Population-Based Estimates of Minority Children's Receipt of ADHD Diagnosis and Treatment in the U.S.

Abstract:

Our study had two purposes. First, we investigated whether U.S. schoolchildren who are racial/ethnic minorities are under-diagnosed with attention-deficit/hyperactivity disorder (ADHD). Second, we investigated whether, for those schoolchildren who received an ADHD diagnosis, whether racial/ethnic minorities are less likely to receive treatment for ADHD, as indicated by their use of prescription medication. Results indicated that schoolchildren who are Black, Hispanic, and Asian are less likely to receive an ADHD diagnosis, both prior to and after extensive statistical control. This pattern was also evident at both 5th and 8th grade. The estimates were highly similar at both time periods (OR ranges of .18 to .54 and .17 to .41, respectively). Those racial/ethnic minority schoolchildren who had received an ADHD diagnosis were also less likely to receive treatment. This pattern was again evident in both 5th and 8th grade (OR ranges of .15 to .27 and .09 to .24).

Background:

Attention-deficit/hyperactivity disorder (ADHD) is a neurobehavioral condition resulting in reduced attention, concentration, and impulse control, and increased hyperactivity (American Psychiatric Association, 2011). ADHD is the most commonly diagnosed mental health disorder in school-aged children, with about 5-10% of students receiving the diagnosis (Barkley, 2006; Bloom, Cohen, & Freeman, 2010; Loe et al., 2008; Schneider & Eisenberg, 2006). If not effectively treated, ADHD symptoms worsen over time. This becomes particularly evident once children enter middle school (DuPaul & Stone, 2003; Langberg et al., 2008; Vile Junod et al., 2006). This is because the ADHD student's inattention, lack of concentration, lower impulse control, and/or hyperactivity is more likely to be exacerbated by tasks and activities emphasizing more passive learning (e.g., listening and taking notes during mathematics or science lectures), coursework requiring greater independent study skills and organization (e.g., completing a term paper), and transitions to multiple classrooms and teachers throughout the day. As they age, students with ADHD are more likely to later drop out of school, obtain a lower-level diploma, display low academic achievement, and fail to obtain a postsecondary education (e.g., Fisher et al., 1990; Galera et al., 2009; Lee et al., 2011; Wilens et al., 2011). These students are about four and three times more likely to be depressed and attempt suicide, respectively, than peers (Chronis-Tuscano et al., 2010), and more likely to engage in substance abuse (Willens et al., 2011).

It is therefore critical that a student's ADHD be diagnosed and effectively treated, especially by middle school. Doing so should help mitigate the negative impact of the disorder, and so increase the likelihood of the student experiencing greater educational and societal opportunity. However, there is some limited evidence indicating that particular population subgroups, including racial/ethnic minorities, are less likely to receive an ADHD diagnosis and, if diagnosed, to receive treatment (Coker et al., 2009; Eiralid & Diaz, 2010; Merikangas et al., 2010; Pastor & Reuben, 2005). Causal mechanisms underlying the under-diagnosis and -treatment of particular population subgroups are poorly established, although a complex interplay of student-, family-, and school-level factors (e.g., lower parental education, lower access to health care, enrollment in lower quality schools) is thought to be responsible (Bailey et al., 2010; Schultz et al., 2011; Stone et al., 2010).

Yet whether and to what extent racial/ethnic minority schoolchildren are under-diagnosed and –treated for ADHD remains to be established. This is because the majority of studies investigating ADHD diagnosis in school-aged children have used clinic-referred samples (e.g., Mick et al., 2002a, 2002b; Milberger et al., 1996). This has recently been identified as a major

limitation of the extant work (Scriberras, Ukoumunne, & Efron, 2011). This is because clinical samples are known to over-represent boys and children with more severe ADHD symptoms, but under-represent girls, children with less severe ADHD symptoms, and racial/ethnic minorities (Brassett-Harknett & Butler, 2007). Studies using clinical samples do not address the issue of whether and to what extent these groups of students systematically vary in their rates of diagnosis and treatment for ADHD. The relatively fewer available studies that used community-based samples (e.g., Sauver et al., 2004; Schmitz et al., 2006) have relied on a limited number of socio-demographic factors. For example, Loe et al.'s (2008) longitudinal, community-based sample of 741 children with and without ADHD included only four and six children with ADHD whose mothers had less than a high school education or a college or postgraduate education, respectively. Thus, estimates of the extent to which SES increased children's risk for an ADHD diagnosis were not possible. Similarly, Biederman et al.'s analyses (2010) were based on a sample of 110 non-Hispanic, white boys, necessarily constraining estimates of the extent to which ADHD diagnosis rates varied for racial/ethnic minorities and girls. The great majority of studies have analyzed data from samples of elementary school-aged children. To what extent racial/ethnic minorities are under-diagnosed and -treated for ADHD, particularly as they transition to middle school, is unknown.

The purpose of this study was two-fold. First, we investigated whether U.S. schoolchildren who are racial/ethnic minorities are under-diagnosed with ADHD. Second, we investigated whether, for those schoolchildren who received an ADHD diagnosed, whether racial/ethnic minorities were less likely to receive treatment for ADHD, as indicated by their use of prescription medication. Medication has been established in randomized clinical trials as effective in increasing attention, concentration, impulse control and, consequently, a student's learning and classroom productivity (e.g., MTA Cooperative Group, 1999, 2004). To more rigorously investigate racial/ethnic minority children's potential under-diagnosis and –treatment, we used a population-based sample of U.S. schoolchildren, as well as extensive statistical control for a wide range of student-, family-, and school-level characteristics, including gender, age, family SES, and the student's level of academic and, when available, behavioral functioning. We investigated these potential patterns of under-diagnosis and -treatment immediately prior to and following the transition to middle school (i.e., the springs of 5th and 8th grade).

Method:

Database and analytical sample. Complete case data were analyzed from an analytical sample of children participating in the Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K). The ECLS-K is a nationally representative longitudinal survey of children, their parents, teachers, and school administrators. The data are maintained by the U.S. Department of Education, National Center for Education Statistics (NCES). Children participating in the ECLS-K began their kindergarten year in 1998. Data on these children were collected in spring 1999, fall 1999 (data were collected from only a random subset of children at this wave), spring 2000, spring 2002, spring 2004, and spring 2007.

Measures. Student's race/ethnicity was reported on during parent interviews. Five racial/ethnic groups are included. These were non-Hispanic white, black/African American, Hispanic, Asian, and a group categorized as other race/ethnicity, composed of the remaining students, including Native Hawaiians and other Pacific Islanders, American Indians, Alaskan Natives, and multiracial non-Hispanics. Student's gender was reported by his or her parent, and dummy coded with male as "1" and female as "0." Student 's age was reported by his or her parent and coded in months at the 5th and 8th grade survey waves. Mother's marital status was

reported by the parent and dummy coded as "1" for not married and "0" for married. Family's socioeconomic status (SES) was extensively surveyed, including the father's and mother's incomes and educational attainments, as well as the household's income, when the student was attending 5th and, again, 8th grade. The frequency of the student's attention and other learning-related behaviors and externalizing problem behaviors was rated by his or her 5th grade teacher, using a measure with strong psychometric properties (i.e., the *Social Rating Scale*). The student's reading and mathematics achievement was assessed in both 5th and 8th grade using individually administered and untimed measures (i.e., the *Reading and Mathematics Tests*). The *Reading Test* measured children's basic skills (e.g., print familiarity, letter recognition, decoding, sight word recognition), vocabulary (receptive vocabulary), and comprehension (e.g., making interpretations, using personal background knowledge). The *Mathematics Test* measured a range of age- and grade-appropriate mathematics skills (e.g., identify numbers and shapes, sequence, add or subtract or multiply or divide, use rates and measurements, use fractions, calculate area and volume). The school's average reading and mathematics achievement was computed using school ID. We also calculated school average approaches to learning and externalizing scores by school ID. The school percentage minority enrollment was obtained from a questionnaire administered to school principals. This variable ranged from 0 to 100 percent. Parents reported on the student's diagnosis of ADHD. Parents were asked by NCES field staff whether, using three separate questions, whether the child had been evaluated by a professional for his or her (a) "…ability to pay attention or learn?" (b) "…overall activity level?", or (c) "…behavior and relations to other children and adults?" Following a "yes" response by the student's parent to any of these questions, the field staff then asked, "Did you obtain a diagnosis of a problem by a professional?" Following a "yes" response by a student's parent, the field staff then asked, "What was the diagnosis?" Possible responses by the student's parent included ADHD, attention deficit disorder (ADD), and hyperactivity. (Field staff also offered standard definitions of these disorders if requested by the parent.) We considered students whose parents answered "yes" to each of these three types of questions (i.e., "yes" to having a problem in paying attention or learning *or* activity level *or* behavior, *and* "yes" to receiving a diagnosis, *and* "yes" to this diagnosis being for ADHD, ADD, *or* hyperactivity) as having received a diagnosis of ADHD. Prior work has established parental report as an accurate method of establishing a student's ADHD diagnosis status (e.g., Biederman et al., 1993; Bussing et al., 2003; Faraone et al., 1995). Attention-Related Medication. In 5th and 8th grade, parents of students with diagnosed ADHD were asked whether the child was currently taking prescription medication for ADD, ADHD, or hyperactivity. For example, during the 5th grade survey wave, the student's parent was asked, "In an earlier year of the study, someone in your household told us that your child has attention deficit disorder, ADHD, or hyperactivity. Is your child now taking any prescription medicine for the condition related to his or her ADD, ADHD, or hyperactivity?" If the student was reported to be taking medication, parents were asked the name of the medication(s).

Results:

Table 1 displays descriptive statistics for the analytical sample, as well as for the sub-samples of 5th and 8th grade children who received a diagnosis for ADHD. Although white children constituted 57% of the analytical sample, they constituted 75% and 77% of those who received an ADHD diagnosis. In contrast, lower percentages of Black, Hispanic, and Asian children received an ADHD diagnosis relative to their percentage of the analytical sample. However these estimates of racial/ethnic children's under-diagnosis for ADHD are unadjusted for confounding factors, including family SES and the individual level of academic and

behavioral functioning. Table 2 displays results from the multi-level logistic regression modeling of children's ADHD diagnosis by 5th grade. Prior to statistical control for confounding factors, children who are racial/ethnic minorities are less likely to receive an ADHD diagnosis than whites. These children's under-diagnosis remains evident despite increasing statistical control, including gender, teacher-rated frequency of attention and other learning-related behaviors, and mathematics achievement. Table 3 replicates these analyses for the sample of children attending 8th grade. Racial/ethnic children's under-diagnosis for ADHD is again evident prior to and following statistical control, including for gender, family SES, and reading and mathematics achievement. The estimates for racial/ethnic minority children's under-treatment for ADHD are similar for both 5th and 8th grade, despite variation in available measurement and corresponding statistical control. Table 4 displays results of multi-level logistic modeling of children's use of prescription medication for ADHD, following an ADHD diagnosis, in 5th grade. Children who are racial/ethnic minorities are less likely to be using prescription medications for ADHD. This pattern is evident prior to and following extensive statistical control, including gender, the frequency of attention and other learning-related behaviors, the frequency of externalizing problem behaviors, and mathematics achievement. Table 5 displays results of multi-level logistic modeling of children's use of prescription medication for ADHD, following an ADHD diagnosis, in 8th grade. Children who are racial/ethnic minorities are again less likely to be taking prescription medication for ADHD, both prior to and after extensive statistical control for confounding factors, including gender, SES, and reading and mathematics achievement. The estimates for this under-treatment for racial/ethnic minority children at 5th and 8th grade closely approximate one another, again despite variation in available measurement and corresponding statistical control. Collectively, these rigorously derived estimates using a population-based sample of U.S. schoolchildren and extensive statistical control indicate that racial/ethnic minority children are under-diagnosed for ADHD and, when diagnosed, under-treated for this condition.

Discussion:

Students with ADHD are more likely to drop out of school, obtain a lower-level diploma, display low academic achievement, and fail to obtain a postsecondary education (e.g., Fisher et al., 1990; Galera et al., 2009; Lee et al., 2011; Wilens et al., 2011), as well as to display socio-emotional maladjustment, depression, and greater substance abuse (Chronis-Tuscano et al., 2010; Willens et al., 2011). Diagnosing and treating a student's ADHD is therefore critical if he or she is to experience greater educational and societal opportunity. To date, however, there is only limited evidence that particular population subgroups, including racial/ethnic minorities, are less likely to be diagnosed and to receive treatment for ADHD (Coker et al., 2009; Eiralid & Diaz, 2010; Merikangas et al., 2010; Pastor & Reuben, 2005. Yet this extant work has a number of substantive and methodological limitations, including reliance on clinical- or community-samples typically assessed during the elementary school grades (DuPaul, 2007). Extensive statistical control has not been employed (Brasset-Harknett & Bulter, 2007; Loe & Feldman, 2007). Our results add to the field's very limited knowledge base. Our analyses of a population-based sample of U.S. schoolchildren indicate that racial/ethnic minorities are less likely to be diagnosed for ADHD and, if diagnosed, receive treatment for this condition. This pattern of disparity could not be explained in our analyses by a wide range of student-, family-, and school-level confounds, including variation in academic and behavioral functioning, family SES, and mean levels of academic and behavioral functioning of a school's students. This pattern of disparity was evident despite some of the control variables exerting consistently strong effects (e.g., gender). Racial/ethnic disparities were evident in both 5th and 8th grade. Our results are

unlikely to be spurious. Further investigation of the factors contributing to racial/ethnic minority children's under-diagnosis and -treatment for ADHD is clearly warranted. These disparities are starkly evident both immediately prior and following the critical middle school time period.

Table 1. Descriptive Statistics, ECLS-K Sample

	N = 11,820 Overall		*N* = 620 5th Grade, ADHD		*N* = 500 8th Grade, ADHD	
Child is White	57.0 %		74.6 %		76.8 %	
Child is Black	11.4 %		9.3 %		8.8 %	
Child is Hispanic	19.0 %		9.7 %		8.0 %	
Child is Asian	6.9 %		1.0 %		0.8 %	
Child is Other Race	5.6 %		5.4 %		5.6 %	
Child is Male	50.6 %		75.2 %		74.2 %	
Child Age at 5th Grade Wave (months)	130.86	16.10	129.9	18.8		
Child Age at 8th Grade Wave (months)	166.49	16.07			166.71	17.84
Mother Not Married, 5th Grade	26.5 %		31.5 %			
Mother Not Married, 8th Grade	25.1%				32.2 %	
Approaches to Learning, 5th Grade	3.07	0.68	2.42	0.58		
Externalizing, 5th Grade	1.64	0.58	2.10	0.68		
Reading Score, 5th Grade	150.10	26.39	140.22	27.4		
Math Score, 5th Grade	123.69	24.79	114.46	26.5		
Reading Score, 8th Grade	171.09	27.59			157.17	31.68
Math Score, 8th Grade	142.25	22.01			132.06	24.14
Takes Rx for ADHD, 5th Grade			72.4 %			
Takes Rx for ADHD, 8th Grade					63.2 %	

Table 2. Receipt of an ADHD Diagnosis by Spring of 5th Grade, ECLS-K Data (Odds Ratios).

	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*
Child is Black	0.61 ***	0.51 ***	0.38 ***	0.33 ***	0.30 ***	0.34 ***
Child is Hispanic	0.38 ***	0.32 ***	0.30 ***	0.28 ***	0.28 ***	0.30 ***
Child is Asian	0.10 ***	0.11 ***	0.17 ***	0.16 ***	0.17 ***	0.18 ***
Child is Other Race	0.73	0.65 *	0.54 **	0.50 **	0.48 **	0.54 **
Child is Male		3.17 ***	1.79 ***	1.76 ***	1.94 ***	1.94 ***
Child Age at 5th Grade Wave		1.00 *	1.00	1.00	1.00	1.00
Mother Not Married in 5th Grade		1.31 **	1.14	1.14	1.14	1.14
Lowest SES Quintile		1.72 ***	0.93	0.72	0.66 *	0.69
Second Lowest SES Quintile		1.44 **	0.97	0.84	0.79	0.82
Middle SES Quintile		1.43 **	1.04	0.93	0.89	0.91
Second Highest SES Quintile		1.17	1.01	0.96	0.96	0.98
Approaches to Learning, 5th Grade			0.26 ***	0.29 ***	0.31 ***	0.30 ***
Externalizing, 5th Grade			1.44 ***	1.45 ***	1.49 ***	1.54 ***
Reading Score, 5th Grade				0.99 ***	1.00	1.00
Math Score, 5th Grade					0.99 ***	0.99 ***
School % Minority Students						0.98
Mean School Reading Score						1.01
Mean School Math Score						1.00
Mean Approaches to Learning Score						0.93
Mean Externalizing Score						1.19

Table 3. Receipt of an ADHD Diagnosis by Spring of 8th Grade, ECLS-K Data (Odds Ratios).

	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Child is Black	0.56 ***	0.57 ***	0.36 ***	0.34 ***	0.41 ***
Child is Hispanic	0.30 ***	0.30 **	0.23 ***	0.23 ***	0.28 ***
Child is Asian	0.08 ***	0.12 ***	0.14 ***	0.15 ***	0.17 ***
Child is Other Race	0.73	0.76	0.68	0.63 *	0.72
Child is Male		3.00 ***	2.69 ***	2.94 ***	2.93 ***
Child Age at 8th Grade Wave		1.00	1.00	1.00	1.00
Mother Not Married in 8th Grade		1.45 ***	1.36 **	1.32 *	1.32 *
Lowest SES Quintile		1.50 *	0.68	0.58 **	0.65 *
Second Lowest SES Quintile		1.33	0.80	0.70 *	0.79
Middle SES Quintile		1.21	0.86	0.82	0.90
Second Highest SES Quintile		1.04	0.86	0.83	0.85
Reading Score, 8th Grade			0.98 ***	0.99 ***	0.98 ***
Math Score, 8th Grade				0.98 ***	0.98 ***
School % Minority Students					0.97
Mean School Reading Score					1.01
Mean School Math Score					1.00

Table 4. Use of Prescription Medication by Children Diagnosed with ADHD by 5th Grade, ECLS-K Data (Odds Ratios).

	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*
Child is Black	0.46 ***	0.40 ***	0.28 ***	0.24 ***	0.22 ***	0.27 ***
Child is Hispanic	0.31 ***	0.27 ***	0.25 ***	0.23 ***	0.23 ***	0.27 ***
Child is Asian	0.08 ***	0.08 ***	0.13 ***	0.13 ***	0.13 ***	0.15 ***
Child is Other Race	0.58 *	0.52 **	0.43 ***	0.39 ***	0.38 ***	0.46 **
Child is Male		3.06 ***	1.75 ***	1.73 ***	1.91 ***	1.92 ***
Child Age at 5th Grade Wave		1.00 *	1.00	1.00	1.00	1.00
Mother Not Married in 5th Grade		1.30 *	1.15	1.14	1.14	1.15
Lowest SES Quintile		1.52 *	0.88	0.75	0.67 *	0.72
Second Lowest SES Quintile		1.42 *	1.06	0.96	0.91	0.94
Middle SES Quintile		1.41 *	1.09	0.96	0.92	0.94
Second Highest SES Quintile		1.13	1.01	0.98	0.98	1.01
Approaches to Learning, 5th Grade			0.29 ***	0.32 ***	0.34 ***	0.31 ***
Externalizing, 5th Grade			1.47 ***	1.47 ***	1.51 ***	1.44 ***
Reading Score, 5th Grade				0.99 ***	1.00	1.00
Math Score, 5th Grade					0.99 ***	0.99 **
School % Minority Students						0.94
Mean School Reading Score						1.01
Mean School Math Score						0.99
Mean Approaches to Learning Score						1.28
Mean Externalizing Score						1.54

Table 5. Use of Prescription Medication by Children Diagnosed with ADHD by 8th Grade, ECLS-K Data (Odds Ratios).

	Model 1	Model 2	Model 3	Model 4	Model 5
Child is Black	0.35 ***	0.34 ***	0.22 ***	0.21 ***	0.23 ***
Child is Hispanic	0.25 ***	0.24 ***	0.21 ***	0.20 ***	0.24 ***
Child is Asian	0.04 ***	0.06 ***	0.08 ***	0.08 ***	0.09 ***
Child is Other Race	0.63 *	0.64	0.62 *	0.57 *	0.56 *
Child is Male		3.48 ***	3.12 ***	3.53 ***	3.60 ***
Child Age at 8th Grade Wave		0.99 ***	0.99 *	0.99 *	0.99
Mother Not Married in 8th Grade		1.45 **	1.35 *	1.29	1.31 *
Lowest SES Quintile		1.41	0.66	0.56 **	0.56 *
Second Lowest SES Quintile		1.20	0.72	0.61 **	0.65 *
Middle SES Quintile		0.99	0.70 *	0.67 *	0.70 *
Second Highest SES Quintile		0.79	0.66 *	0.64 **	0.61 **
Reading Score, 8th Grade			0.98 ***	0.99 ***	0.99 ***
Math Score, 8th Grade				0.98 ***	0.98 ***
School % Minority Students					0.95
Mean School Reading Score					1.01
Mean School Math Score					0.99