DATA was conducted by the National Center for Health Statistics as a module of the State and Local Area Integrated Telephone Survey and was sponsored by the National Center on Birth Defects and Developmental Disabilities. NS-DATA was designed to collect information about the diagnostic experiences of children 4 to 17 years old ever diagnosed with ADHD or Tourette syndrome (TS) and provide information about current and past medication use, behavioral interventions, and school performance. Households eligible to be re-contacted for NS-DATA had children aged 2-15 at the time of the NSCH whose parents had reported that they had once been told by a doctor or other healthcare provider that their child had ADHD or TS. Respondents had to be adults living in the same household as the sampled child and be knowledgeable about the child's health.

The NSCH had a 51% cooperation rate among eligible households but a 23% overall response rate, and NS-DATA had a 47% completion rate among eligible households 2-3 years later, and thus an 11% overall response rate after incorporating nonresponse to the NSCH. Weighting adjustments were applied such that the population estimated by the weighted sample of completed NS-DATA interviews matched that of the pool of eligible households demographically. This reduced estimated nonresponse bias such that the remaining observable bias in weighted estimates was smaller than sampling error.

NS-DATA shares the complex survey design of the NSCH, with stratification by state and sample type (landline or cell phone). More information about both the NS-DATA and NSCH, including consent procedures, can be found in the Frequently Asked Questions (CDC, 2013; CDC, 2015) or at http://www.cdc.gov/nchs/slaits.htm. Verbal consent was obtained from a parent or guardian respondent (hereafter referred to as the parent) at the time of the interview, with parents being informed of their rights as survey participants.

Sample

The NS-DATA consisted of two interview modules, one administered to parents of children ever having ADHD and the other to parents of children ever having TS. Parents of children with both conditions were administered both modules. Eligibility for the analytic sample include children whose parents had completed the ADHD module (n=2,966), reported that

their children were currently diagnosed with ADHD (n=2,495), and provided information about whether the child has a current ASD diagnosis (n=2,464). The sample was subdivided into children who had a current ASD diagnosis (n=352) and children who did not (n=2,112). Approximately 1% of cases were missing (n=31) on ASD diagnosis and were omitted from analysis. Basic demographics by ASD status appear in Table 1.

Measures

Diagnostic criteria—An initial screener question for NS-DATA asked parents, “has a doctor or other health care provider ever told you that your child had ADHD or ADD?” Parents were asked later in the survey, “does [your child] currently have ADHD?” A current ASD diagnosis was ascertained through two questions: parents had to respond in the affirmative to whether “a doctor or health care provider ever told you that [your child] had Autism Spectrum Disorder or Pervasive Developmental Disorder” as well as the follow-up question “does [your child] currently have Autism Spectrum Disorder or Pervasive Developmental Disorder?” Parents of children with a current ADHD diagnosis were also asked about the severity of their child's condition, “Would you describe [his/her] ADHD as mild, moderate, or severe?”

Co-occurring psychiatric conditions—Parents were asked about 14 other psychiatric conditions, including oppositional defiant disorder, conduct disorder, sleep disorder, intellectual disability, learning disorder, language disorder, obsessive compulsive disorder, post-traumatic stress disorder, another anxiety disorder, bipolar disorder, intermittent explosive disorder, another mood disorder, eating disorder, and substance use disorder. For each condition, parents were first asked if a doctor or health care provider ever told them that their child had the given condition, and if the parent answered in the affirmative, they were subsequently asked if their child currently had the condition. The 14 conditions were categorized into “behavioral disorders” (oppositional defiant disorder, conduct disorder, intermittent explosive disorder); “developmental disorders” (intellectual disability, learning disorder, language disorder); “mood disorders” (bipolar disorder, other mood disorder); “anxiety disorders” (obsessive compulsive disorder, post-traumatic stress disorder, other anxiety disorder); and “other disorders” (sleep disorder, eating disorder, substance use disorder).

ADHD symptomatology—The Vanderbilt ADHD Parent Rating Scale (VADPRS) was adapted to be administered over the telephone to parents. The VADPRS contains diagnosis-based behavioral items intended to capture *DSM-IV* criteria when the child is off medication, including 9 items measuring inattention and 9 items on hyperactivity/impulsivity. Each item is rated on a 4 point Likert scale, and parents are instructed to “think about your child's behaviors in the past 6 months when he/she is not taking medication for ADHD or any other medication for other difficulties with [his/her] emotions, concentration or behavior.” Parents could rate the frequency of a given behavior from never to very often, and items were dichotomized into never/occasionally and often/very often for analysis. Parents who indicated their children exhibited a behavior often or very often were coded as having the symptom. Parents also indicated whether their child has had difficulties in eight performance areas (overall school performance, mathematics, writing, reading, peer

relationships, parent relationships, sibling relationships, organized activities) over the past 6 months when off medication. The VADPRS has been found to have high concurrent validity with ADHD diagnoses based on clinical evaluations, and high reliability (Wolraich et al., 2003). Symptom counts for inattentive and hyperactive/impulsive symptoms were summed, and the child's ADHD subtype (predominantly inattentive, predominantly hyperactive/impulsive, combined) was determined using the scale's scoring instructions (Wolraich et al., 2003). A child whose parent at the time of the interview did not report at least 6 or more inattentive or hyperactive/impulsive symptoms, along with a difficulty in at least one performance area, was coded as not currently having an ADHD subtype (coded as 'neither').

Treatment needs—Parents were asked if their child has ever taken medication for ADHD. Parents who answered in the affirmative were subsequently asked if their child was currently taking medication for ADHD. Parents were also asked if their child had received a series of school-based services "for ADHD or difficulties with emotions, concentration, or behavior," which included "school-based educational support, intervention, or accommodation" and "classroom management." Additional out-of-school psychosocial treatments included "peer interventions," "social skills training," and "cognitive behavioral therapy." Any parent who endorsed that their child had ever received a given treatment was subsequently asked if the child was still receiving the treatment.

Parents were also asked about their perception of an unmet ADHD need. They were asked "in the past 12 months, did your child need an ADHD treatment that [he/she] was unable to get?" Parents who affirmed an unmet treatment need were subsequently asked if it was "medication," "school-based behavioral treatment, support, or accommodation," "behavioral treatment based outside of school," or "other treatment outside of school." Treatment need was defined by whether a child either was currently receiving a given treatment or if a parent indicated a perceived unmet need for a given treatment.

Demographics—Child demographics included age, sex, race/ethnicity, and current health insurance type (public, private, uninsured). Household demographics included region, income (measured as a percentage of the federal poverty level), educational attainment of the highest educated parent or guardian, family structure (two parents (biological, adoptive or step) compared to all other family types), and housing situation (own, rent, other).

Statistical analysis

Estimates were calculated using Stata 13.0 to account for the complex survey design of the NS-DATA. First, demographic characteristics between children currently diagnosed with ADHD and ASD and children currently diagnosed with ADHD, but not ASD were compared (Table 1). Next, ADHD symptomatology, parent-reported severity, and the presence of co-occurring psychiatric conditions were examined between these same groups of children (Table 2). Finally, the prevalence of ADHD subtypes (Figure 1) and treatment needs (Figure 2) were examined between these two groups. Multivariate logistic regressions were used to compare differences between groups, adjusted for potentially confounding child characteristics when modeling ADHD subtypes, and adjusted for child characteristics, co-occurring psychiatric conditions, ADHD symptomatology (both number of hyperactive/

impulsive symptoms and number of inattentive symptoms), and parent-reported ADHD severity when modeling treatment needs.

Results

Demographics

Approximately 1 in 8 children currently diagnosed with ADHD were also diagnosed with current ASD (13.0%). Children diagnosed with ADHD and ASD were younger, on average, than children diagnosed with ADHD, but not ASD ($p<.001$), with approximately half of children with ADHD and ASD (49.2%) being between the ages of 4-11 compared to 31.9% of children with ADHD, but not ASD. Finally, children with ADHD and ASD were more likely to be male than children with ADHD, but not ASD ($p<.05$) (See Table 1).

Co-occurring psychiatric conditions

Children with ASD and ADHD were more likely to be diagnosed with a co-occurring behavioral disorder (odds ratio (OR)=2.32, 95% confidence interval (CI): 1.45-3.71, $p<.001$), anxiety disorder (OR=2.51, 95% CI: 1.65-3.82, $p<.001$), mood disorder (OR=2.19, 95% CI: 1.36-3.53, $p<.01$), developmental disorder (OR=3.45, 95% CI: 2.25-5.29, $p<.001$), or other mental health disorder (OR=1.85, 95% CI: 1.10-3.13, $p<.05$) than children with ADHD, but not ASD. Children with ASD and ADHD were more likely to have two or more types of mental health conditions (OR=3.85, 95% CI: 2.52-5.89, $p<.001$) than children with ADHD, but not ASD (See Table 2).

ADHD severity

Parents of children diagnosed with both ASD and ADHD disproportionately rated their child's ADHD to be more severe than parents of children diagnosed with ADHD, but not ASD. Indeed, parents of children with ASD were about 2.5 times as likely to have rated their child's ADHD as severe (OR=2.52, 95% CI: 1.58-4.01, $p<.001$). Only 1 in 5 parents of children with ASD rated their child's ADHD to be mild, compared to approximately 1 in 3 parents of children with ADHD without ASD (See Table 2).

ADHD symptoms

Approximately 3 out of 4 children diagnosed with ADHD and ASD had six or more inattentive symptoms, while 1 in 2 children had six or more hyperactive/impulsive symptoms. Children diagnosed with ADHD and ASD had a significantly higher number of inattentive symptoms ($\beta=1.14$, 95% CI: 0.63-1.66, $p<.001$), and a significantly higher number of hyperactive/impulsive symptoms ($\beta=1.32$, 95% CI: 0.76-1.87, $p<.001$) than children with ADHD, but not ASD (See Table 2).

ADHD subtype

Approximately 4 out of 10 children with ADHD and ASD had a combined ADHD subtype (42.7%), while 3 in 10 children had a predominantly inattentive subtype (27.4%), but few children with ADHD and ASD had a predominantly hyperactive/impulsive subtype (5.7%) (see Figure 1). Approximately 1 in 4 children with ADHD and ASD did not have a parent-

reported ADHD subtype (24.2%). In an adjusted analysis accounting for child age and sex, children with ADHD and ASD were more likely to have a combined ADHD subtype (adjusted odds ratio (AOR)=2.01, 95% CI: 1.28-3.16, $p<.01$), and were also more likely to have any subtype when compared to children with ADHD, but not ASD (AOR=2.19, 95% CI: 1.35-3.54, $p<.01$).

Parent-reported treatment needs

Children who were currently receiving a given treatment (ADHD medication, in-school or out-of-school), or had a parent who reported a perceived unmet need for a given treatment, were considered to have a treatment need. In unadjusted models, children diagnosed with ADHD and ASD were more likely to have an in-school treatment need (93.7% vs. 63.2%, $p<.001$) and out-of-school treatment need (69.4% vs. 27.3%, $p<.001$), but not an ADHD medication treatment need (76.0% vs. 68.4, $p=.10$) when compared with children with ADHD, but not ASD (see Figure 2).

In adjusted models, accounting for child age, sex, co-occurring conditions, parent-reported ADHD severity, and number of ADHD inattentive and hyperactive/impulsive symptoms, children diagnosed with ADHD and ASD continued to be more likely to need both in-school (AOR=4.68, 95% CI: 2.14-10.22, $p<.001$) and out-of-school services (AOR=3.71, 95% CI: 2.18-6.33, $p<.001$) than children diagnosed with ADHD, but not ASD. Children diagnosed with ADHD and ASD continued to be as likely to need ADHD medications (AOR=1.28, 95% CI: 0.79-2.07, $p=.31$) as children with ADHD, but not ASD.

It should be noted that most children with treatment needs received treatment. Unmet needs for a given treatment made up a small portion of treatment needs, with only 5.9% of all children having an unmet ADHD medication need, 5.7% having an unmet in-school need, and 5.4% having an out-of-school unmet need. Children with ADHD and ASD were as likely to have an unmet need for a given treatment as children with ADHD, but not ASD. This suggests that actual treatment usage is what differentiates the two groups on treatment need.

Discussion

Approximately 1 in 8 children currently diagnosed with ADHD were also diagnosed with current ASD (13.0%). The prevalence of ASD among children currently diagnosed with ADHD was higher among younger children (ages 4-11) (18.7%) when compared to older children (ages 12-17) (10.0%). This difference may be attributable to a larger cohort effect, with the youngest children benefitting from an improved recognition of ASD symptoms and increased awareness of the importance of early identification in recent years (Christensen et al., 2015; Matson & Kozlowski, 2011). A cohort effect would help to explain the younger age of the ASD and ADHD group when compared to the ADHD, but not ASD group. It may also reflect recent changes to the DSM-V that allow for the dual diagnosis of ADHD and ASD, which was not permittable with earlier editions of the *DSM*.

Children with ADHD and ASD had greater treatment needs (that is either unmet need or treatment usage) when compared to their peers with ADHD, but not ASD. This finding

aligns with previous literature focused on children with ASD, which found high rates of service needs, particularly among children diagnosed with co-occurring conditions (Zablotsky et al., 2015). A large majority of children diagnosed with ASD and ADHD had a treatment need for in-school services (93.7%), and 7 out of 10 children had a treatment need for out-of-school services. For both types of services, children with ADHD and ASD had a greater treatment need than children with ADHD, but not ASD. One reason for the greater treatment need may be that standard ADHD treatments, such as stimulants, have smaller effect sizes for children with ASD (Antshel et al., 2011) when compared to children with ADHD only, which could result in the need for additional treatments, thereby contributing to greater ongoing treatment needs for both in and out-of-school services among this population. When ASD symptoms are not managed, it may lead to more severe psychopathology as well as poorer interpersonal, school, family and cognitive functioning and life outcomes among this population when compared to controls (Green et al., 2016; Kotte et al., 2013).

Although some might observe that children with ADHD and ASD had a non-significant, but marginally higher (p=.10) ADHD medication treatment need than children with ADHD, but not ASD, this contrast was not significant after adjustment (p=.33). It is possible that the lack of evidence for ADHD medication to provide additional benefit for children with ASD beyond ADHD symptomatology (Santosh et al., 2006) may explain this null finding.

Children with ADHD and ASD had a higher number of inattentive symptoms, as well as hyperactive/impulsive symptoms, were more likely to be rated as having a severe ADHD by their parents, and were more likely to be classified as having the combined ADHD subtype when compared to their peers with ADHD, but not ASD. Previous studies have found the combined ADHD subtype to be associated with high rates of externalizing and internalizing disorders, as well as sleep disorders (Levy et al., 2005; Maynes et al., 2009). It is possible that the presence of ADHD symptoms may further exacerbate symptoms of ASD (Yerys et al., 2009) which may translate to greater executive functioning deficits. In fact, children diagnosed with both ASD and ADHD have been found to have greater attentional and inhibition problems and emotional deficits than children with either condition (Tye et al., 2014a; Tye et al., 2014b). However, it is worth noting that these executive functioning deficits may not always be captured when relying exclusively on diagnoses to differentiate children with the two disorders (Neely et al., 2016).

Co-occurring conditions are common among children with either ADHD (Cuffe et al., 2015) or ASD (Simonoff et al., 2008), yet there appears to be an additive effect of being diagnosed with both conditions, with children diagnosed with ADHD and ASD being more likely to be diagnosed with a series of co-occurring conditions relative to children with ADHD, but not ASD. Other recent studies have also revealed this relationship with children diagnosed with both ADHD and ASD had higher rates of behavioral and conduct symptoms, mood disorders, and other psychopathologies when compared to children with only one of the disorders (Chen et al., 2014; Gadow, DeVincent, & Schneider, 2009; Jang et al., 2013). It could be hypothesized that the combination of conditions lead to a greater exacerbation of symptoms of either condition, thereby increasing the likelihood of the presentation of additional disorders (e.g. avoidant, disruptive behaviors).

The NS-DATA is a national population-based survey with a large sample size that allowed for an investigation with sufficient power to explore research questions within a subgroup of children with ADHD who had also been diagnosed with ASD. Despite these strengths, the dataset does have limitations. Parent-reported information about treatment and mental health diagnoses could not be validated by a clinician and differential diagnosis may exist by age. It is not possible to rule out unmeasured confounding among children with ADHD who may have an undiagnosed ASD condition. Moreover, although parents were asked to consider their child's condition while not using medications when answering questions about their child's current ADHD symptoms, it is not known if parents likewise considered their child's condition while not receiving non-pharmaceutical treatments. In some instances parents reported their child to have a sub-threshold number of symptoms in the past 6 months for a clinical diagnosis; this may indicate that the parent did not consider the child when off medication, or could suggest that the child no longer had the condition. Finally, despite weighting adjustments to minimize nonresponse bias and evidence to suggest that remaining estimated biases tend to be smaller than sampling error (CDC, 2014), the low overall response rate means that bias resulting from nonresponse cannot be completely ruled out. Future studies may benefit from recruiting a comparison sample of children diagnosed with ASD, but not ADHD in addition to children with both conditions and children with ADHD, but not ASD.

Conclusions

Children diagnosed with both ADHD and ASD have more treatment needs and co-occurring psychopathology, and are more likely to have a combined hyperactive/impulsive and inattentive ADHD subtype, than children with ADHD alone. The growth and complexity of this observed population of children warrants additional research.

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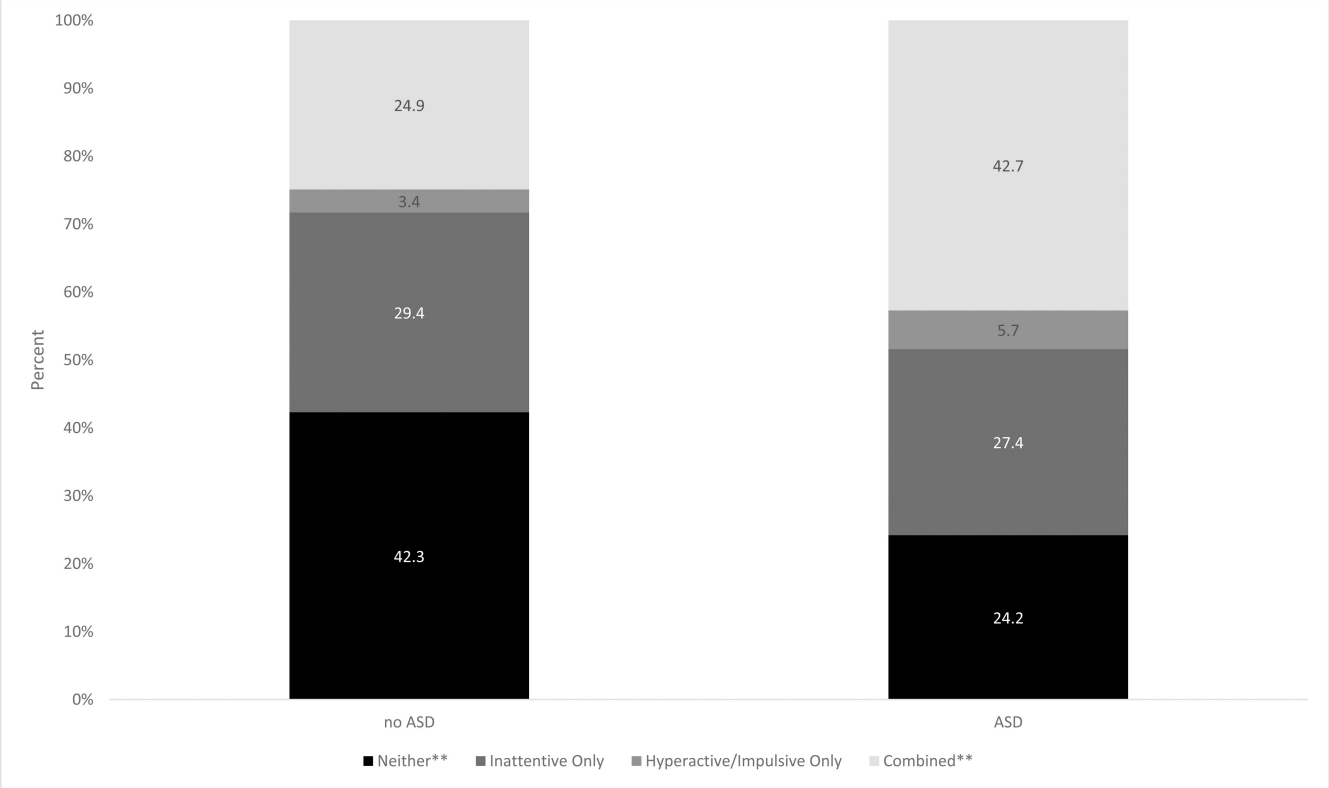

Figure 1. ADHD subtype among children with an ADHD diagnosis, by ASD diagnosis status

** $p<.01$

Note: Estimates shown are unadjusted percentages whereas statistical comparisons between the groups are based on odds ratios adjusted for child age and sex

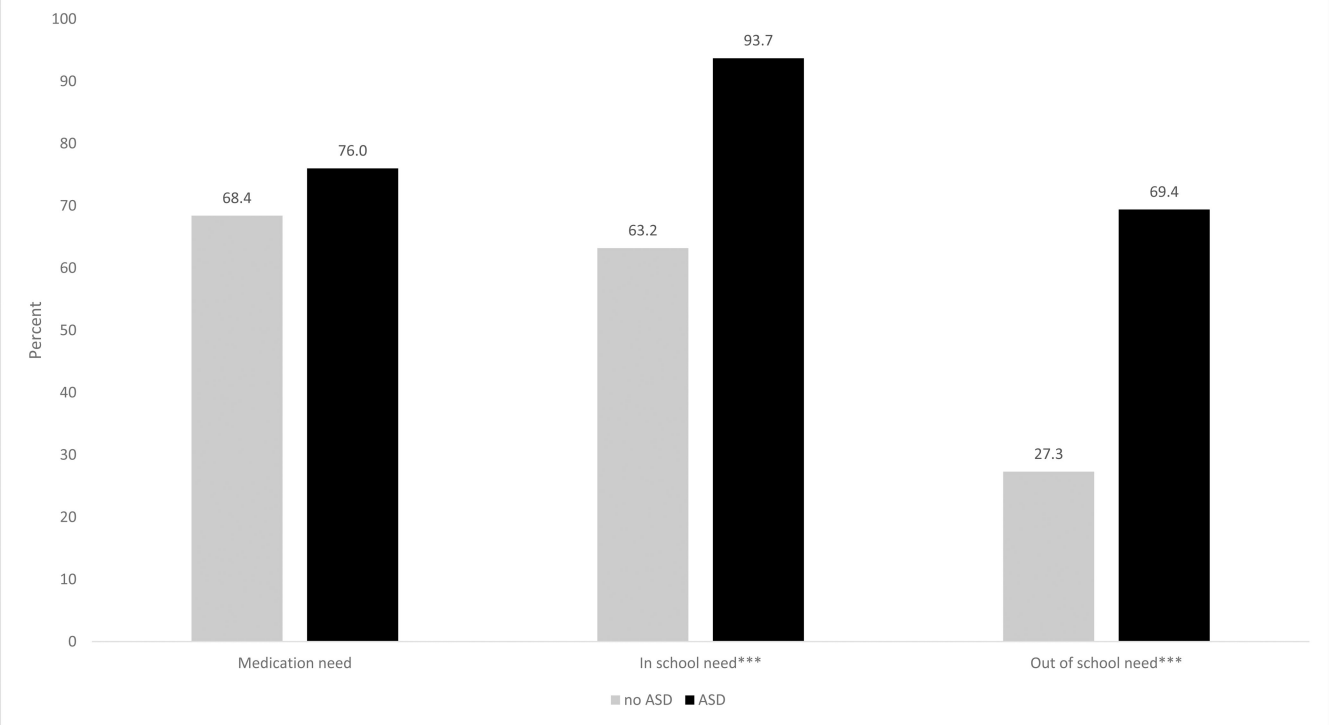

Figure 2. Treatment needs among children with an ADHD diagnosis, by ASD diagnosis status

*** p<.001

Note: Estimates shown are unadjusted percentages whereas statistical comparisons between the groups are based on odds ratios adjusted for child age, sex, co-occurring conditions, parent-reported ADHD severity, and number of inattentive and hyperactive/impulsive symptoms.

Table 1

Demographics of the population of children with an ADHD diagnosis, by ASD diagnosis status

	ADHD + ASD (n=352) % (SE)	ADHD, no ASD (n=2,112) % (SE)	χ^2 value	p-value
Child characteristics				
Age group (%)			11.89***	<.001
4-11	49.2 (4.9)	31.9 (1.8)		
12-17	50.8 (4.9)	68.1 (1.8)		
Male (%)	78.3 (3.7)	69.6 (1.8)	3.88*	.04
Race/ethnicity (%)			0.15	.93
Non-Hispanic white	65.2 (4.9)	62.8 (1.9)		
Non-Hispanic black	14.1 (3.5)	14.9 (1.5)		
Non-Hispanic other	7.3 (2.4)	6.6 (0.8)		
Hispanic	13.5 (3.8)	15.7 (1.6)		
Insurance type (%)			1.04	.34
Public	54.3 (4.9)	48.6 (1.9)		
Private	44.8 (4.9)	49.6 (1.9)		
Uninsured	0.9 (0.5)	1.8 (0.5)		
Household characteristics				
Region (%)			0.62	.60
Northeast	18.2 (3.6)	15.1 (1.1)		
Midwest	25.6 (4.0)	22.0 (1.2)		
South	40.8 (4.7)	44.4 (1.5)		
West	15.4 (3.3)	18.5 (1.1)		
Federal poverty level (%)			0.74	.53
<100%	26.0 (4.7)	28.0 (1.9)		
100% - 199%	19.9 (4.1)	22.8 (1.7)		
200% - 399%	25.6 (3.9)	27.4 (1.7)		
≥400%	28.5 (4.5)	21.9 (1.4)		
Highest education individual (%)			2.18	.11
Less than high school	15.8 (3.8)	18.6 (1.7)		
High school	28.5 (4.2)	36.8 (1.9)		
More than high school	55.6 (4.9)	44.6 (1.9)		
Household type (%)			1.05	.31
Two parent household	66.8 (4.7)	61.4 (1.9)		
Other	33.2 (4.7)	38.6 (1.9)		

	ADHD + ASD (n=352) % (SE)	ADHD, no ASD (n=2,112) % (SE)	χ^2 value	p-value
Housing situation (%)			0.15	.84
Own	58.4 (5.0)	58.4 (2.0)		
Rent	40.2 (5.1)	39.4 (2.0)		
Other	1.4 (0.8)	2.2 (0.6)		

*** p<.001

** *p*<.01

* *p*<.05

NOTES: ADHD = attention-deficit/hyperactivity disorder; ASD = autism spectrum disorder SE = standard error

Table 2

Clinical characteristics among children with an ADHD diagnosis, by ASD diagnosis status

	ADHD + ASD (n=352) % (SE)	ADHD, no ASD (n=2,112) % (SE)	Odds Ratio (CI)
Co-occurring current conditions (%)			
Behavioral disorders	33.0 (4.7)	17.5 (1.6)	2.32*** (1.45-3.71)
Anxiety disorders	41.9 (4.7)	22.3 (1.6)	2.51*** (1.65-3.83)
Mood disorders	31.4 (4.7)	17.3 (1.5)	2.19** (1.36-3.53)
Developmental disorders	62.5 (4.7)	32.5 (1.8)	3.45*** (2.25-5.29)
Other mental health disorders	20.1 (3.7)	12.0 (1.4)	1.85* (1.10-3.13)
Two or more types of disorders	58.0 (4.8)	26.4 (1.8)	3.85*** (2.52-5.89)
ADHD severity (%)			
Mild	20.1 (4.1)	31.9 (1.7)	0.54* (0.32-0.90)
Moderate	45.0 (4.9)	50.6 (1.9)	0.80 (0.53-1.21)
Severe	34.9 (4.8)	17.5 (1.6)	2.52*** (1.58-4.01)
ADHD Symptoms (%)			
Six or more inattentive symptoms	72.0 (4.4)	57.6 (1.9)	1.89** (1.20-2.98)
Six or more hyperactive/impulsive symptoms	48.8 (5.0)	30.8 (1.9)	2.14*** (1.40-3.28)

*** p<.001

** *p*<.01

* *p*<.05

NOTES: ADHD = attention-deficit/hyperactivity disorder; ASD = autism spectrum disorder SE = standard error