

Racial and Ethnic Disparities in ADHD Diagnosis From Kindergarten to Eighth Grade

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KEY WORDS

attention-deficit/hyperactivity disorder, disparities, race, ethnicity, socioeconomic status

ABBREVIATIONS

ADD—attention-deficit disorder

ADHD—attention-deficit/hyperactivity disorder

ECLS-K—Early Childhood Longitudinal Study, Kindergarten Class of 1998–1999

SES—socioeconomic status

Dr Morgan conceptualized the study research questions and design, collaborated on the analyses and their interpretation, drafted the initial manuscript, and approved the final manuscript as submitted; Dr Staff also conceptualized the study's research questions and design, conducted the study's initial analyses, reviewed and revised the manuscript for important content, and approved the final manuscript as submitted; Drs Hillemeier and Farkas collaborated in the study's research questions and design, made substantive intellectual contributions to the data analysis and interpretation, revised the manuscript for important content, and approved the final version to be published; and Mr Maczuga conducted the study's analyses with Dr Staff, revised the manuscript for important content, and approved the final version to be published.

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WHAT'S KNOWN ON THIS SUBJECT: Minority children are less likely than white children to be diagnosed and treated with attention-deficit/hyperactivity disorder. However, diagnosis patterns over time in early and middle childhood and whether confounding factors explain these disparities are not currently well understood.



WHAT THIS STUDY ADDS: Racial/ethnic disparities in attention-deficit/hyperactivity disorder diagnosis occur by kindergarten and continue until eighth grade. Racial/ethnic disparities among diagnosed children in medication use occur in both fifth and eighth grades. These disparities are not attributable to confounding factors.

abstract



OBJECTIVE: Whether and to what extent racial/ethnic disparities in attention-deficit/hyperactivity disorder (ADHD) diagnosis occur across early and middle childhood is currently unknown. We examined the over-time dynamics of race/ethnic disparities in diagnosis from kindergarten to eighth grade and disparities in treatment in fifth and eighth grade.

METHODS: Analyses of the nationally representative Early Childhood Longitudinal Study, Kindergarten Class of 1998–1999 ($N = 17\,100$) using discrete-time hazard modeling.

RESULTS: Minority children were less likely than white children to receive an ADHD diagnosis. With time-invariant and -varying confounding factors statistically controlled the odds of ADHD diagnosis for African Americans, Hispanics, and children of other races/ethnicities were 69% (95% confidence interval [CI]: 60%–76%), 50% (95% CI: 34%–62%), and 46% (95% CI: 26%–61%) lower, respectively, than for whites. Factors increasing children's risk of an ADHD diagnosis included being a boy, being raised by an older mother, being raised in an English-speaking household, and engaging in externalizing problem behaviors. Factors decreasing children's risk of an ADHD diagnosis included engaging in learning-related behaviors (eg, being attentive), displaying greater academic achievement, and not having health insurance. Among children diagnosed with ADHD, racial/ethnic minorities were less likely than whites to be taking prescription medication for the disorder.

CONCLUSIONS: Racial/ethnic disparities in ADHD diagnosis occur by kindergarten and continue until at least the end of eighth grade. Measured confounding factors do not explain racial/ethnic disparities in ADHD diagnosis and treatment. Culturally sensitive monitoring should be intensified to ensure that all children are appropriately screened, diagnosed, and treated for ADHD. *Pediatrics* 2013;132:85–93

Attention-deficit/hyperactivity disorder (ADHD) is the most commonly diagnosed mental health disorder in US children.^{1–3} An ADHD diagnosis allows eligible children to receive specialized, adaptive educational programming in school, as well as medication that can help mitigate the disorder's negative impact on learning and behavior.^{4–6} Yet, not all groups of children are equally likely to be diagnosed and receive treatment. Racial/ethnic minorities in particular have been reported to be diagnosed with ADHD at lower rates than white children,⁷ and therefore may have unmet treatment needs.⁸ Children who are African American are diagnosed with ADHD at only two-thirds the rate of white children despite displaying greater ADHD symptomatology,⁹ and Hispanic children have also been reported to be underdiagnosed.¹ Less is known about diagnosis disparities for children of other races/ethnicities.⁹ In addition, racial/ethnic minorities who are diagnosed with ADHD have been reported to be less likely to use prescription medication.^{2,10} Hypothesized mechanisms for ADHD diagnosis and treatment disparities include less frequent access to health professionals and service utilization^{11–14} and, when seen, less frequent solicitation by professionals of developmental concerns.¹⁵ Additional hypothesized mechanisms include a lower likelihood of referral by school professionals, limited ability to pay for health care, and negative attitudes toward disability identification and treatment in some racial/ethnic subcultures.^{16,17}

Research investigating ADHD diagnosis and treatment has typically used cross-sectional designs or convenience samples^{2,18} or focused on limited time frames.⁷ The onset and over-time dynamics of racial/ethnic disparities in ADHD diagnosis throughout early and middle childhood are unknown. Yet, early diagnosis and treatment are

important because ADHD symptomatology persists by early childhood.^{19–21} In addition, the extent to which other factors confound reported racial/ethnic disparities in ADHD diagnosis and treatment is unclear. Minority children are more likely to be exposed to risk markers for ADHD, including low birth weight, low maternal education, low household income, greater frequency of classroom problem behaviors, and lower academic achievement.^{1,22–24} The inclusion of confounding factors is therefore necessary to obtain estimates uniquely attributable to children's status as racial/ethnic minorities. Identifying risks attributable to these confounding factors should also inform efforts to target ADHD screening, diagnostic, and treatment practices, as well as to clarify potential causes of reported racial/ethnic disparities. Identification and treatment at ages when ADHD symptomatology is still newly emergent, and so more amenable to adaptive services and treatment, should help maximize their effectiveness.

The objective of this study was to investigate the onset and over-time dynamics of race/ethnic disparities in ADHD diagnosis across early and middle childhood in the United States. We extend previous work by modeling these disparities over children's early life course rather than only at a particular time point, by extensively adjusting for plausible confounding factors (eg, lower socioeconomic status [SES] and lower behavioral and academic functioning), and by analyzing a nationally representative cohort of US schoolchildren (ie, the Early Childhood Longitudinal Study, Kindergarten Class of 1998–1999 [ECLS-K]). Our longitudinal modeling of ADHD diagnosis in the United States capitalizes on the richness of the ECLS-K data set, which includes the timing of ADHD diagnosis as well as detailed information

about family sociodemographic characteristics and other potential confounders. We also use this detailed information to examine racial/ethnic disparities in prescription medication use.

METHODS

Sample Description

The ECLS-K is a nationally representative cohort of US children who entered kindergarten in the fall of 1998. This database is maintained by the National Center for Education Statistics (<http://nces.ed.gov/ecls/kindergarten.asp>). Data were subsequently collected from children, parents, and teachers in spring of 1999, fall of 1999, spring of 2000, spring of 2002, spring of 2004, and spring of 2007. Our initial analytical sample consisted of 17 100 kindergarten children with information on race/ethnicity and who were (1) followed until eighth grade and had not been diagnosed with ADHD before that time point or (2) censored from the study either because they were diagnosed with ADHD before eighth grade or their data were missing before this time point. We used this sample in our initial (ie, model 1) analysis, which included only race/ethnicity and time as predictors of an ADHD diagnosis. Our second analysis (model 2) included additional child- and family-level predictors measured in kindergarten, as well as time-varying measures of children's behavioral and academic functioning. Missing data on these variables reduced the analytical sample size to 15 100. Table 1 shows the means of the criterion and predictor variables for each of these analyses. The similarities of these distributions across the analytical samples suggest that sample attrition had relatively little effect on our estimates. Additional detail regarding the ECLS-K's study design is available from the National Center for Education Statistics.²⁵

TABLE 1 Descriptive Statistics

	Analytical Sample	
	Model 1	Model 2
Ever diagnosed with ADHD, %	6.61	6.80
Race/ethnicity, %		
White	57.34	59.63
Hispanic	19.32	18.66
African American	15.73	14.74
Other	7.61	6.97
Male, %	—	51.17
Child age, mean (SD), mo	—	68.46 (4.39)
Mother not married, %	—	30.69
Low birth weight, %	—	4.00
Younger mother, %	—	5.64
Older mother, %	—	4.22
SES, %		
Lowest SES quintile	—	17.99
Second lowest SES quintile	—	19.55
Middle SES quintile	—	20.67
Second highest SES quintile	—	20.68
Highest SES quintile	—	21.10
Region, %		
Northeast	—	18.17
Midwest	—	23.82
South	—	35.62
West	—	22.40
No health insurance, %	—	9.20
English is language of interview, %	—	92.37
Time-varying predictors		
Externalizing problem behaviors, z score	—	0 (1.00)
Learning-related behaviors, z score	—	0 (1.00)
Academic achievement, z score average	—	0 (1.00)
<i>n</i>	17 100	15 100

Data are weighted. Rounded sample sizes are in accordance with National Center for Education Statistics reporting requirements for participant confidentiality. — = N/A. z score = score in standard deviation units on a normalized distribution.

We obtained Penn State institutional review board approval for the study.

Variables of Interest

ADHD Diagnosis

We identified children as diagnosed with ADHD if they were reported by their parent in kindergarten, first, third, fifth, or eighth grade as having received a formal diagnosis of attention-deficit disorder (ADD), ADHD, or hyperactivity. Specifically, we identified children as

having an ADHD diagnosis on the basis of a parent's response of "yes" to each of 3 separate survey questions (ie, "yes" to the child being evaluated by a professional in response to a problem in paying attention, learning, behaving, or in activity level; "yes" to receiving a diagnosis by this professional; and "yes" to the diagnosis being for ADHD, ADD, or hyperactivity). Although medical record documentation of the presence or absence of ADHD is preferable, parents have been repeatedly found to be valid and reliable reporters of ADHD diagnosis, symptoms, and receipt of treatment.^{26–31} Supplementary analyses (not shown but available from the study's first author) of special education teacher—rather than parent-reported ADHD diagnosis were consistent with this study's findings. Table 1 shows weighted descriptive statistics for the analytical samples we used. In the first and largest of these analytical samples, 6.6% of the students reportedly received a diagnosis of ADHD by the eighth grade.

Time-Invariant Measures

Parents reported child gender and race/ethnicity. The sample contained approximately equal proportions of males and females (see Table 1). Racial/ethnic categories included Hispanic (~19%), non-Hispanic African American (16%), non-Hispanic white (57%), and other races/ethnicities (including Asian, Native Hawaiian, Pacific Islander, American Indian, and Alaskan Native and those described as being more than 1 race).

The child's and mother's ages at the date of interview in the spring of kindergarten were recorded and used to calculate the mother's age at time of birth. If the child's mother was ≤ 17 years of age at her child's birth, she was classified as being a younger mother (~6%). If the mother was ≥ 39 years old, she was classified as an

older mother (4%). Parents reported whether the child was born with low birth weight (4% of children weighed < 5 lb)³² and whether health insurance was available for the child (9% of children did not have health insurance). Whether the interview was conducted in English (~92% of the sample) was used as a measure of whether the parents spoke English. ECLS-K staff combined reports of the mother's and father's education and occupation, along with family income, to create a scale measuring the family's SES. Dummy variables for SES quintiles were used in our analyses. Time-invariant data were collected in the spring of kindergarten.

Time-Varying Measures

General education teachers in kindergarten, first, third, and fifth grades independently rated the frequency of children's externalizing and learning-related behaviors by using the Social Rating Scale, a psychometrically validated behavioral measure. The Externalizing Problem Behaviors subscale items measure acting-out behaviors (eg, argues with a teacher, fights, shows anger, acts impulsively, disturbs the classroom). The scale's reliabilities at each wave ranged from 0.86 to 0.89. The Approaches to Learning subscale items measure learning-related behaviors (ie, pays attention, keeps belongings organized, works independently, shows eagerness to learn new things, easily adapts to changes in routine, and persists in completing tasks). This scale's reliabilities ranged from 0.89 to 0.91. We used the average if 2 teachers provided ratings of the student in a given year. These survey items were not collected in the eighth grade, so we estimated children's eighth grade behavioral functioning by using ratings obtained from the previous (ie, fifth grade) survey wave.

Children's academic achievement was estimated by using the average of their scores from the ECLS-K's Reading and Mathematics Tests during each survey wave. These individually administered and untimed achievement tests were psychometrically validated. Both measures use item-response theory and routing procedures to maximize academic content coverage and to derive scale scores that are comparable across different grade levels (reliabilities ranged from 0.87 to 0.96). All time-varying measures were standardized.

Prescription Medication Use

In the fifth- and eighth-grade surveys, parents were asked whether their child was currently taking any prescription medication (eg, methylphenidate, amphetamine, atomoxetine) related to ADD, ADHD, or hyperactivity. We conducted supplementary analyses investigating whether and to what extent racial/ethnic minority children diagnosed with ADHD in the fifth grade were also less likely to be taking medication for the disorder in the fifth and eighth grade. "Yes" or "no" responses were coded as 1 or 0, respectively. Approximately 650 of 780 children with an ADHD diagnosis were identified by their parents as using prescription medication for ADHD in the fifth grade.

Analytic Method

We used discrete-time logit (hazard) models for event history analysis³³ to identify factors predictive of the timing of ADHD diagnosis from kindergarten to eighth grade by using the program "dthaz" in Stata version SE 12.1 (Stata-Corp, College Station, TX). These models are advantageous over analyses predicting ADHD diagnosis at a particular time point because they situate the diagnoses in time, appropriately handle the censoring of children who are lost to attrition or who were not diagnosed

with ADHD by the end of the observation period, and allow for time-varying covariates (eg, externalizing problem behaviors, learning-related behaviors, academic achievement). Hazard models have been used to investigate racial/ethnic disparities in conditions and disorders other than ADHD.^{34–36} We also used logistic regression modeling to estimate racial/ethnic disparities in prescription medication use. Table 3 shows these estimates, without and with adjustment for confounding factors.

RESULTS

Table 2 shows weighted estimates from the discrete-time logit modeling of children's ADHD diagnosis from kindergarten to eighth grade. Model 1 included race/ethnicity and time as predictors. From kindergarten to eighth grade, children from each racial/ethnic minority group were significantly less likely to receive an ADHD diagnosis than whites. Compared with white children, Hispanic children had odds that were 56% (1–0.44) lower of being

TABLE 2 Discrete-Time Logistic Regression Models (Adjusted Odds Ratios) of ADHD Diagnosis

	Model 1	Model 2
Race/ethnicity (versus white)		
Hispanic	0.44*** (0.35–0.54)	0.50*** (0.38–0.66)
African American	0.64*** (0.53–0.78]	0.31*** (0.24–0.40)
Other	0.52*** (0.39–0.69)	0.54*** (0.39–0.74)
Male	—	1.98*** (1.68–2.33)
Child's age	—	1.14*** (1.07–1.23)
Mother not married (versus mother married)	—	1.12 (0.94–1.34)
Low birth weight (versus not low birth weight)	—	1.15 (0.84–1.57)
Younger mother (versus mother's age 18–38 y)	—	1.04 (0.76–1.42)
Older mother (versus mother's age 18–38 y)	—	1.65*** (1.26–2.15)
SES (versus highest SES quintile)		
Lowest SES quintile	—	0.79 (0.61–1.03)
Second lowest SES quintile	—	0.84 (0.66–1.06)
Middle SES quintile	—	0.80 (0.64–1.01)
Second highest SES quintile	—	0.84 (0.68–1.05)
Region (versus Midwest)		
Northeast	—	0.97 (0.78–1.19)
South	—	1.16 (0.97–1.39)
West	—	0.71** (0.56–0.90)
No health insurance (versus have health insurance)	—	0.67** (0.50–0.91)
English is language of interview (versus other)	—	1.86* (1.12–3.10)
Time-varying predictors		
Externalizing problem behaviors (z score)	—	1.46*** (1.37–1.55)
Learning-related behaviors (z score)	—	0.59*** (0.54–0.65)
Academic achievement (z score average)	—	0.70*** (0.64–0.77)
Grade level (versus spring of kindergarten)		
Spring of first grade	1.06 (0.87–1.29)	1.16 (0.94–1.44)
Spring of third grade	1.17 (0.97–1.42)	1.40*** (1.14–1.72)
Spring of fifth grade	0.97 (0.79–1.19)	1.20 (0.96–1.48)
Spring of eighth grade	0.50*** (0.39–0.64)	0.63*** (0.49–0.82)
<i>n</i>	17 100 (83 040 person-years)	15 100 (73 280 person years)

Data are weighted odds ratios (95% confidence interval). Rounded sample sizes are in accordance with National Center for Education Statistics reporting requirements for participant confidentiality. **P* < .05; ***P* < .01; ****P* < .001. —, not applicable. z score indicates score in standard deviation units on a normalized distribution.

diagnosed with ADHD. The odds for African Americans and children of other race/ethnicities were 36% (1–0.64) and 48% (1–0.52) lower than whites, respectively. The time point–specific odds of being diagnosed with ADHD peaked at third grade and declined subsequently.

Model 2 added a number of time-invariant and time-varying controls to the regression equation. Lower odds of ADHD diagnosis among racial/ethnic minority children remained evident in model 2 despite inclusion of potential confounding variables. African American and Hispanic children and those of other races/ethnicities were 69% (1–0.31), 50% (1–0.50), and 46% (1–0.54) less likely than white children, respectively, to be diagnosed with ADHD. Model 2 also indicated that boys had twice the odds of girls of being diagnosed with ADHD (differences by race/ethnicity were similar for boys and girls; results not shown). More frequent externalizing behaviors increased this risk.

In contrast, more frequent learning-related behaviors and greater academic achievement decreased this risk. Children whose mothers were older than age 38 at the child's birth were more likely to receive an ADHD diagnosis, as were children who had access to health care or those raised by English-speaking parents. Those from the western United States were less likely to be diagnosed than those from the Midwest.

These results show that with the most extensive control variables, including time-varying factors relating to behavioral risk indicators of ADHD and to academic achievement, children who are African American, Hispanic, and of other race/ethnic groups are much less likely than children who are white to receive an ADHD diagnosis in the United States across early and middle childhood. To further assess the robustness of these results, in additional models (not shown) we included additional time-varying variables of teacher's race and age, as well as school-level

characteristics (eg, the percentages of racial/ethnic minority students and those receiving free or reduced lunch attending the school). These variables were excluded in the final reported models because they were not, in general, statistically significant predictors and their inclusion in the prediction equation did not change our substantive findings. (Inclusion of these variables also reduced the sample size because of missing values.)

Figures 1 and 2 use model 2's results to derive time-specific probabilities of ADHD diagnosis by race/ethnicity. The over-time hazard of ADHD diagnosis (Fig 1) increased through third grade and declined thereafter. This hazard (ie, the instantaneous probability of diagnosis) in kindergarten, first grade, third grade, fifth grade, and eighth grade was highest for white children, holding the other variables in Table 2's model 2 constant at their means. These same probabilities of diagnosis were lower for Hispanics, and children of

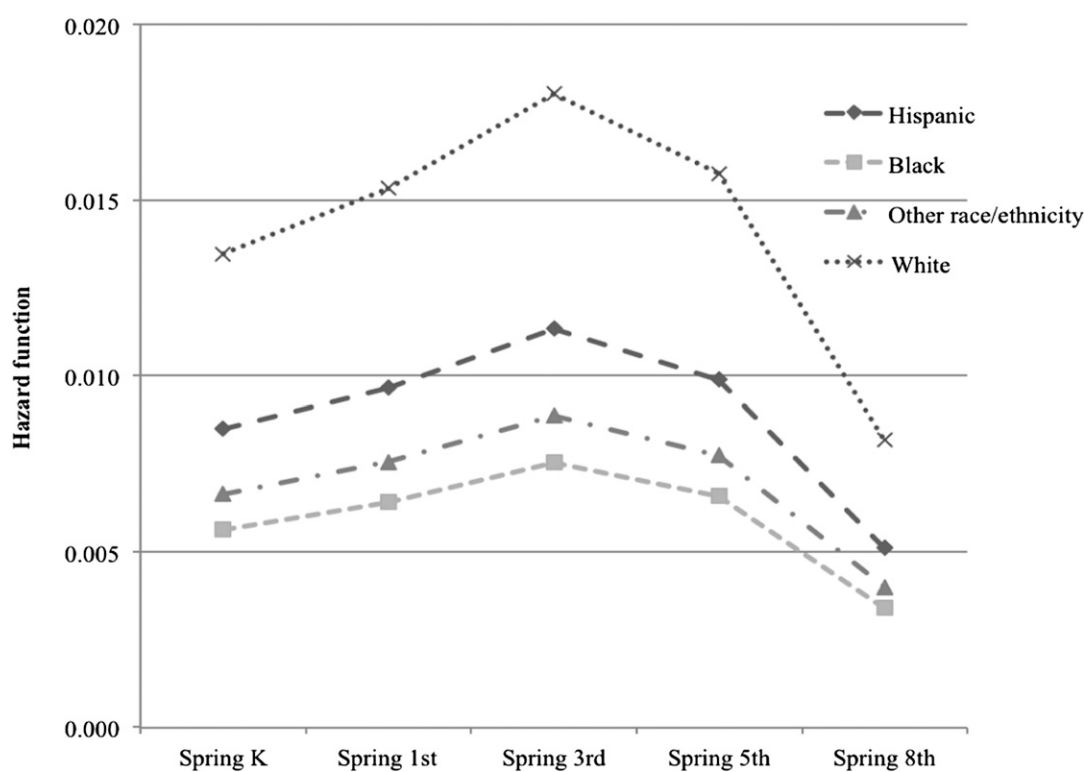


FIGURE 1

Plot of the hazard function of ADHD diagnosis by race/ethnicity. K, kindergarten; 1st, first grade; 5th, fifth grade; 8th, eighth grade.

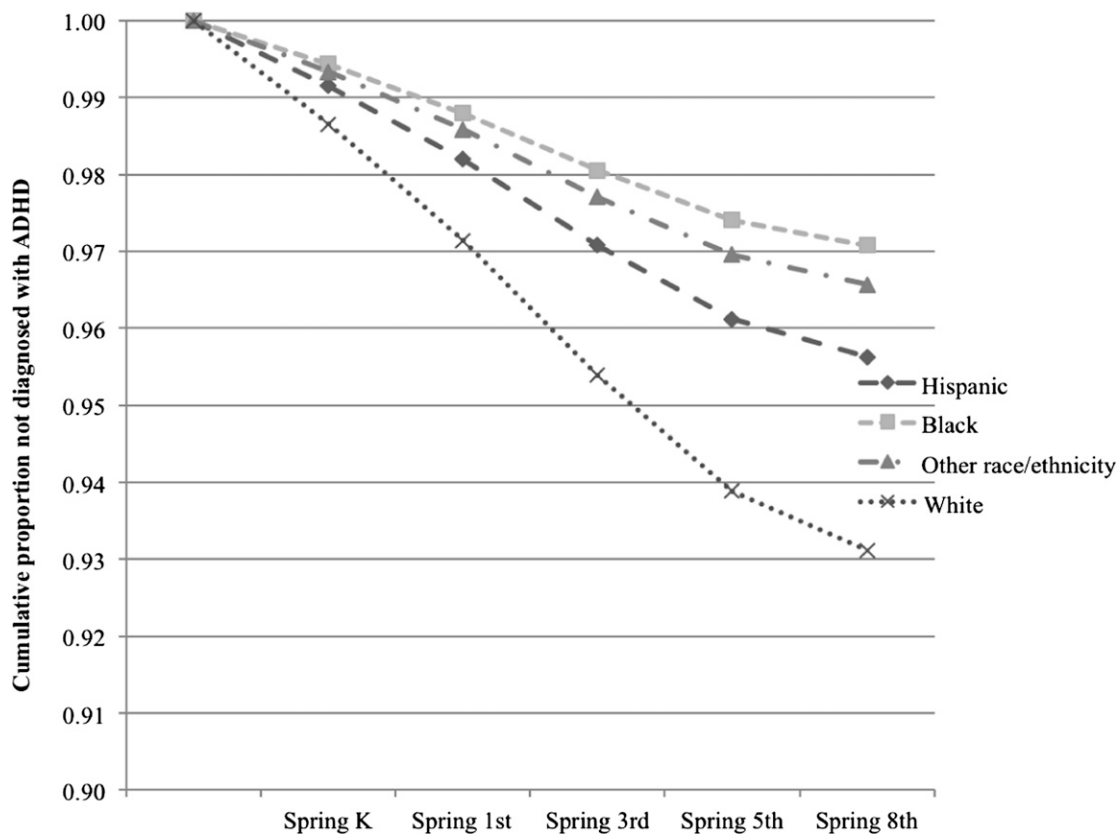


FIGURE 2

Plot of the survival function of ADHD diagnosis by race/ethnicity. K, kindergarten; 1st, first grade; 5th, fifth grade; 8th, eighth grade.

other races/ethnicities, and lowest for African Americans. Figure 2 shows the survival function, or the cumulative proportion of children not diagnosed with ADHD, at each survey wave by race/ethnicity, again holding model 2's other variables constant at their sample means. By the spring of eighth grade, ~7% of white children received an ADHD diagnosis sometime between kindergarten and eighth grade. The comparable rates for African American, Hispanics, and children of other races/ethnicities were ~3%, 4.4%, and 3.5%, respectively.

Table 3 shows logistic regression (odds ratios) estimates of racial/ethnic disparities in prescription medication use among children diagnosed with ADHD in the fifth grade. The odds ratios shown in model 1 were unadjusted, whereas model 2 included a full set of controls. Before and after covariate

TABLE 3 Race/Ethnicity Odds Ratios from Logistic Regression Models of Prescription Medication Use for ADHD in the Fifth or Eighth Grade in Children Diagnosed With ADHD in the Fifth Grade

Race/Ethnicity (Versus White)	Model 1	Model 2
Hispanic	0.36*** (0.22–0.58)	0.53* (0.29–0.98)
African American	0.35*** (0.22–0.57)	0.35*** (0.19–0.62)
Other	0.42** (0.23–0.76)	0.49* (0.26–0.95)

Data are weighted odds ratios (95% confidence interval). Sample size = 780; rounded sample sizes are in accordance with National Center for Education Statistics reporting requirements for participant confidentiality. Model 1 does not include additional control variables. Model 2 includes controls for child's gender, age, and birth weight; mother's marital status and age at birth of child; SES quintiles; region; health insurance coverage; language spoken at home; externalizing problem behaviors; learning-related behaviors; and academic achievement. * $P < .05$; ** $P < .01$; *** $P < .001$.

adjustment, Hispanic, African American, and children of other races/ethnicities diagnosed with ADHD were much less likely to be using medication than white children diagnosed with ADHD. This disparity occurred in both the fifth and eighth grades.

DISCUSSION

We investigated racial/ethnic disparities in ADHD diagnosis in a large, nationally representative cohort of

schoolchildren as they attended kindergarten to eighth grade. Results indicated that racial/ethnic minority children are much less likely than otherwise identical white children to receive an ADHD diagnosis. Children at lower risk include those displaying greater academic achievement, those with more frequent learning-related classroom behaviors, and those without health insurance. Boys, children frequently engaging in externalizing

problem behaviors, and those raised by an older mother are more likely to receive a diagnosis of ADHD. Being raised by an English-speaking parent also increased the likelihood of diagnosis. In addition, and again after extensive statistical control, children diagnosed with ADHD were much less likely to use prescription medication for the disorder if they were Hispanic, African American, or of other races/ethnicities.

Previous research has reported racial/ethnic disparities in ADHD diagnosis and treatment, particularly for African Americans.⁹ However, whether and to what extent these disparities also occur among Hispanics and children of other races/ethnicities has not been systematically examined.^{37,38} Our study extends previous work by establishing that children who are African-American, Hispanic, or of other races/ethnicities are less likely than whites to be diagnosed with ADHD. These racial/ethnic disparities in ADHD diagnosis occur as early as kindergarten and continue at least until the end of middle school. Racial/ethnic minorities are also less likely to be using medication to treat the disorder by the end of elementary and middle school. These racial/ethnic disparities are not attributable to many potential confounding factors that also strongly predict children's receipt of an ADHD diagnosis or medication use.

Our analyses relied on multi-item parent response to identify children as being diagnosed with ADHD. Although previous work has repeatedly found that parents are valid and reliable

reporters of their children's ADHD symptomology, diagnosis, and treatment response,^{26–31} and has relied on the same type of parent survey items used here,⁷ we were unable to independently verify to what extent children identified by their parents also met formal ADHD diagnostic criteria. Although we controlled for many potential confounding factors, including changing levels of behavioral functioning and academic achievement, it is possible that unmeasured variables may have contributed to the lower risk we attribute to children's status as racial/ethnic minorities. Our study analyzed a single cohort of children, whose experiences (eg, health insurance coverage) may have resulted from period-specific events and conditions. Consistent with previous work,^{7,9,13} we interpreted the directionality of the disparities as indicating underdiagnosis for racial/ethnic minorities. Another possibility is that children who are white are comparatively overdiagnosed. Additional research is needed to determine the extent to which such under- and overdiagnosis occurs. Our study examines over-time diagnosis until the end of eighth grade, which constituted the final survey wave of the ECLS-K. We may have observed other diagnosis patterns had the ECLS-K's data collection continued into high school.

Our study provides clinic- and school-based professionals with risk estimates that are more rigorously derived than those currently available, particularly regarding over-time diagnosis rates for ADHD. Underdiagnosis for African Americans, Hispanics, and

children of other races/ethnicities may occur because clinicians are disproportionately responsive to white parents who are more likely to solicit ADHD diagnosis and treatment of their children.^{39,40} Clinical practice and policy may need to be redirected to ensure that children from minority families are appropriately evaluated, diagnosed, and treated for ADHD.

Our study should inform efforts to reduce racial/ethnic disparities in ADHD diagnosis and pharmacologic treatment. We found that disparities in ADHD diagnosis and treatment occur for children who are Hispanic and of other races/ethnicities as well as for African Americans. To date, clinicians and policy-makers have had very little information about disparities in diagnoses and treatment of non-African American minority groups. Medical and school-based professionals should ensure that their efforts to reduce racial/ethnic disparities in ADHD diagnosis and treatment also extend to groups other than African Americans. Our findings provide additional support to calls for increasing solicitations by pediatricians, school psychologists, teachers, and other clinicians of concerns by minority parents for their children's learning and behavior,^{15,41} ensuring sensitivity to differing cultural values about disability during well-child visits and referrals,⁴² and encouraging symptom recognition and help-seeking behaviors by these parents,⁴³ and suggest that these efforts by clinicians should be made throughout minority children's early life course.⁴⁴

REFERENCES

1. Froehlich TE, Lanphear BP, Epstein JN, Barbaresi WJ, Katusic SK, Kahn RS. Prevalence, recognition, and treatment of attention-deficit/hyperactivity disorder in a national sample of US children. *Arch Pediatr Adolesc Med.* 2007;161(9):857–864
2. Pastor PN, Reuben CA. Racial and ethnic differences in ADHD and LD in young school-age children: parental reports in the National Health Interview Survey. *Public Health Rep.* 2005;120(4):383–392
3. Sciotto MJ, Eisenberg M. Evaluating the evidence for and against the overdiagnosis of ADHD. *J Atten Disord.* 2007;11(2):106–113

4. The MTA Cooperative Group. A 14-month randomized clinical trial of treatment strategies for attention-deficit/hyperactivity disorder. *Arch Gen Psychiatry*. 1999;56(12):1073–1086
5. Powers RL, Marks DJ, Miller CJ, Newcorn JH, Halperin JM. Stimulant treatment in children with attention-deficit/hyperactivity disorder moderates adolescent academic outcome. *J Child Adolesc Psychopharmacol*. 2008;18(5):449–459
6. US Department of Education, Office of Special Education and Rehabilitative Services, Office of Special Education Programs. *Identifying and Treating Attention Deficit Hyperactivity Disorder: A Resource for School and Home*. Washington, DC: US Department of Education; 2008
7. Schneider H, Eisenberg D. Who receives a diagnosis of attention-deficit/hyperactivity disorder in the United States elementary school population? *Pediatrics*. 2006;117(4). Available at: www.pediatrics.org/cgi/content/full/117/4/e601
8. Mehta S, Nagar S, Aparasu R. Unmet prescription medication need in U.S. children. *J Am Pharm Assoc*. 2009;49(6):769–776
9. Miller TW, Nigg JT, Miller RL. Attention deficit hyperactivity disorder in African American children: what can be concluded from the past ten years? *Clin Psychol Rev*. 2009;29(1):77–86
10. Zuvekas SH, Vitiello B. Stimulant medication use in children: a 12-year perspective. *Am J Psychiatry*. 2012;169(2):160–166
11. Coker TR, Elliott MN, Kataoka S, et al. Racial/ethnic disparities in the mental health care utilization of fifth grade children. *Acad Pediatr*. 2009;9(2):89–96
12. Flores G, Tomany-Korman SC. Racial and ethnic disparities in medical and dental health, access to care, and use of services in US children. *Pediatrics*. 2008;121(2). Available at: www.pediatrics.org/cgi/content/full/121/2/e286
13. Flores G, Olson L, Tomany-Korman SC. Racial and ethnic disparities in early childhood health and health care. *Pediatrics*. 2005;115(2). Available at: www.pediatrics.org/cgi/content/full/115/2/e183
14. Berger-Jenkins E, McKay M, Newcorn J, Bannon W, Laraque D. Parent medication concerns predict underutilization of mental health services for minority children with ADHD. *Clin Pediatr (Phila)*. 2012;51(1):65–76
15. Guerrero AD, Rodriguez MA, Flores G. Disparities in provider elicitation of parents' developmental concerns for US children. *Pediatrics*. 2011;128(5):901–909
16. Olaniyan O, dosReis S, Garriett V, et al. Community perspectives of childhood behavioral problems and ADHD among African American parents. *Ambul Pediatr*. 2007;7(3):226–231
17. Hervey-Jumper H, Douyon K, Falcone T, Franco KN. Identifying, evaluating, diagnosing, and treating ADHD in minority youth. *J Atten Disord*. 2008;11(5):522–528
18. Cuffe SP, Moore CG, McKeown RE. Prevalence and correlates of ADHD symptoms in the national health interview survey. *J Atten Disord*. 2005;9(2):392–401
19. Campbell SB, Breaux AM, Ewing LJ, Szumowski EK. Correlates and predictors of hyperactivity and aggression: a longitudinal study of parent-referred problem preschoolers. *J Abnorm Child Psychol*. 1986;14(2):217–234
20. Daley D, Jones K, Hutchings J, Thompson M. Attention deficit hyperactivity disorder in pre-school children: current findings, recommended interventions and future directions. *Child Care Health Dev*. 2009;35(6):754–766
21. Lahey BB, Pelham WE, Loney J, et al. Three-year predictive validity of DSM-IV attention deficit hyperactivity disorder in children diagnosed at 4-6 years of age. *Am J Psychiatry*. 2004;161(11):2014–2020
22. Claycomb CD, Ryan JJ, Miller LJ, Schnakenberg-Ott SD. Relationships among attention deficit hyperactivity disorder, induced labor, and selected physiological and demographic variables. *J Clin Psychol*. 2004;60(6):689–693
23. Basch CE. Inattention and hyperactivity and the achievement gap among urban minority youth. *J Sch Health*. 2011;81(10):641–649
24. US Census Bureau. Income, expenditures, poverty, & wealth, table 712. The 2012 Statistical Abstract. 2012. Available at: www.census.gov/compendia/statab/cats/income_expenditures_poverty_wealth.html. Accessed April 8, 2013
25. Tourangeau K, Nord C, Le T, Sorongon A, Najarian M. *Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K), combined user's manual for the ECLS-K eighth-grade and K-8 full sample data files and electronic codebooks (NCES 2009-004)*. Washington, DC: US Department of Education; 2009
26. Biederman J, Faraone SV, Milberger S, Doyle A. Diagnoses of attention-deficit hyperactivity disorder from parent reports predict diagnoses based on teacher reports. *J Am Acad Child Adolesc Psychiatry*. 1993;32(2):315–317
27. Biederman J, Gao H, Rogers AK, Spencer TJ. Comparison of parent and teacher reports of attention-deficit/hyperactivity disorder symptoms from two placebo-controlled studies of atomoxetine in children. *Biol Psychiatry*. 2006;60(10):1106–1110
28. Biederman J, Faraone SV, Monuteaux MC, Grossbard JR. How informative are parent reports of attention-deficit/hyperactivity disorder symptoms for assessing outcome in clinical trials of long-acting treatments? A pooled analysis of parents' and teachers' reports. *Pediatrics*. 2004;113(6):1667–1671
29. Bussing R, Mason DM, Leon CE, Sinha K. Agreement between CASA parent reports and provider records of children's ADHD services. *J Behav Health Serv Res*. 2003;30(4):462–469
30. Faraone SV, Biederman J, Zimmerman B. Correspondence of parent and teacher reports in medication trials. *Eur Child Adolesc Psychiatry*. 2005;14(1):20–27
31. Faraone SV, Biederman J, Milberger S. How reliable are maternal reports of their children's psychopathology? One-year recall of psychiatric diagnoses of ADHD children. *J Am Acad Child Adolesc Psychiatry*. 1995;34(8):1001–1008
32. National Center for Educational Statistics. Early Childhood Longitudinal Study, kindergarten cohort: psychometric reports. Available at: <http://nces.ed.gov/pubsearch/getpubcats.asp?sid=0242009>. Accessed March 8, 2013
33. Allison P. *Survival Analysis Using SAS: A Practical Guide*. Cary, NC: SAS Institute; 1995
34. Arnold M, Hsu L, Pipkin S, McFarland W, Rutherford GW. Race, place and AIDS: the role of socioeconomic context on racial disparities in treatment and survival in San Francisco. *Soc Sci Med*. 2009;69(1):121–128
35. Dunlop DD, Song J, Manheim LM, Daviglius ML, Chang RW. Racial/ethnic differences in the development of disability among older adults. *Am J Public Health*. 2007;97(12):2209–2215
36. Nembhard WN, Salemi JL, Ethen MK, Fixler DE, Dimaggio A, Canfield MA. Racial/ethnic disparities in risk of early childhood mortality among children with congenital heart defects. *Pediatrics*. 2011;127(5). Available at: www.pediatrics.org/cgi/content/full/127/5/e1128
37. Bird HR, Shrout PE, Duarte CS, Shen S, Bauermeister JJ, Canino G. Longitudinal mental health service and medication use for ADHD among Puerto Rican youth in two contexts. *J Am Acad Child Adolesc Psychiatry*. 2008;47(8):879–889
38. Leslie LK, Lambros KM, Aarons GA, Haine RA, Hough RL. School-based service use by youth with ADHD in public-sector settings. *J Emot Behav Disord*. 2008;16(3):163–177

39. Leslie LK, Plemmons D, Monn AR, Palinkas LA. Investigating ADHD treatment trajectories: listening to families' stories about medication use. *J Dev Behav Pediatr*. 2007; 28(3):179–188
40. Bussing R, Koro-Ljungberg ME, Gary F, Mason DM, Garvan CW. Exploring help-seeking for ADHD symptoms: a mixed-methods approach. *Harv Rev Psychiatry*. 2005;13(2):85–101
41. Sayal K, Goodman R, Ford T. Barriers to the identification of children with attention deficit/hyperactivity disorder. *J Child Psychol Psychiatry*. 2006;47(7): 744–750
42. Brotanek JM, Seeley CE, Flores G. The importance of cultural competency in general pediatrics. *Curr Opin Pediatr*. 2008;20(6): 711–718
43. Eiraldi RB, Mazzuca LB, Clarke AT, Power TJ. Service utilization among ethnic minority children with ADHD: a model of help-seeking behavior. *Adm Policy Ment Health*. 2006;33(5):607–622
44. DuPaul GJ, Carlson JS. Child psychopharmacology: how school psychologists can contribute to effective outcomes. *Sch Psychol Q*. 2005;20(2):206–221

SNAILS OF UNUSUAL SIZE: Florida is home to several exotic or unique species of animals. Unfortunately, many are not indigenous to the state. The Burmese python population has exploded and decimated local populations of small- and medium-sized mammals. Now, a new threat has emerged. As reported on CNN (U.S., April 15, 2013), the giant African land snail population is rapidly expanding. Many of us are quite familiar with snails. While somewhat slimy and often pests in the garden, they do not cause too much damage. However, the African land snails are different. For one, they are huge. They can grow up to 18 centimeters in length. They also have a voracious appetite. While differences exist between the eastern and western African species, both can be pests and devastate ground cover and crops. Furthermore, the giant land snails found in Florida have sharp spines on their shells that can puncture car tires. Fortunately, while the snails can carry a parasite called rat lungworm, no human cases in Florida have been reported to date. How the snails were introduced into Florida is not known, but most likely they were bought (illegally) as pets and then released, or were accidental stowaways in luggage. Once released, the snails multiply rapidly. Snails produce 1200 eggs each year, reach adulthood in a year, and live up to nine years. Since discovery of the snails in the Miami-Dade County area in 2011, trappers have already captured more than 117,000. Once again, introduction of a non-native species into a hospitable environment is having enormous consequences.

Noted by WVR, MD

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