Hammill Institute on Disabilities

Journal of Learning Disabilities
2023, Vol. 56(5) 359–370

DOI: 10.1177/00222194221099675
journaloflearningdisabilities.sagepub.com


Sociodemographic Disparities in Attention-Deficit/Hyperactivity Disorder Overdiagnosis and Overtreatment During Elementary School

Paul L. Morgan, PhD[1], Adrienne D. Woods, PhD[2], and Yangyang Wang, MA[1]

Abstract

Attention-deficit/hyperactivity disorder (ADHD) overdiagnosis and overtreatment unnecessarily exposes children to potential harm and contributes to provider and community skepticism toward those with moderate or severe symptoms and significant impairments, resulting in less supportive care. Yet, which sociodemographic groups of children are overdiagnosed and overtreated for ADHD is poorly understood. We conducted descriptive and logistic regression analyses of a population-based subsample of 1,070 U.S. elementary schoolchildren who had displayed above-average levels of independently assessed behavioral, academic, or executive functioning the year prior to their initial ADHD diagnoses and who did not have prior diagnostic histories. Among these children, (a) 27% of White children versus 19% of non-White children were later diagnosed with ADHD and (b) 20% of White children versus 14% of non-White children were later using medication. In adjusted analyses, White children are more likely to later be diagnosed (odds ratio [OR] range = 1.70–2.62) and using medication (OR range = 1.70–2.37) among those whose prior behavioral, academic, and executive functioning suggested that they were unlikely to have ADHD.

Keywords

attention-deficit/hyperactivity disorder, racial disparities, overdiagnosis, medication, longitudinal

About 10% of elementary schoolchildren are diagnosed with attention-deficit/hyperactivity disorder (ADHD) (Danielson et al., 2018; Xu et al., 2018). Some of these children may be overdiagnosed and overtreated for ADHD (Bruchmüller et al., 2012; Canady, 2019; Kazda et al., 2021; Partridge et al., 2014; Tatlow-Golden et al., 2016; Thomas et al., 2015). For example, child psychologists, psychiatrists, and social workers given vignettes of children not meeting diagnostic criteria rate about 20% of the children as having ADHD (Bruchmüller et al., 2012). ADHD overdiagnosis occurs when no significant impairments are evident and when no or only mild symptoms occur within a normal developmental range (Paris et al., 2015), indicating that diagnostic criteria have not been met (Merten et al., 2017). Overtreatment may occur when children use medication despite displaying below-threshold levels of impairment (Angold et al., 2000). Diagnostic criteria for ADHD include symptoms that are frequent, persistent, and inconsistent with children's developmental level and that clearly and negatively affect their academic or social functioning (American Psychiatric Association, 2013). Despite evidence that ADHD prevalence is increasing among elementary schoolchildren (Anderson, 2018; Xu et al., 2018), to what extent ADHD overdiagnosis and overtreatment occurs among elementary schoolchildren is poorly understood (Kazda et al., 2021). Overdiagnosis may result from health providers not strictly adhering to standardized and multi-informant criteria (Morley, 2010). Population-based analyses indicate that over time increases in ADHD prevalence in children occur at subthreshold rather than at diagnostic levels of functioning, suggesting that overdiagnosis may help explain increasing ADHD prevalence (Kazda et al., 2021; Rydell et al., 2018).

[1]Penn State, University Park, PA, USA
[2]SRI International, Arlington, VA, USA

Corresponding Author:
Paul L. Morgan, Department of Education Policy Studies, Penn State, 310E Rackley Building, University Park, PA 16802, USA.
Email: paulmorgan@psu.edu

Potential Relations Between Sociodemographic Characteristics and ADHD Overdiagnosis and Overtreatment

Sociodemographic characteristics may be related to ADHD overdiagnosis and overtreatment (Bruchmüller et al., 2012; Davis et al., 2021; Elder, 2010). White and/or better-resourced parents may be more knowledgeable about the possibility of ADHD diagnosis and treatment (Zuckerman et al., 2018) including as a way to increase their children's academic achievement (Davidovitch et al., 2017; Owens, 2021). Parents who are non-White and/or less resourced are reported to be less familiar with or knowledgeable about ADHD diagnosis, treatment, and related services (Bussing et al., 2012; Bussing, Gary, et al., 2003; Coker et al., 2009, 2010) including medication use (Arcia et al., 2004), more likely to be concerned about potential stigma (Dempster et al., 2015; Zuckerman et al., 2018), and less likely to access mental health care providers offering culturally appropriate services (Simoni, 2021; Slobodin & Masalha, 2020). Non-White populations are less likely to use mental health services and treatments (Lim et al., 2019) including for ADHD (Coker et al., 2009; Glasofer & Dingley, 2021). Among young children with only mild emotional and behavioral difficulties, 8.9%, 5.6%, and 2.6% of those who are White, Black, and Hispanic use medication, respectively (Simon et al., 2015). Non-White parents have been reported to be less likely than White parents to seek a professional evaluation of whether their children have ADHD (28% vs. 51%) and more likely to have negative expectations (58% vs. 34%) about any resulting treatment (Bussing, Zima, et al., 2003). Non-White parents are also more likely to expect mental health care providers to be untrustworthy, disrespectful, uninformed, and to fail to provide high-quality care (Richardson, 2001). About 20% of Black parents versus 30% of White parents report having received information about ADHD from physicians (Bussing et al., 1998). A lack of such information is a significant barrier to accessing mental health care services (Hansen et al., 2021). Among children experiencing ADHD symptoms, 20% and 26% of Black and Hispanic children versus 49% of White children use mental health care (Coker et al., 2009). Analyses adjusting for additional potential confounds including household income and English proficiency indicate that the odds that Black and Hispanic children use mental health care for ADHD are 70% and 30% lower, respectively, than the odds for similarly situated White children.

Yet to what extent racial or ethnic and economic disparities occur specifically in ADHD overdiagnosis and overtreatment is currently unclear (Fairman et al., 2020; MacDonald et al., 2018; Odgers & Jensen, 2020). Available studies have largely analyzed for disparities in ADHD diagnosis and treatment among the general population of children including in analyses controlling for behavioral, academic, or executive functioning (Morgan et al., 2013, 2014, 2017; Rhinehart et al., 2022). These analyses were designed to approximate contrasts among children similar in their relative likelihoods of being diagnosed or using medication including those who were likely to have ADHD. These studies were not designed to examine for disparities among the specific subpopulation of elementary schoolchildren who are *unlikely* to have ADHD.

Investigating the extent to which sociodemographic characteristics relate to ADHD overdiagnosis and overtreatment among elementary schoolchildren who are unlikely to have ADHD on the basis of above-average behavioral, academic, or executive functioning should inform both research and practice (Fairman et al., 2020). ADHD overdiagnosis and overtreatment contributes to provider and community skepticism toward those with moderate or severe symptoms and significant impairments. This can result in less supportive clinical care as well as inefficient allocation of limited mental health resources (Thomas et al., 2015). Children who are diagnosed with ADHD despite displaying only mild symptoms, particularly those from better-resourced families, experience lower academic achievement and behavior during elementary school (Owens, 2020; Owens & Jackson, 2017). This may occur due to lowered expectations and self-esteem (Koonce et al., 2004; Owens & Jackson, 2017). Because children with mild ADHD may be more likely to be educated in general education classrooms, they may be more likely to compare themselves to children without disabilities and so adopt negative ability beliefs that interfere with their academic and behavior functioning (Owens, 2020; Owens & Jackson, 2017). ADHD medication use increases academic functioning including in children meeting strict diagnostic criteria (Jangmo et al., 2019; Jensen, 1999; Keilow et al., 2018; Prasad et al., 2013; Scheffler et al., 2009), suggesting that ADHD diagnosis and treatment are likely beneficial to the larger population of children experiencing moderate or severe ADHD symptoms and impairments. However, ADHD diagnosis and treatment of the specific subpopulation of children experiencing no or mild symptoms or impairments may result in lower academic and behavioral functioning as well as unnecessary exposure to the potential harmful side effects of medication use (Clemow & Walker, 2014; Owens, 2020; Owens & Jackson, 2017).

To date, only one prior study has reported analyses specifically designed to investigate racial or ethnic disparities in ADHD diagnosis and treatment among schoolchildren unlikely to have ADHD due to displaying above-average behavioral functioning and no prior diagnostic histories (Coker et al., 2016). Among children displaying neither the symptoms of ADHD nor an ADHD diagnosis, 7% of White children were using medication in contrast to 4% and 3% of

Black and Hispanic children in 10th grade. Adjusted odds ratios (ORs) in 5th, 7th, and 10th grade in an asymptomatic sample were directionally consistent with White children being more likely to use medication. (These specific analyses were not statistically significant, possibly due to small sample sizes.) Racial, ethnic, and economic disparities in ADHD overdiagnosis were not investigated. Assessment of ADHD symptoms was based on parent report and so did not include independently assessed indicators of impairment. Parent report may be biased by social desirability and limited reference to typical childhood development (Coker et al., 2016).

A recent scoping review of 334 studies indicates that the increasing proportion of new ADHD cases occurs on the mild end of spectrum (Kazda et al., 2021). The review's findings also suggest that the harms may outweigh the benefits of ADHD diagnosis and treatment for these mild cases. However, whether and to what extent sociodemographic characteristics are associated with ADHD overdiagnosis and overtreatment is poorly understood (Coker et al., 2016; Kazda et al., 2021). Greater knowledge about the sociodemographic populations who are more likely to be overdiagnosed and overtreated for ADHD would help advance educational and health equity. For example, such knowledge would inform efforts to ensure that limited mental health resources are being allocated to sociodemographic populations known to be experiencing ADHD underdiagnosis and undertreatment (Coker et al., 2016; Morgan et al., 2013, 2014).

Study Purpose

To address identified limitations in the extant knowledge base (Coker et al., 2016; Fairman et al., 2020; Kazda et al., 2021; Morgan et al., 2013; Odgers & Jensen, 2020), we analyzed a subsample of elementary schoolchildren participating in a population-based cohort to estimate the likelihood of ADHD overdiagnosis and overtreatment among U.S. schoolchildren independently assessed as displaying above-average levels of behavioral, academic, and executive functioning the year immediately prior to their initial diagnosis and who did not have prior diagnostic histories. We considered these children as unlikely to have ADHD. This is because schoolchildren diagnosed with ADHD should display moderate to severe behavioral symptoms that may result from executive functioning disorders (Kofler et al., 2019) as well as significant impairments (O'Neill et al., 2017) indicating below-average academic (Perrin et al., 2019) or social development (National Institute of Mental Health [NIMH], 2019) for their age. Our sample allows us to investigate for sociodemographic disparities among children who appeared unlikely to meet criteria for ADHD diagnosis and treatment based on independently administered measures of behavioral, academic, or executive functioning. We hypothesized that children who are White or from better-resourced families would be more likely to later be diagnosed and treated for ADHD among those children previously displaying above-average behavioral, academic, or executive functioning.

Method

We analyzed a subsample of a population-based cohort of U.S. elementary schoolchildren participating in the Early Childhood Longitudinal Study: Kindergarten Class of 2010–2011 (ECLS-K: 2011). Children in the ECLS-K: 2011 were followed from the fall of kindergarten through the spring of fifth grade. Data were collected in the spring of each grade using parent and teacher ratings of children's behavioral functioning as well as by individually and independently assessed measures of children's academic and executive functioning. We rounded sample sizes to the nearest 10 in compliance with the ECLS-K: 2011's participant confidentiality procedures. We obtained university Institutional Review Board approval.

Measures

Behavioral, academic, and executive functioning. At each grade, we created binary indicators capturing whether children were in the highest 33% of the full ECLS-K: 2011 distribution ($N = 18{,}170$) of independently assessed behavioral, academic, or executive functioning and so displaying above-average performance. (Results were similar but underpowered using the highest 25% of the distribution.) Externalizing and self-regulatory behaviors are the specific behaviors most strongly related to ADHD diagnosis (Elder, 2010). At each grade, teachers reported how often children displayed externalizing problem behaviors like fighting or arguing with a teacher (with 1 = *Never*, 4 = *Very Often*). Higher scores indicated that the child displayed these behaviors more frequently. Children were coded as being "above average" if they were among those with the fewest externalizing problems as indicated by a score at or below the 33rd percentile of all participating ECLS-K: 2011 children ($n = 3{,}140$). (We refer to this level of functioning as displaying "below-average" externalizing problem behaviors in Tables 1–3.) Teachers also responded to a set of items assessing children's self-regulatory behaviors including self-control, attentional focus, and inhibitory control (e.g., attention, organization, distractibility). These items were correlated at $r = .65$ to .86 across survey waves and were standardized and combined into a measure capturing behavioral self-regulation. Children whose standardized scores were in the top 33% of the full ECLS-K: 2011 distribution were coded as displaying above-average behavioral self-regulation ($n = 3{,}980$).

Trained ECLS-K: 2011 field staff independently assessed children's academic achievement at each grade using untimed, psychometrically strong measures of general reading and mathematics achievement displaying consistent evidence of construct validity (Najarian et al., 2019). The reading assessment was designed to measure children's skills in word recognition, vocabulary, and reading comprehension. The mathematics assessment involved questions measuring conceptual and procedural knowledge as well as children's ability to solve problems. The reliability of item-response-theory (IRT) scores ranged from .86 to .95 for the reading assessment and .92 to .94 for the mathematics assessment from the spring kindergarten to fifth grade (Tourangeau et al., 2019). We averaged children's reading and mathematics achievement at each grade. Children averaging academic achievement in the highest 33% of the full ECLS-K: 2011 distribution were coded as displaying above-average academic achievement (n = 4,470).

During each grade, National Center for Education Statistics (NCES) field staff also individually assessed children's executive functioning. Working memory was assessed using a numbers-reversed task in which children repeated a given number sequence backwards. Cognitive flexibility was assessed using a card-sorting task in which children were asked to sort out cards using changing rules (i.e., first by color and then by border). We created two binary variables in each grade indicating which children were among those with above-average executive functioning (i.e., top 33% of the total sample's distribution) for working memory (n = 4,950) and cognitive flexibility (n = 6,210), respectively.

ADHD diagnosis and treatment. Parents were asked a series of questions about their children's development during the spring of each survey wave. Parents responding that their child was functioning slightly or much lower than other children were asked whether the child had emotional or psychological difficulties and whether this was a severe problem. Parents were then asked whether the child had been evaluated by a health professional (e.g., pediatrician, psychiatrist, speech-language pathologists, but not teachers). Parents responding "yes" were then asked whether a diagnosis was obtained and for what condition. Children whose parents responded that they had been diagnosed with either ADHD or attention-deficit disorder (ADD) were coded as having ADHD. We excluded children reported to have an ADHD diagnosis during kindergarten to investigate for sociodemographic disparities among a sample without prior diagnostic histories. We then created a binary variable indicating whether children were ever diagnosed with ADHD ("1") at any subsequent timepoint between first and fifth grade (n = 1,070), or if children were never diagnosed ("0"). Parents were also asked whether their child was currently taking any prescription medication for the diagnosed condition. A second variable indicated that the child had been diagnosed and was taking ADHD medication ("1") between first and fifth grade (n = 810). We limited the sample to those who displayed above-average functioning the year prior to their initial ADHD diagnosis to limit reverse causality (i.e., in which being diagnosed and treated for ADHD resulted in above-average behavioral, academic, or executive functioning).

Diagnosis and treatment for ADHD was uncommon among children who were displaying above-average levels of independently assessed behavioral, academic, or executive functioning. Among children who had been displaying below-average levels of externalizing problem behaviors, only 1.9% were diagnosed with ADHD in a subsequent year. These proportions were: (a) 0.8% among children displaying above-average levels of behavioral self-regulation; (b) 3.6% among children displaying above-average levels of academic achievement; (c) 5.1% among children displaying above-average levels of working memory; and (d) 5.2% among children displaying above-average levels of cognitive flexibility.

Explanatory factors. Race and ethnicity were coded as "1" for non-Hispanic White and "0" for non-White. The non-White category included children who were reported to be Black, Asian, mixed or multiple races, or of Hispanic ethnicity. We were unable to disaggregate this category into racial or ethnic subgroups due to small sample sizes. Family socioeconomic status (SES) was a composite variable created and standardized by ECLS-K: 2011 staff that measured parental educational attainment, occupational prestige, and household income. We trichotomized this variable using the full ECLS-K: 2011 sample and created a variable indicating that the child was from a high-SES household (i.e., highest 33% of the total sample's distribution) or a low-SES household (i.e., lowest 33%) relative to average-SES households (i.e., middle 33%). Discretizing variables into at least three categories when comparing high and low values is recommended methodologically (Gelman & Park, 2009). Children's age in months at the kindergarten academic assessments was measured continuously.

Missing Data

We first performed a complete case analysis using listwise deletion of the observed ADHD status and medication use data. There were no missing observations for racial identity. Family SES was missing 11.75% of observations and age at kindergarten entry was missing 5.35%. Missingness on our five functioning indicators averaged 28.9% and ranged from 26.4% (working memory) to 33.4% (teacher-rated behavior).

We then multiply imputed m = 20 datasets by chained equations using predictive mean matching with the 10 nearest neighbors to estimate missing observations. We would

Table 1. Descriptive Information for Children With ADHD Who Had Been Displaying Above-Average Behavior, Achievement, or Executive Functioning the Year Immediately Prior to Their Initial Diagnosis, by Race or Ethnicity and SES.

	White	Non-White		High SES	Low SES		Total
Variable	(n = 660)	(n = 420)	p	(n = 320)	(n = 330)	p	(N = 1,070)
Below-average externalizing							
% with ADHD Dx	13.3%	7.6%	.004	12.7%	8.1%	.054	11.1%
% with medication	9.3%	6.0%	.052	7.0%	6.6%	.840	10.6%
Above-average self-regulation							
% with ADHD Dx	19.4%	19.6%	.936	21.5%	22.2%	.829	19.5%
% with medication	13.1%	13.6%	.814	15.8%	14.7%	.700	17.7%
Above-average achievement							
% with ADHD Dx	27.3%	19.1%	.002	30.4%	20.1%	.003	24.1%
% with medication	19.7%	13.6%	.010	21.5%	14.7%	.024	23.0%
Above-average working memory							
% with ADHD Dx	34.4%	29.1%	.070	39.9%	29.9%	.008	32.3%
% with medication	25.0%	21.0%	.130	28.8%	22.2%	.053	31.1%
Above-average cognitive flexibility							
% with ADHD Dx	42.4%	35.8%	.031	40.5%	41.0%	.897	39.9%
% with medication	31.6%	25.5%	.032	30.7%	29.3%	.697	38.8%

Note. Samples may not sum to 100% due to rounding. "% with ADHD Dx" = proportion of children by column who received an ADHD diagnosis between first and fifth grade and who were in the highest 33% (i.e., "above average") of the distribution for each outcome the year prior to initial diagnosis. "% with medication" = proportion of children by column who had an ADHD diagnosis and were also taking medication, and who were in the highest 33% (i.e., "above average") of the distribution for each outcome the year prior to initial diagnosis. ADHD = attention-deficit/hyperactivity disorder; SES = socioeconomic status; Dx = diagnosis.

Source. U.S. Department of Education, National Center for Education Statistics (NCES), Early Childhood Longitudinal Study, Kindergarten Class of 2010-11 (ECLS-K:2011), Kindergarten Through Fifth Grade Full Sample Restricted-Use Data File.

have retained an average of 66.2% of our sample under complete case logistic regression analysis (ranging from a low of 55.9% for the teacher-rated behavior to a high of 71.5% for achievement). Results were substantively similar to those obtained with multiple imputation. Students with missing data on our achievement and behavior measures tended to be younger at kindergarten entry, less likely to be in the highest 33rd percentile of prior achievement and behavior, and less likely to be White, from higher SES households, or to be English language learners.

Statistical Analyses

All data were cleaned and analyzed in Stata v. 15.0. Table 1 displays descriptive statistics for the analytical sample of 1,070 elementary schoolchildren who (a) had not been diagnosed with ADHD by kindergarten but (b) were initially diagnosed with ADHD between first and fifth grade. Table 2 displays descriptive statistics of the sample of children diagnosed with and using medication for ADHD who were in the top 33% of the behavioral, achievement, or executive functioning distributions. Table 3 reports the multivariate logistic regression analyses predicting the likelihood of ADHD diagnosis and medication use among children who previously displayed above-average levels of independently assessed behavioral, academic, or executive functioning using Stata's *logit* command. Statistically significant ORs above 1.00 indicated that the specific population group were more likely to be diagnosed or medicated the year following independently assessed above-average behavioral, academic, or executive functioning. The logistic regression analyses simultaneously adjusted for race, family SES, and age at kindergarten assessment. Significance levels are adjusted for 10 comparisons using the Benjamini–Hochberg correction.

Results

Descriptive statistics in Table 1 indicate that, of the 1,070 children diagnosed with ADHD between first and fifth grade, (a) 61% are White (n = 660) while 39% are non-White (n = 420); and (b) 29.8% were from high-SES families (n = 320) while 30.7% were from low-SES families (n = 330). Of White children with ADHD, 77.4% were using medication relative to 72.1% of non-White children with ADHD (p = .048). The percentage difference in medication use between children with ADHD from high- and low-SES families (i.e., 74.1% vs. 75.4%) was not statistically significant (p = .70).

Among the 1,070 children with ADHD, 11.1% and 19.5% had been rated by their teachers as displaying above-average externalizing or self-regulatory behavioral functioning during the year prior to their initial diagnosis. The proportions of children with ADHD who had displayed above-average levels of academic achievement and

Table 2. Descriptive Information of Children Diagnosed With ADHD (Top Panel) and Using Medication (Bottom Panel) in the Top Third of the Behavioral, Academic, and Executive Functioning Distributions.

	Below-average externalizing	Above-average self-regulation	Above-average achievement	Above-average working memory	Above-average cognitive flexibility
Variable	% or *M (SD)*	% or *M (SD)*	% or *M (SD)*	% or *M (SD)*	% or *M (SD)*
ADHD Dx					
White	73.44	70.21	75.47	67.48	67.08
High SES	35.00	45.24	49.01	44.07	35.12
Low SES	23.33	21.43	15.23	23.73	30.77
K Age	75.06 (5.39)	76.14 (4.96)	74.48 (4.39)	74.66 (4.45)	74.39 (4.93)
ADHD Med					
White	69.05	65.63	74.79	67.03	67.49
High SES	25.00	46.67	45.69	42.70	35.37
Low SES	27.50	20.00	18.10	25.84	30.13
K Age	75.46 (5.76)	76.55 (5.14)	74.72 (4.53)	74.75 (4.57)	74.62 (4.94)

Note. ADHD = attention-deficit/hyperactivity disorder; Dx = diagnosis; Med = medication; K = kindergarten; SES = socioeconomic status.

Table 3. Logistic Regression Predicting the Likelihood of Being Diagnosed With and Medicated For ADHD Among Children Displaying Above-Average (Highest 33%) Behavior, Achievement, or Executive Functioning the Year Prior to Their Initial Diagnosis and Treatment.

	Below-average externalizing		Above-average self-regulation		Above-average achievement		Above-average working memory		Above-average cognitive flexibility	
	n = 4,870		*n* = 7,100		*n* = 6,190		*n* = 6,990		*n* = 8,870	
Variable	OR	*p*	OR	*p*	OR	*p*	OR	*p*	OR	*p*
ADHD Dx										
White	2.62***	.001	2.04*	.027	2.25***	.000	1.70***	.000	1.92***	.000
High SES	0.76	.320	1.17	.627	0.83	.300	0.99	.961	0.78	.073
Low SES	0.97	.916	1.15	.735	1.03	.891	1.35	.091	1.45+	.011
K Age	1.05	.081	1.08+	.008	1.00	.804	1.04*	.014	1.02	.063
ADHD Med										
White	2.37*	.011	1.69	.155	2.23***	.000	1.70***	.001	1.96***	.000
High SES	0.53	.085	1.17	.697	0.77	.195	0.99	.960	0.77	.096
Low SES	0.92	.829	1.02	.974	1.16	.586	1.48	.053	1.42+	.039
K Age	1.06	.055	1.10**	.009	1.02	.466	1.04*	.019	1.03*	.019

Note. ADHD = attention-deficit/hyperactivity disorder; OR = odds ratio; Dx = diagnosis; SES = socioeconomic status; K = kindergarten; Med = medicated.
Source. U.S. Department of Education, National Center for Education Statistics (NCES), Early Childhood Longitudinal Study, Kindergarten Class of 2010–2011 (ECLS-K:2011), Kindergarten Through Fifth Grade Full Sample Restricted-Use Data File.
*$p < .05$. **$p < .01$. ***$p < .001$, +p not significant following Benjamini–Hochberg correction for multiple comparisons.

executive functioning (i.e., working memory and cognitive flexibility) the year prior to their initial diagnosis were 24.1%, 32.3%, and 39.9%, respectively. These proportions were about 1% to 2% smaller for children who were also using ADHD medication.

There were significantly more White than non-White children who were diagnosed with ADHD but who had displayed above-average levels of independently assessed behavioral, academic, or executive functioning the year prior to their initial diagnoses. For example, 27.3% of White children versus 19.1% of non-White children diagnosed with ADHD had displayed above-average levels of academic achievement prior to their initial ADHD diagnosis (risk ratio [RR] = 1.43, $p = .002$). We also observed socioeconomic disparities in ADHD diagnoses among children with above-average performance levels. Among children with ADHD who were from high- and low-SES families, respectively, 30.4% versus 20.1% had been displaying above-average levels of academic achievement (RR = 1.51, $p = .003$).

We observed racial or ethnic and socioeconomic disparities among children with ADHD diagnoses who were using medication and who had also been displaying above-average levels of independently assessed academic and executive functioning the year prior to their initial diagnosis. Among children who had previously been achieving in the highest third of the total sample's distribution, 19.7% of White children versus 13.6% of non-White children were reported to use ADHD medication the following year (RR of 1.45, $p = .01$). Among those children with ADHD who previously had been in the highest third of the total sample's cognitive flexibility distribution, 31.6% of White versus 25.5% of non-White children had also begun using medication (RR of 1.24, $p = .03$). The racial or ethnic disparity in medication use among those who had previously displayed below-average levels of externalizing problem behaviors was marginally significant (RR = 1.55, $p = .052$). We also observed socioeconomic disparities in ADHD medication use among children subsequently diagnosed with ADHD but who had been previously displaying above-average levels of academic achievement (RR of 1.46, $p = .02$).

Table 3 displays results from logistic regression models using imputed data from elementary schoolchildren subsequently diagnosed with ADHD but who had previously displayed above-average levels of independently assessed behavioral, academic, and executive functioning the year prior to their initial diagnosis. Among those who had previously displayed above-average performance, White children were consistently more likely than non-White children to be subsequently diagnosed with or use medication for ADHD. The adjusted OR for diagnosis and medication use ranged from 1.70 to 2.62 across the five measures of above-average levels of functioning following adjustments for age and family SES.

Racial and ethnic disparities among children who had previously displayed above-average performance were evident across all five indicators of ADHD diagnosis as well as four of the five indicators of ADHD treatment. For the other indicator (i.e., behavioral self-regulation), the estimate was directionally consistent with racial and ethnic disparities (i.e., adjusted OR of 1.69 for medication use) but was not statistically significant. Children who were older at kindergarten assessment and who were displaying above-average behavioral self-regulation or working memory were slightly more likely to be diagnosed (OR = 1.08 and 1.04, respectively) and treated for ADHD (OR = 1.10 and 1.04) the subsequent year than children who were younger. This was also the case for children who displayed above-average cognitive flexibility (OR = 1.03). Children from high- or low-SES families were not consistently more or less likely to be diagnosed or to use medication for ADHD than children from middle-SES families in analyses corrected for multiple comparisons.

As a robustness check (results not shown), we also analyzed the likelihood of receiving an ADHD diagnosis or using medication among children with above-average performance on any one behavioral, academic, or executive functioning measure *and* who were not among the lowest 10% of the distribution on any other behavioral, academic, or executive functioning measure. Doing so ensured that we were conservatively restricting the analyses to only those children who had not been displaying significant impairments across any of the study's other measures. Results were consistent in both effect size and directionality (e.g., OR range = 1.62 to 3.18 for White children). This was also the case for children who were not in the lowest 25% or 33% of the distribution in underpowered analyses. Although it was uncommon to receive an ADHD diagnosis or treatment in the absence of at least one behavioral, academic, or executive functioning symptom, those children who did so despite (a) prior histories of above-average functioning as well as (b) no prior histories of significant impairment were more likely to be White and older for their grade.

Discussion

In analyses of a sample of U.S. elementary schoolchildren with no prior diagnostic histories and who had been displaying above-average behavioral, academic, or executive functioning, ADHD diagnosis and treatment the following year were more likely to occur for children who are White, older, and from higher SES families. Racial or ethnic disparities in ADHD diagnosis and treatment among children displaying above-average performance were not explained by family SES. We observed these findings across five independently administered measures of behavioral, academic, and executive functioning.

Strengths and Limitations

Our study adds to the very limited empirical work assessing for sociodemographic disparities in ADHD overdiagnosis and overtreatment among U.S. schoolchildren (Coker et al., 2016; Fairman et al., 2020; Kazda et al., 2021; Odgers & Jensen, 2020). We address methodological and substantive limitations in the prior work by analyzing data from children participating in a population-based cohort, using multiple indicators of independently assessed behavioral, academic, and executive functioning, and examining for sociodemographic disparities in both ADHD overdiagnosis and overtreatment. The only prior study to date reporting similar analyses was based on parental report of children's functioning and was limited to reports of behavioral but not academic or executive functioning (Coker et al., 2016).

Our study has limitations. We were unable to directly assess whether the children had been inappropriately diagnosed and treated for ADHD. Instead, we used above-average

performance on independently administered behavioral, academic, and executive functioning measures to indirectly assess for ADHD overdiagnosis and overtreatment. Although it is possible for children who display above-average levels of behavioral, academic, or executive functioning to be appropriately diagnosed with ADHD, this is unlikely because children so diagnosed should display moderate to severe behavioral symptoms (Kofler et al., 2019) and below-average academic (Perrin et al., 2019) or social development (NIMH, 2019) for their age. ADHD diagnosis and treatment were uncommon among the population of schoolchildren displaying above-average functioning, occurring in less than 5% of this group. In the unlikely event that these children were appropriately diagnosed with ADHD while only displaying very mild symptoms, our results would offer additional evidence that non-White children are underdiagnosed and undertreated for ADHD relative to similarly situated White children with respect to achievement, behavior, age, and socioeconomic advantage (Coker et al., 2016; Morgan et al., 2013, 2014, 2017; Rhinehart et al., 2022; Stevens et al., 2005). We find that this might also be the case among children displaying above-average behavioral, academic, and executive functioning and so among those unlikely to meet diagnostic criteria for ADHD diagnosis and treatment. Our results are also consistent with prior work (Coker et al., 2016) finding that only a small percentage of children with neither a prior ADHD diagnosis nor who were displaying ADHD symptoms were diagnosed and treated for ADHD. An implication of this finding is that ADHD overdiagnosis and overtreatment likely contributes only minimally to previously reported racial and ethnic disparities in ADHD diagnosis and treatment (Coker et al., 2016; Morgan et al., 2013).

We were unable to examine to what extent children from English-speaking families may be overdiagnosed and overtreated for ADHD relative to non-English-speaking families due to small sample sizes. We also were unable to examine disparities among children attending U.S. middle or high schools. This is because the ECLS-K: 2011's data collection ended at the end of elementary school. We were unable to examine for racial, ethnic, or socioeconomic disparities in medication type and dosage. Because only parents who reported an ADD or ADHD diagnosis for their child were asked about whether the child was using medication, those children who were using ADHD medication but whose parents were not aware of a prior diagnosis would have been excluded from analysis. We were unable to disaggregate the sample of non-White children by specific racial or ethnic minority backgrounds due to small sample sizes. The degree of overdiagnosis and overtreatment may vary by the specific racial or ethnic group. We were unable to independently confirm the teacher behavior ratings with direct observations. Racial bias may have influenced the teacher ratings of children's externalizing and self-regulatory behaviors. However, teacher ratings and direct observations of ADHD behaviors correlate including in samples of non-White children (Epstein et al., 2005; Hosterman et al., 2008). Some of the behavioral measures may be more sensitive to schoolchildren with hyperactive or impulsive ADHD subtypes instead of predominantly inattentive or comorbid-anxious subtypes. Our behavioral measures did include a self-regulation indicator that assessed for attention, organization, and task persistence. Our executive functioning measures include cognitive flexibility as well as working memory and so should have been sensitive to children experiencing the predominantly inattentive ADHD subtype.

Clinical Implications

Although some children may be overdiagnosed with ADHD (Bruchmüller et al., 2012; Canady, 2019; Partridge et al., 2014; Tatlow-Golden et al., 2016), to what extent elementary schoolchildren's sociodemographic characteristics are related to their likelihood of ADHD overdiagnosis and overtreatment has been unclear. Such work is needed (Fairman et al., 2020). ADHD diagnosis and medication use among the specific subpopulation of children displaying only mild ADHD symptoms has been reported to be associated with lower academic and behavioral functioning in analyses adjusting for potential confounds (Owens & Jackson, 2017), particularly among those from better-resourced families (Owens, 2020). This might occur because this specific group of children is more likely to be educated in general educated classrooms, leading to the children being more likely to adopt negative ability beliefs based on comparisons to children without disabilities (Owens, 2020; Owens & Jackson, 2017). Younger children have been reported to be more likely to be diagnosed or treated for ADHD (Holland & Sayal, 2019), but whether and how this is the case across racial, ethnic, or economic subgroups has also been unclear (Pottegard et al., 2014). Our findings suggest that, among children who displayed above-average levels of behavioral or executive functioning, those who were older were slightly more likely to be subsequently diagnosed with or treated for ADHD compared with children who were younger. More research is needed to examine whether age is related to the likelihood of ADHD diagnosis and medication use among those displaying above-average behavioral, academic, or executive functioning.

We consistently find that previously undiagnosed schoolchildren who had been displaying above-average behavioral, academic, or executive functioning were more likely to receive subsequent ADHD diagnosis and treatment if they are White. Nine of 10 (i.e., 90%) tests of this relation were statistically signficant in analyses adjusting for family SES and age. The size of the estimated ORs are practically significant (Ferguson, 2009). White children may also

experience fewer functional limitations of ADHD because they receive more educational and mental health services following diagnosis than non-White children (Coker et al., 2009), experience preferential racial treatment within their schools (Warikoo et al., 2016), and attend better-resourced schools with smaller class sizes and better trained teachers who may be more sensitive to ADHD symptoms (Sherman et al., 2008). Non-White children may need to display higher rates of ADHD behaviors to be referred for evaluation and treatment (Epstein et al., 2005). Our results are consistent with some White families being more likely to seek out ADHD diagnoses and treatments for their children even when their children display no or only mild symptoms or impairments, possibly so as to increase the children's academic achievement (Davidovitch et al., 2017; Owens, 2021; Zuckerman et al., 2018).

Our work extends prior work reporting that non-White and/or socioeconomically disadvantaged children are less likely than similarly situated children who are White to be diagnosed or treated for ADHD (Coker et al., 2016; Morgan et al., 2013, 2014, 2017; Rhinehart et al., 2022). Social or cultural differences may explain these differences in ADHD diagnosis and treatment between White and non-White families. For example, White families may be more likely to seek out diagnosis and treatment because they are better able to access information about ADHD, which may also lead to fewer reservations about medication use and a lower likelihood of endorsing myths about ADHD diagnoses (e.g., that ADHD is caused by sugar consumption or inappropriate parenting methods, that medications lead to drug addiction) (Bussing et al., 1998; dosReis et al., 2003; Schnittker, 2003). White families also typically experience fewer barriers to evaluation and treatment than non-White families (Kazdin et al., 1995; Zuckerman et al., 2018). Non-White parents have reported skepticism about the accuracy of ADHD diagnosis and treatment by providers and instead are more likely to view diagnosis and treatment as an attempt to exert racialized social control or because school environments are unresponsive to the needs of non-White children (Glasofer et al., 2021; Olaniyan et al., 2007).

Our study adds to the very limited knowledge base about whether ADHD overdiagnosis and overtreatment is occurring among elementary schoolchildren. We find evidence that this is occurring among children displaying above-average academic and executive functioning as well as, as previously reported (Coker et al., 2016), behavioral functioning. Our work extends prior work by finding that White children are more likely to use medication among those with no prior diagnostic histories and who were not previously displaying ADHD symptoms as indicated by independently assessed behavioral, academic, or executive functioning in analyses adjusted for family SES and age. Our findings therefore provide additional support for stricter adherence by child psychologists, pediatricians, psychiatrics, and other health providers to standardized and multi-informant diagnostic and treatment criteria for ADHD (Davidovitch et al., 2017). Limiting ADHD overdiagnosis and overtreatment among children displaying above-average behavioral, academic, or executive functioning should help reduce provider and community skepticism and resulting stigma and reduced care for children experiencing moderate or severe ADHD symptoms and significant impairments. Preventing or reducing ADHD overdiagnosis and overtreatment should contribute to more appropriate care, limit increasing ADHD prevalence, increase the academic and behavioral functioning of elementary schoolchildren being diagnosed with ADHD but who are displaying few or mild symptoms, reduce unnecessary exposure to adverse side effects of medication use, and better allocate limited mental health resources (Clemow & Walker, 2014; Coker et al., 2016; Koonce et al., 2004; Owens, 2020; Owens & Jackson, 2017; Thomas et al., 2015).

Authors' Note

This study was conducted while Dr. Woods was a postdoctoral research scholar at Penn State.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

Funding support provided by the National Center for Special Education Research, Institute of Education Sciences (R324A200166) and Penn State's Center for Educational Disparities Research as well as an infrastructure grant to the Population Research Institute (P2CHD041025) from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, National Institutes of Health. The study's funders had no role in the design, data collection, analysis, data interpretations, or dissemination of these findings.

ORCID iDs

Paul L. Morgan https://orcid.org/0000-0001-9347-6486
Adrienne D. Woods https://orcid.org/0000-0003-1101-6975

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). American Psychiatric Association.

Anderson, J. (2018, August). *Reported diagnosis and prescription utilization related to attention deficit hyperactivity disorder in children ages 5–17, 2008–2015* (Statistical Brief #514). Agency for Healthcare Research and Quality. https://meps.ahrq.gov/mepsweb/data_files/publications/st514/stat514.shtml

Angold, A., Erkanli, A., Egger, H. L., & Costello, E. J. (2000). Stimulant treatment for children: A community perspective. *Journal of the American Academy of Child & Adolescent*

Psychiatry, *39*(8), 975–984. https://doi.org/10.1097/00004583-200008000-00009

Arcia, E., Fernández, M. C., & Jáquez, M. (2004). Latina mothers' stances on stimulant medication: Complexity, conflict, and compromise. *Journal of Developmental and Behavioral Pediatrics*, *25*(5), 311–317. https://doi.org/10.1097/00004703-200410000-00002

Bruchmüller, K., Margraf, J., & Schneider, S. (2012). Is ADHD diagnosed in accord with diagnostic criteria? Overdiagnosis and influence of client gender on diagnosis. *Journal of Consulting and Clinical Psychology*, *80*(1), 128–138. https://doi.org/10.1037/a0026582

Bussing, R., Gary, F. A., Mills, T. L., & Wilson Garvan, C. (2003). Parental explanatory models of ADHD: Gender and cultural variations. *Social Psychiatry and Psychiatric Epidemiology*, *38*(10), 563–575. https://doi.org/10.1007/s00127-003-0674-8

Bussing, R., Schoenberg, N. E., & Perwien, A. R. (1998). Knowledge and information about ADHD: Evidence of cultural differences among African-American and white parents. *Social Science and Medicine*, *46*(7), 919–928. https://doi.org/10.1016/S0277-9536(97)00219-0

Bussing, R., Zima, B. T., Gary, F. A., & Garvan, C. W. (2003). Barriers to detection, help-seeking, and service use for children with ADHD symptoms. *Journal of Behavioral Health Services and Research*, *30*(2), 176–189. https://doi.org/10.1007/BF02289806

Bussing, R., Zima, B. T., Mason, D. M., Meyer, J. M., White, K., & Garvan, C. W. (2012). ADHD knowledge, perceptions, and information sources: Perspectives from a community sample of adolescents and their parents. *Journal of Adolescent Health*, *51*(6), 593–600. https://doi.org/10.1016/j.jadohealth.2012.03.004

Canady, V. A. (2019). New survey finds most Americans think ADHD overdiagnosed. *Mental Health Weekly*, *29*(34), 6–7. https://doi.org/10.1002/mhw.32043

Clemow, D. B., & Walker, D. J. (2014). The potential for misuse and abuse of medications in ADHD: A review. *Postgraduate Medicine*, *126*(5), 64–81. https://doi.org/10.3810/pgm.2014.09.2801

Coker, T. R., Elliott, M. N., Kataoka, S., Schwebel, D. C., Mrug, S., Grunbaum, J. A., Cuccaro, P., Peskin, M. F., & Schuster, M. A. (2009). Racial/ethnic disparities in the mental health care utilization of fifth grade children. *Academic Pediatrics*, *9*(2), 89–96. https://doi.org/10.1016/j.acap.2008.11.007

Coker, T. R., Elliott, M. N., Toomey, S. L., Schwebel, D. C., Cuccaro, P., Emery, S. T., Davies, S. L., Visser, S. N., & Schuster, M. A. (2016). Racial and ethnic disparities in ADHD diagnosis and treatment. *Pediatrics*, *138*(3), e20160407. https://doi.org/10.1542/peds.2016-0407

Coker, T. R., Rodriguez, M. A., & Flores, G. (2010). Family-centered care for US children with special health care needs: Who gets it and why? *Pediatrics*, *125*(6), 1159–1167. https://doi.org/10.1542/peds.2009-1994

Danielson, M. L., Bitsko, R. H., Ghandour, R. M., Holbrook, J. R., Kogan, M. D., & Blumberg, S. J. (2018). Prevalence of parent-reported ADHD diagnosis and associated treatment among U.S. children and adolescents, 2016. *Journal of Clinical Child and Adolescent Psychology*, *47*(2), 199–212. https://doi.org/10.1080/15374416.2017.1417860

Davidovitch, M., Koren, G., Fund, N., Shrem, M., & Porath, A. (2017). Challenges in defining the rates of ADHD diagnosis and treatment: Trends over the last decade. *BMC Pediatrics*, *17*(1), 1–10. https://doi.org/10.1186/s12887-017-0971-0

Davis, D. W., Jawad, K., Feygin, Y., Creel, L., Kong, M., Sun, J. C., Lohr, W. D., Williams, P. G., Le, J., Jones, V. F., Trace, M., & Pasquenza, N. (2021). Disparities in ADHD diagnosis and treatment by race/ethnicity in youth receiving Kentucky Medicaid in 2017. *Ethnicity and Disease*, *31*(1), 67–76. https://doi.org/10.18865/ED.31.1.67

Dempster, R., Davis, D. W., Faye Jones, V., Keating, A., & Wildman, B. (2015). The role of stigma in parental help-seeking for perceived child behavior problems in urban, low-income African American parents. *Journal of Clinical Psychology in Medical Settings*, *22*(4), 265–278. https://doi.org/10.1007/s10880-015-9433-8

dosReis, S., Zito, J. M., Safer, D. J., Soeken, K. L., Mitchell, J. W., & Ellwood, L. C. (2003). Parental perceptions and satisfaction with stimulant medication for attention-deficit hyperactivity disorder. *Journal of Developmental and Behavioral Pediatrics*, *24*(3), 155–162. https://doi.org/10.1097/00004703-200306000-00004

Elder, T. E. (2010). The importance of relative standards in ADHD diagnoses: Evidence based on exact birth dates. *Journal of Health Economics*, *29*(5), 641–656. https://doi.org/10.1016/j.jhealeco.2010.06.003

Epstein, J. N., Valencia, E. Y., Tonev, S. T., Arnold, L. E., Willoughby, M., Abikoff, H. B., & Hinshaw, S. P. (2005). The role of children's ethnicity in the relationship between teacher ratings of attention-deficit/hyperactivity disorder and observed classroom behavior. *Journal of Consulting and Clinical Psychology*, *73*(3), 424–434. https://doi.org/10.1037/0022-006X.73.3.424

Fairman, K. A., Peckham, A. M., & Sclar, D. A. (2020). Diagnosis and treatment of ADHD in the United States: Update by gender and race. *Journal of Attention Disorders*, *24*(1), 10–19. https://doi.org/10.1177/1087054716688534

Ferguson, C. J. (2009). An effect size primer: A guide for clinicians and researchers. *Professional Psychology: Research and Practice*, *40*(5), 532–538. https://psycnet.apa.org/doi/10.1037/a0015808

Gelman, A., & Park, D. P. (2009). Splitting a predictor at the upper quarter or third and the lower quarter or third. *American Statistician*, *63*(1), 1–8. https://doi.org/10.1198/tast.2009.0001

Glasofer, A., & Dingley, C. (2021). Diagnostic and medication treatment disparities in African American children with ADHD: A literature review. *Journal of Racial and Ethnic Health Disparities*, 1–22. https://doi.org/10.1007/s40615-021-01142-0

Glasofer, A., Dingley, C., & Reyes, A. T. (2021). Medication decision making among African American caregivers of children with ADHD: A review of the literature. *Journal of Attention Disorders*, *25*(12), 1687–1698. https://doi.org/10.1177/1087054720930783

Hansen, A. S., Telléus, G. K., Mohr-Jensen, C., & Lauritsen, M. B. (2021). Parent-perceived barriers to accessing services for

their child's mental health problems. *Child and Adolescent Psychiatry and Mental Health*, *15*(1), 1–11. https://doi.org/10.1186/s13034-021-00357-7

Holland, J., & Sayal, K. (2019). Relative age and ADHD symptoms, diagnosis and medication: A systematic review. *European Child and Adolescent Psychiatry*, *28*(11), 1417–1429. https://doi.org/10.1007/s00787-018-1229-6

Hosterman, S. J., DuPaul, G. J., & Jitendra, A. K. (2008). Teacher ratings of ADHD symptoms in ethnic minority students: Bias or behavioral difference? *School Psychology Quarterly*, *23*(3), 418–435. https://doi.org/10.1037/a0012668

Jangmo, A., Stålhandske, A., Chang, Z., Chen, Q., Almqvist, C., Feldman, I., Bulik, C. M., Lichtenstein, P., D'Onofrio, B., Kuja-Halkola, R., & Larsson, H. (2019). Attention-deficit/hyperactivity disorder, school performance, and effect of medication. *Journal of the American Academy of Child and Adolescent Psychiatry*, *58*(4), 423–432. https://doi.org/10.1016/j.jaac.2018.11.014

Jensen, P. S. (1999). A 14-month randomized clinical trial of treatment strategies for attention-deficit/hyperactivity disorder. *Archives of General Psychiatry*, *56*(12), 1073–1086. https://doi.org/10.1001/archpsyc.56.12.1073

Kazda, L., Bell, K., Thomas, R., McGeechan, K., Sims, R., & Barratt, A. (2021). Overdiagnosis of attention-deficit/hyperactivity disorder in children and adolescents: A systematic scoping review. *JAMA Network Open*, *4*(4), 1–29. https://doi.org/10.1001/jamanetworkopen.2021.5335

Kazdin, A. E., Stolar, M. J., & Marciano, P. L. (1995). Risk factors for dropping out of treatment among White and Black families. *Journal of Family Psychology*, *9*(4), 402–417. https://doi.org/10.1037/0893-3200.9.4.402

Keilow, M., Holm, A., & Fallesen, P. (2018). Medical treatment of Attention Deficit/Hyperactivity Disorder (ADHD) and children's academic performance. *PLoS ONE*, *13*(11), 1–17. https://doi.org/10.1371/journal.pone.0207905

Kofler, M. J., Irwin, L. N., Soto, E. F., Groves, N. B., Harmon, S. L., & Sarver, D. E. (2019). Executive functioning heterogeneity in pediatric ADHD. *Journal of Abnormal Child Psychology*, *47*(2), 273–286. https://doi.org/10.1007/s10802-018-0438-2

Koonce, D. A., Cruce, M. K., Aldridge, J. O., Langford, C. A., Sporer, A. K., & Stinnett, T. A. (2004). The ADHD label, analogue methodology, and participants' geographic location on judgments of social and attentional skills. *Psychology in the Schools*, *41*(2), 221–234. https://doi.org/10.1002/pits.10150

Lim, E., Gandhi, K., Siriwardhana, C., Davis, J., & Chen, J. J. (2019). Racial and ethnic differences in mental health service utilization among the Hawaii Medicaid population. *Physiology & Behavior*, *28*(5), 536–545. https://doi.org/10.1080/09638237.2018.1521917

MacDonald, K., Fainman-Adelman, N., Anderson, K. K., & Iyer, S. N. (2018). Pathways to mental health services for young people: A systematic review. *Social Psychiatry and Psychiatric Epidemiology*, *53*(10), 1005–1038. https://doi.org/10.1007/s00127-018-1578-y

Merten, E. C., Cwik, J. C., Margraf, J., & Schneider, S. (2017). Overdiagnosis of mental disorders in children and adolescents (in developed countries). *Child and Adolescent Psychiatry and Mental Health*, *11*(1), 1–12. https://doi.org/10.1186/s13034-016-0140-5

Morgan, P. L., Farkas, G., Hillemeier, M. M., & Maczuga, S. (2017). Replicated evidence of racial and ethnic disparities in disability identification in U.S. schools. *Educational Researcher*, *46*(6), 305–322. https://doi.org/10.3102/0013189X17726282

Morgan, P. L., Hillemeier, M. M., Farkas, G., & Maczuga, S. (2014). Racial/ethnic disparities in ADHD diagnosis by kindergarten entry. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *55*(8), 905–913. https://doi.org/10.1111/jcpp.12204

Morgan, P. L., Staff, J., Hillemeier, M. M., Farkas, G., & Maczuga, S. (2013). Racial and ethnic disparities in ADHD diagnosis from kindergarten to eighth grade. *Pediatrics*, *132*(1), 85–93. https://doi.org/10.1542/peds.2012-2390

Morley, C. P. (2010). Disparities in ADHD assessment, diagnosis, and treatment. *International Journal of Psychiatry in Medicine*, *40*(4), 383–389. https://doi.org/10.2190/PM.40.4.b

Najarian, M., Tourangeau, K., Nord, C., Wallner-Allen, K., & Vaden-Kiernan, N. (2019). *Early Childhood Longitudinal Study, Kindergarten Class of 2010-2011 (ECLS-K: 2011)*, third-grade, fourth-grade, and fifth-grade psychometric report (NCES2020-123) U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics.

National Institute of Mental Health. (2019, September). *Attention-deficit/hyperactivity disorder*. https://www.nimh.nih.gov/health/topics/attention-deficit-hyperactivity-disorder-adhd/index.shtml

Odgers, C. L., & Jensen, M. R. (2020). Annual research review: Adolescent mental health in the digital age: Facts, fears, and future directions. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *61*(3), 336–348. https://doi.org/10.1111/jcpp.13190

Olaniyan, O., dosReis, S., Garriett, V., Mychailyszyn, M. P., Anixt, J., Rowe, P. C., & Cheng, T. L. (2007). Community perspectives of childhood behavioral problems and ADHD among African American parents. *Ambulatory Pediatrics*, *7*(3), 226–231. https://doi.org/10.1016/j.ambp.2007.02.002

O'Neill, S., Rajendran, K., Mahbubani, S. M., & Halperin, J. M. (2017). Preschool predictors of ADHD symptoms and impairment during childhood and adolescence. *Current Psychiatry Reports*, *19*(12), Article 95. https://doi.org/10.1007/s11920-017-0853-z

Owens, J. (2020). Relationships between an ADHD diagnosis and future school behaviors among children with mild behavioral problems. *Sociology of Education*, *93*(3), 191–214. https://doi.org/10.1177/0038040720909296

Owens, J. (2021). Parental intervention in school, academic pressure, and childhood diagnoses of ADHD. *Social Science & Medicine*, *272*, 113746. https://doi.org/10.1016/J.SOCSCIMED.2021.113746

Owens, J., & Jackson, H. (2017). Attention-deficit/hyperactivity disorder severity, diagnosis, & later academic achievement in a national sample. *Social Science Research*, *61*, 251–265. https://doi.org/10.1016/j.ssresearch.2016.06.018

Paris, J., Bhat, V., & Thombs, B. (2015). Is adult attention-deficit hyperactivity disorder being overdiagnosed? *Canadian Journal of Psychiatry*, *60*(7), 324–328. https://doi.org/10.1177/070674371506000705

Partridge, B., Lucke, J., & Hall, W. (2014). Over-diagnosed and over-treated: A survey of Australian public attitudes towards the acceptability of drug treatment for depression and ADHD. *BMC Psychiatry*, *14*(1), 1–9. https://doi.org/10.1186/1471-244X-14-74

Perrin, H. T., Heller, N. A., & Loe, I. M. (2019). School readiness in preschoolers with symptoms of attention-deficit/hyperactivity disorder. *Pediatrics*, *144*(2), e20190038. https://doi.org/10.1542/peds.2019-0038

Pottegard, A., Hallas, J., Díaz, H., & Zoëga, H. (2014). Children's relative age in class and use of medication for ADHD: A Danish nationwide study. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *55*(11), 1244–1250. https://doi.org/10.1111/jcpp.12243

Prasad, V., Brogan, E., Mulvaney, C., Grainge, M., Stanton, W., & Sayal, K. (2013). How effective are drug treatments for children with ADHD at improving on-task behaviour and academic achievement in the school classroom? A systematic review and meta-analysis. *European Child and Adolescent Psychiatry*, *22*(4), 203–216. https://doi.org/10.1007/s00787-012-0346-x

Rhinehart, L., Iyer, S., & Haager, D. (2022). Children who receive special education services for ADHD: Early indicators and evidence of disproportionate representation in the Early Childhood Longitudinal Study (ECLS-K: 2011). *Journal of Emotional and Behavioral Disorders*, *30*(1), 3–15. https://doi.org/10.1177%2F10634266211039757

Richardson, L. A. (2001). Seeking and obtaining mental health services: What do parents expect? *Archives of Psychiatric Nursing*, *15*(5), 223–231. https://doi.org/10.1053/apnu.2001.27019

Rydell, M., Lundström, S., Gillberg, C., Lichtenstein, P., & Larsson, H. (2018). Has the attention deficit hyperactivity disorder phenotype become more common in children between 2004 and 2014? Trends over 10 years from a Swedish general population sample. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *59*(8), 863–871. https://doi.org/10.1111/jcpp.12882

Scheffler, R. M., Brown, T. T., Fulton, B. D., Hinshaw, S. P., Levine, P., & Stone, S. (2009). Positive association between attention-deficit/hyperactivity disorder medication use and academic achievement during elementary school. *Pediatrics*, *123*(5), 1273–1279. https://doi.org/10.1542/peds.2008-1597

Schnittker, J. (2003). Misgivings of medicine? African Americans' skepticism of psychiatric medication. *Journal of Health and Social Behavior*, *44*(4), 506–524. https://doi.org/10.2307/1519796

Sherman, J., Rasmussen, C., & Baydala, L. (2008). The impact of teacher factors on achievement and behavioural outcomes of children with attention deficit/hyperactivity disorder (ADHD): A review of the literature. *Educational Research*, *50*(4), 347–360. https://doi.org/10.1080/00131880802499803

Simon, A. E., Pastor, P. N., Reuben, C. A., Huang, L. N., & Goldstrom, I. D. (2015). Use of mental health services by children ages six to 11 with emotional or behavioral difficulties. *Psychiatric Services*, *66*(9), 930–937. https://doi.org/10.1176/appi.ps.201400342

Simoni, Z. (2021). Social class, teachers, and medicalisation lag: A qualitative investigation of teachers' discussions of ADHD with parents and the effect of neighbourhood-level social class. *Health Sociology Review*, *30*(2), 188–203. https://doi.org/10.1080/14461242.2020.1820364

Slobodin, O., & Masalha, R. (2020). Challenges in ADHD care for ethnic minority children: A review of the current literature. *Transcultural Psychiatry*, *57*(3), 468–483. https://doi.org/10.1177/1363461520902885

Stevens, J., Harman, J. S., & Kelleher, K. J. (2005). Race/ethnicity and insurance status as factors associated with ADHD treatment patterns. *Journal of Child and Adolescent Psychopharmacology*, *15*(1), 88–96.

Tatlow-Golden, M., Prihodova, L., Gavin, B., Cullen, W., & McNicholas, F. (2016). What do general practitioners know about ADHD? Attitudes and knowledge among first-contact gatekeepers: Systematic narrative review. *BMC Family Practice*, *17*(1), 1–15. https://doi.org/10.1186/s12875-016-0516-x

Thomas, R., Sanders, S., Doust, J., Beller, E., & Glasziou, P. (2015). Prevalence of attention-deficit/hyperactivity disorder: A systematic review and meta-analysis. *Pediatrics*, *135*(4), e994–e1001. https://doi.org/10.1542/peds.2014-3482

Tourangeau, K., Nord, C., Lê, T., Wallner-Allen, K., Vaden-Kiernan, N., Blaker, L., & Najarian, M. (2019). *Early Childhood Longitudinal Study, Kindergarten Class of 2010–11 (ECLS-K: 2011) user's manual for the ECLS-K: 2011 kindergarten–fifth grade data file and electronic codebook, public version* (NCES 2019-051). U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. U.S. Department of Education.

Warikoo, N., Sinclair, S., Fei, J., & Jacoby-Senghor, D. (2016). Examining racial bias in education: A new approach. *Educational Researcher*, *45*(9), 508–514. https://doi.org/10.3102/0013189X16683408

Xu, G., Strathearn, L., Liu, B., Yang, B., & Bao, W. (2018). Twenty-year trends in diagnosed attention-deficit/hyperactivity disorder among U.S. children and adolescents, 1997-2016. *JAMA Network Open*, *1*(4), 1–9. https://doi.org/10.1001/jamanetworkopen.2018.1471

Zuckerman, K. E., Chavez, A. E., Regalado Murillo, C., Lindly, O. J., & Reeder, J. A. (2018). Disparities in familiarity with developmental disabilities among low-income parents. *Academic Pediatrics*, *18*(8), 944–951. https://doi.org/10.1016/j.acap.2018.06.011