Racial and Ethnic Disparities in Parent-Reported Diagnosis of ADHD:

National Survey of Children's Health (2003, 2007, and 2011)

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ABSTRACT

Background: Attention-deficit/hyperactivity disorder (ADHD) is the most commonly diagnosed mental disorder among children in the United States. While overall ADHD prevalence continues to rise, few have examined difference by race/ethnicity.

Objective: To examine trends in parent-reported ADHD prevalence between 2003 and 2011 across racial/ethnic groups and the role of sociodemographic factors in observed differences in ADHD.

Method: Data were from 3 waves of the National Survey of Children's Health (2003, 2007, and 2011), including 190,408 children aged 5–17 years. Independent variables included race/ethnicity (white non-Hispanic, black non-Hispanic, Hispanic, other non-Hispanic), gender, age, poverty level, primary language, insurance status, parental marital status, and neighborhood safety. Sociodemographic factors and year were compared among those diagnosed with ADHD and between racial/ethnic groups using χ^2 tests. Adjusted logistic regression models, stratified by race/ethnicity, were fit to examine the association between identified risk factors and ADHD across racial/ethnic groups. Parental report of an ADD or ADHD diagnosis for a child aged 5–17 years was the dependent variable. If the household included more than 1 child aged 5–17 years, 1 was selected at random.

Results: Increasing trends were observed over the past decade in the prevalence of parent-reported ADHD overall (43%, $P < .001$), among children aged 10–14 years (47%, $P < .001$), and adolescents aged 15–17 years (52%, $P < .001$). Although the ADHD prevalence was still highest among whites, increasing trends were observed for all racial/ethnic groups, most notably among Hispanics, increasing 83% from 2003 to 2011 ($P < .001$). A greater increase in ADHD was also observed among females (55%, $P < .001$) than among males (40%).

Conclusions: Economics, family status, non-English language in the home, and neighborhood safety factors differentially impacted diagnosed ADHD across racial/ethnic groups. Although new insights into the role of economic, family, and neighborhood factors on parent-reported ADHD diagnoses were noted, more research is needed to understand causes of the observed racial/ethnic disparities.

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Attention-deficit/hyperactivity disorder (ADHD) is the most commonly diagnosed mental disorder among US children.[1] According to the *Diagnostic and Statistical Manual of Mental Disorders,* Fifth Edition (*DSM-5*), ADHD is defined as a persistent pattern of inattention and/or hyperactivity and impulsivity that affects performance in social, educational, or work settings.[2] It is also one of the few mental disorders in which childhood onset is part of the diagnostic criteria.[3] ADHD is most commonly treated by a combination of drug therapy and behavioral parent training and may also require behavioral classroom modifications through a 504 plan or, in rarer cases, an individualized education program.[4] Although treatment is generally effective, symptoms often persist into adulthood, prompting many health professionals to view ADHD as a lifelong disorder.[4,5]

Population-based studies generally estimate ADHD prevalence in US children to be between 5% and 11%.[1,6–12] In recent years, it has also been well documented that ADHD prevalence in school-aged children has been increasing[9,12–14]; however, estimates vary widely. The Centers for Disease Control and Prevention (CDC) has estimated that national prevalence for children aged 4–17 years rose from 7.8% to 9.5% over the years 2003 to 2007[14] and to 11% in 2011.[15] The Agency for Healthcare Research and Quality (AHRQ) reports that ADHD prevalence in children rose from 2.9% in 1996 to 5.2% by 2008.[13] Although the reasons for the recent rise in US prevalence of ADHD are unknown, proposed explanations include changes in diagnostic criteria or special-education policy and increased public awareness of ADHD.[16] However, in a larger historical context, there is some evidence that, since the 1960s, objectively measured ADHD prevalence has not been rising, and much of the variation is attributable to methodology.[17]

Prevalence of ADHD has been found to vary significantly across race and ethnicity.[6,7,18] While higher prevalence is generally found in whites and lower prevalence in Hispanics, the reasons for this disparity are unclear.[14,18,19] Evidence suggests that sociodemographic factors may play a role, as identified risk groups include those who use English as their primary language, nonimmigrants, those in the lower economic levels, those with health insurance, and those living with a single mother.[7,9,11,12,18,20,21] Although there has been a large amount of work relating sociodemographic factors to racial/ethnic differences in ADHD, there has been little research examining the effects of these factors *within* racial/ethnic groups. For example, primary language might be expected to have a different effect on ADHD prevalence in Hispanic children than it does in white children. Previous research[22] has examined the effects of sociodemographic factors on Latinos using community samples;

however, the current literature lacks an investigation of this sort using nationally representative data with analyses stratified by race/ethnicity.

Objective

This study had 2 main objectives: first, to examine trends in parent-reported ADHD prevalence across racial/ethnic groups during the period from 2003 to 2011; and second, to examine the racial/ethnic disparity in ADHD prevalence after controlling for other sociodemographic variables. We hypothesized that there would be a significant and consistent increase in ADHD prevalence during the study period. In addition, we examined racial/ethnic differences in ADHD trends as well as the role of sociodemographic factors across these groups. We hypothesized that sociodemographic differences would be significant predictors of the observed differences in ADHD prevalence across race and ethnicity. This study provides the most up-to-date analysis of US trends in parent-reported ADHD by race/ethnicity, an area of high interest considering the increasing prevalence of ADHD.[9,12–14]

Clinical Points

- Prevalence of parental-reported attention-deficit/hyperactivity disorder (ADHD) has increased over the past decade, yet few studies have examined trends by race/ethnic group.
- Increasing prevalence was most notable among older adolescents, females, and Hispanics, groups that do not traditionally present with ADHD, which has implications for clinical diagnosis and treatment.

METHOD

The National Survey of Children's Health (NSCH) is a nationally representative cross-sectional survey, conducted every 4 years since 2003 by the National Center for Health Statistics, an agency of the CDC.[23] Data are collected on the physical and emotional health of noninstitutionalized children aged 17 years and younger, as well as information on health care utilization and demographics. For each cohort year, a sample of participants were selected using random-digit-dialing for households with children under age 18 years, with 1 child being randomly selected from all children in the household to be the subject of the survey, and questions being answered by the parent or guardian who knew the most about the subject child's health and health care. The overall survey response rates for 2003, 2007, and 2011 were 55.3%, 46.7%, and 23.0%, respectively. The low response rate for 2011 was primarily due to the inclusion of

Table 1. Distribution and Change of Sociodemographic Characteristics of Children

Characteristic	2003 (n = 65,227), % (SE)	2007 (n = 62,139), % (SE)	2011 (n = 63,042), % (SE)	Percent Change (2003–2011)	*P* Value[a]
Sex					.95
Female	48.6 (0.3)	48.8 (0.5)	48.8 (0.5)	0.4	
Male	51.4 (0.3)	51.2 (0.5)	51.2 (0.5)	−0.4	
Age, y					.03
5–9	37.4 (0.3)	37.6 (0.5)	38.3 (0.4)	2.4	
10–14	40.2 (0.3)	39.1 (0.5)	38.3 (0.4)	−4.7	
15–17	22.4 (0.3)	23.3 (0.4)	23.4 (0.4)	4.5	
Race/ethnicity					< .001
White	63.9 (0.4)	57.6 (0.5)	54.0 (0.5)	−15.5	
Black	13.8 (0.3)	14.8 (0.3)	14.1 (0.3)	2.2	
Hispanic	15.4 (0.3)	19.2 (0.5)	22.3 (0.5)	44.8	
Other	7.0 (0.2)	8.4 (0.3)	9.7 (0.3)	38.6	
Primary home language					< .001
English	89.5 (0.3)	89.1 (0.4)	86.4 (0.4)	−3.5	
Non-English	10.5 (0.3)	10.9 (0.4)	13.6 (0.4)	29.5	
Poverty level					< .001
≥ 400%	27.4 (0.3)	30.3 (0.4)	28.4 (0.4)	3.7	
> 200%, < 400%	34.2 (0.3)	32.2 (0.5)	29.5 (0.4)	−13.7	
> 100%, < 200%	22.5 (0.3)	20.8 (0.4)	22.0 (0.4)	−2.2	
≤ 100%	15.9 (0.3)	16.6 (0.4)	20.1 (0.4)	26.4	
Health insurance status					< .001
Has insurance	91.3 (0.2)	90.9 (0.3)	94.3 (0.2)	3.3	
No insurance	8.7 (0.2)	9.1 (0.3)	5.7 (0.2)	−34.5	
Parent marital situation					< .001
2 parent biological/adoptive	59.5 (0.3)	63.4 (0.5)	61.5 (0.4)	3.4	
2 parent blended/step	11.4 (0.2)	10.1 (0.3)	11.4 (0.3)	0.0	
Single mother	24.2 (0.3)	19.8 (0.4)	19.5 (0.4)	−19.4	
Other	5.0 (0.2)	6.7 (0.3)	7.5 (0.3)	50.0	
Parent-reported neighborhood safety					< .001
Always	48.3 (0.3)	52.1 (0.5)	55.0 (0.5)	13.9	
Usually	36.2 (0.3)	34.2 (0.5)	31.8 (0.4)	−12.2	
Sometimes	13.0 (0.3)	11.3 (0.4)	11.0 (0.3)	−15.4	
Never	2.5 (0.1)	2.4 (0.2)	2.1 (0.1)	−16.0	

[a]Based on χ^2 test for association between variable and cohort year.
Abbreviation: SE = standard error.

Table 2. Weighted Prevalence of Parent-Reported Attention-Deficit/Hyperactivity Disorder by Sociodemographic Characteristics Among Youth Aged 5–17 Years: National Survey of Children's Health (2003, 2007, and 2011)

Characteristic	2003 (n = 65,227), % (SE)	2007 (n = 62,139), % (SE)	2011 (n = 63,042), % (SE)	Percent Change (2003–2011)	*P* Value[a]
Overall	8.4 (0.2)	10.4 (0.3)	12.0 (0.3)	42.9	…
Sex					< .001
Female	4.7 (0.2)	6.2 (0.4)	7.3 (0.3)	55.3	
Male	11.8 (0.3)	14.3 (0.5)	16.5 (0.5)	39.8	
Age, y					< .001
5–9	6.0 (0.3)	6.9 (0.4)	8.0 (0.4)	33.3	
10–14	9.9 (0.3)	11.5 (0.5)	14.5 (0.5)	46.5	
15–17	9.6 (0.4)	14.0 (0.8)	14.6 (0.6)	52.1	
Race/ethnicity					< .001
White	9.6 (0.2)	11.5 (0.4)	14.0 (0.4)	45.8	
Black	8.1 (0.6)	11.3 (0.8)	12.8 (0.8)	58.0	
Hispanic	4.2 (0.4)	6.4 (0.7)	7.7 (0.7)	83.3	
Other	6.8 (0.7)	10.0 (0.8)	9.7 (0.7)	42.7	
Primary home language					< .001
English	9.2 (0.2)	11.3 (0.3)	13.5 (0.3)	46.7	
Non-English	1.4 (0.3)	2.4 (0.5)	2.9 (0.6)	107.1	
Poverty level					< .001
≥ 400%	10.2 (0.6)	12.8 (0.8)	14.5 (0.7)	42.2	
> 200%, < 400%	8.5 (0.4)	11.4 (0.8)	12.9 (0.6)	51.8	
> 100%, < 200%	8.0 (0.3)	9.7 (0.5)	11.3 (0.5)	41.3	
≤ 100%	7.7 (0.3)	9.0 (0.5)	10.2 (0.5)	32.5	
Health insurance status					< .001
Has insurance	8.7 (0.2)	10.7 (0.3)	12.3 (0.3)	41.4	
No insurance	5.4 (0.6)	7.4 (1.0)	7.2 (1.0)	33.3	
Parent marital situation					< .001
2 parent biological/adoptive	6.3 (0.2)	7.5 (0.3)	9.0 (0.3)	42.9	
2 parent blended/step	13.4 (0.7)	15.5 (1.1)	18.6 (1.1)	38.8	
Single mother	10.7 (0.5)	15.4 (0.9)	16.0 (0.7)	49.5	
Other	9.9 (0.8)	15.2 (1.3)	16.9 (1.2)	70.7	
Parent-reported neighborhood safety					< .001
Always	7.9 (0.2)	9.6 (0.4)	11.6 (0.4)	46.8	
Usually	8.6 (0.3)	10.9 (0.6)	12.3 (0.5)	43.0	
Sometimes	8.5 (0.6)	12.6 (1.1)	13.1 (1.0)	54.1	
Never	13.5 (1.8)	10.4 (1.5)	14.3 (2.1)	5.9	

[a]Based on χ^2 test for association between sociodemographic variable and ADHD, all years combined.
Abbreviation: SE = standard error.

cell-phone interviews for the first time in the NSCH,[24] which may create bias in comparisons across years. The statistical design of the NSCH includes weighting procedures to account for potential bias in survey nonresponse. The NSCH interview was offered in English and Spanish for 2003 and also in Mandarin, Cantonese, Vietnamese, and Korean for 2007 and 2011. For the purposes of this analysis, the sample was restricted to subjects aged 5–17 years. The lower limit of 5 years was chosen because this is the most common age to begin school (kindergarten) in the United States, and the observance of functional impairment in a school environment is important for diagnosing ADHD.[4] Due to the age restriction and missing data, the final sample sizes for 2003, 2007, and 2011 were 65,227, 62,139, and 63,042, respectively.

Parent-reported diagnosis of ADHD was determined by a yes response to the question, "Has a doctor or other health care provider ever told you that [subject child] had attention-deficit disorder or attention-deficit/hyperactive disorder, that is, ADD or ADHD?" Race and ethnicity were classified into 4 categories: white non-Hispanic, black non-Hispanic, Hispanic, and other non-Hispanic. Potential confounding variables were selected based on empirical evidence of their association with both ADHD and race/ethnicity.[15,16,18,20,21,25–28] Independent variables included gender, age group (5–9, 10–14, 15–17 years), poverty level (at or below 100% of poverty level; above 100%, at or below 200%; above 200%, at or below 400%; above 400%), primary language used in household (English, non-English), health insurance status (currently have insurance, no insurance), parent-rated neighborhood safety ("How often do you feel [subject child] is safe in your community or neighborhood?" [always safe, usually safe, sometimes safe, never safe]), and parent marital status (2-parent biological/adoptive, 1 stepparent, single mother, other). The "other" parent marital status could not be subdivided into smaller groups, as these groups did not encompass sufficient participants to conduct analyses.

Data Analysis Plan

Only participants that answered all questions of interest were included in the analyses, with resulting losses in data of 12.2%, 10.6%, and 10.8% for 2003, 2007, and 2011, respectively, and, thus, we elected not to impute missing values. Descriptive statistics were calculated and compared across study years. We conducted χ^2 tests for ADHD and race/ethnicity, ADHD and the potential confounding variables, and race/ethnicity and the potential confounding

Table 3. Sociodemographic Variables by Race/Ethnic Group (all years combined)

Variable	White (n = 111,440), % (SE)	Black (n = 27,069), % (SE)	Hispanic (n = 36,010), % (SE)	Other (n = 15,890), % (SE)	*P* Value[a]	Overall, % (SE)
Sex					.091	
Female	48.3 (0.3)	50.2 (0.7)	48.6 (0.8)	49.8 (1.0)		48.7 (0.3)
Male	51.7 (0.3)	49.8 (0.7)	51.4 (0.8)	50.2 (1.0)		51.3 (0.3)
Age, y					< .001	
5–9	36.4 (0.3)	36.7 (0.7)	41.1 (0.8)	41.8 (0.9)		37.8 (0.3)
10–14	39.2 (0.3)	39.9 (0.7)	39.2 (0.8)	38.0 (0.9)		39.2 (0.3)
15–17	24.4 (0.2)	23.4 (0.6)	19.6 (0.6)	20.3 (0.8)		23.0 (0.2)
Primary home language					< .001	
English	99.2 (0.1)	98.5 (0.2)	49.2 (0.8)	83.7 (0.9)		88.3 (0.2)
Non-English	0.8 (0.1)	1.5 (0.2)	50.8 (0.8)	16.3 (0.9)		11.7 (0.2)
Poverty level					< .001	
≥ 400%	36.5 (0.3)	14.9 (0.4)	35.9 (0.7)	34.6 (0.9)		28.7 (0.2)
> 200%, < 400%	37.1 (0.3)	26.2 (0.6)	29.5 (0.7)	28.0 (0.9)		31.9 (0.2)
> 100%, < 200%	17.7 (0.2)	28.5 (0.6)	22.1 (0.7)	21.4 (0.8)		21.8 (0.2)
≤ 100%	8.7 (0.2)	30.4 (0.6)	12.5 (0.5)	16.0 (0.7)		17.6 (0.2)
Health insurance status					< .001	
Has insurance	94.7 (0.1)	92.6 (0.4)	83.4 (0.6)	93.9 (0.4)		92.2 (0.1)
No insurance	5.3 (0.1)	7.4 (0.4)	16.6 (0.6)	6.1 (0.4)		7.8 (0.1)
Parent marital situation					< .001	
2 parent biological/adoptive	68.3 (0.3)	33.3 (0.6)	61.1 (0.8)	63.2 (0.9)		61.5 (0.3)
2 parent blended/step	11.3 (0.2)	11.8 (0.5)	10.0 (0.5)	9.4 (0.5)		10.9 (0.2)
Single mother	14.8(0.2)	44.7 (0.7)	23.1 (0.6)	20.7 (0.7)		21.1 (0.2)
Other	5.7 (0.1)	10.2 (0.4)	5.7 (0.4)	6.7 (0.4)		6.4 (0.1)
Parent-reported neighborhood safety					< .001	
Always	55.2 (0.3)	44.5 (0.7)	48.0 (0.8)	50.3 (1.0)		51.9 (0.3)
Usually	37.6 (0.3)	28.6 (0.6)	26.8 (0.7)	34.2 (0.9)		34.0 (0.2)
Sometimes	6.2 (0.1)	22.2 (0.6)	20.4 (0.7)	13.0 (0.7)		11.8 (0.2)
Never	1.0 (0.1)	4.6 (0.3)	4.7 (0.3)	2.4 (0.3)		2.3 (0.1)

[a]Based on χ^2 test for association between variable and race/ethnicity, all years combined.
Abbreviation: SE = standard error.

variables. All potential confounding variables found to have a significant association ($P < .05$) with both ADHD and race/ethnicity were included in the full logistic models. To test trends in ADHD prevalence, data sets were concatenated and a new variable, year, was created, where 2003 = 0, 2007 = 4, and 2011 = 8. In the full logistic model, after results were adjusted for significant potential confounding variables, ADHD was regressed on the race/ethnicity indicator and year. This will be referred to as the "overall" model. Logistic regression models were also stratified by racial/ethnic groups, so a total of 5 adjusted logistic models were fit. To test for curvilinear trends in ADHD prevalence, a "year squared" variable was tested in all models but included in the final analyses only when significant. Interactions between race/ethnicity and year were also tested, but these were dropped due to nonsignificance. Adjusted odds ratios (AORs) and 95% CIs were calculated for all subgroups of predictor variables. To model trends across cohort year, the adjusted prevalence of ADHD was calculated and graphed across study years for each racial/ethnic group. Statistical analyses were conducted using SAS (SAS Institute; version 9.3), including design effects in all analyses.

RESULTS

The weighted distribution of demographic variables for each survey year included in the analyses is displayed in Table 1. Significant changes in demographics were found across study years, except for gender. Of note is the increase in Hispanic (44.8%) and the decrease in white participants in the survey (−15.5%) from 2003 to 2011, as well as the increasing number of respondents at or below 100% of the poverty level (26.4%), decreasing number without health insurance (−34.5%), and increasing proportion of non-English speakers (29.5%).

Table 2 displays weighted sociodemographic statistics for youth with parent-reported ADHD. Overall ADHD prevalence for 2003, 2007, and 2011 was 8.4%, 10.4%, and 12.0%, respectively. This represents a 42.9% increase from 2003 to 2011. ADHD prevalence increased in all predictor variable subgroups from 2003 to 2011, despite small declines from 2007 to 2011 for children in the "other" racial/ethnic group and uninsured children, as well as children living in neighborhoods described as "never safe" between 2003 and 2007. Of note are the large increases in prevalence from 2003 to 2011 for Hispanics (83.3%), non-English speakers (107.1%), and children with parents in "other" parent marital situations (70.7%). It also should be noted that ADHD prevalence increased 55.3% in females during this period, while only increasing 39.8% in males.

Bivariate analyses of race/ethnicity and sociodemographic covariates are displayed in Table 3. The χ^2 tests show significant relationships between race/ethnicity and all covariates, except gender. The proportion of Hispanics speaking a non-English language and not having health insurance was much higher in comparison to all other race/

Table 4. Adjusted Logistic Regression Models by Race/Ethnic Group (all years combined)[a]

	White		Black		Hispanic		Other		Overall	
Subgroup	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI
Race/ethnicity										
White									Reference	
Black									0.62	0.58–0.69
Hispanic									0.71	0.60–0.83
Other									0.78	0.69–0.88
Sex										
Female	Reference		Reference		Reference		Reference		Reference	
Male	2.57	2.36–2.79	3.52	2.89–4.28	2.63	1.96–3.53	2.62	2.07–3.32	2.69	2.50–2.89
Age, y										
5–9	Reference		Reference		Reference		Reference		Reference	
10–14	1.80	1.64–1.97	1.55	1.25–1.92	1.90	1.42–2.55	1.83	1.44–2.23	1.78	1.64–1.92
15–17	1.89	1.70–2.09	1.40	1.09–1.80	2.20	1.55–3.12	2.51	1.83–3.24	1.87	1.71–2.05
Primary home language										
English	Reference		Reference		Reference		Reference		Reference	
Non-English	0.40	0.21–0.73	0.24	0.07–0.78	0.22	0.15–0.33	0.08	0.04–0.15	0.19	0.14–0.25
Poverty level										
≥ 400%	Reference		Reference		Reference		Reference		Reference	
> 200%, < 400%	1.04[b]	0.95–1.15	1.13[b]	0.83–1.55	0.81[b]	0.54–1.23	1.22[b]	0.89–1.66	1.05[b]	0.97–1.15
> 100%, < 200%	1.36	1.22–1.52	1.24[b]	0.89–1.72	0.88[b]	0.57–1.36	1.74	1.22–2.47	1.34	1.21–1.48
≤ 100%	1.89	1.66–2.16	1.60	1.15–2.22	1.03[b]	0.68–1.56	2.33	1.63–3.34	1.75	1.56–1.96
Health insurance status										
Has insurance	Reference		Reference		Reference		Reference		Reference	
No insurance	0.72	0.60–0.86	0.49	0.33–0.72	0.62[b]	0.33–1.16	0.95[b]	0.57–1.59	0.68	0.57–0.81
Parent marital situation										
2 parent biological/ adoptive	Reference		Reference		Reference		Reference		Reference	
2 parent blended/step	2.09	1.87–2.33	1.48	1.04–2.09	1.48[b]	0.98–2.23	2.26	1.62–3.17	1.96	1.77–2.17
Single mother	1.88	1.68–2.11	1.59	1.24–2.04	1.41	1.04–1.91	1.86	1.38–2.50	1.77	1.61–1.95
Other	1.71	1.47–2.00	2.05	1.53–2.75	1.21[b]	0.78–1.88	2.13	1.49–3.05	1.77	1.57–2.01
Parent-reported neighborhood safety										
Always	Reference		Reference		Reference		Reference		Reference	
Usually	1.11	1.03–1.21	1.13[b]	0.91–1.41	1.28[b]	0.93–1.76	1.26[b]	0.99–1.62	1.15	1.07–1.24
Sometimes	1.44	1.21–1.70	1.46	1.14–1.87	1.04[b]	0.74–1.46	1.64	1.17–2.31	1.35	1.19–1.52
Never	1.69	1.29–2.22	1.81	1.23–2.68	1.67	1.07–2.62	0.86[b]	0.48–1.52	1.61	1.32–1.96
Year	1.06	1.05–1.07	1.07	1.05–1.10	1.07	1.03–1.11	1.24	1.08–1.42	1.06	1.05–1.07
Year squared	NS		NS		NS		0.98	0.97–0.99	NS	

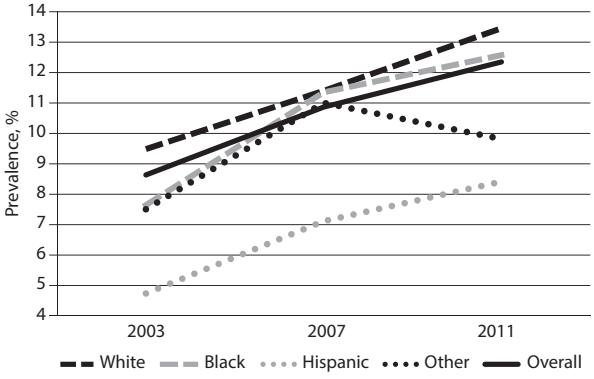
[a]All *P* values were significant at $P < .05$, unless otherwise noted.
[b]$P > .05$.
Abbreviations: AOR = adjusted odds ratio, NS = not significant.

ethnic groups. Both Hispanics and others were younger, and blacks were more likely to live in lower economic levels and in single-parent families.

Adjusted logistic models along with the stratified analysis by race/ethnicity are displayed in Table 4. Examination of trends over the study period indicated that parent-reported ADHD prevalence significantly increased from 2003 to 2011 for the overall population as well as for the white, black, and Hispanic subpopulations, in a linear pattern, while increasing in a curvilinear pattern for those of other race/ethnicity. This supports our first hypothesis that parent-reported ADHD prevalence has increased from 2003 to 2011 across racial/ethnic groups. Regarding our second hypothesis, results from the overall logistic model indicated that, after controlling for covariates, there were significant disparities in parent-reported ADHD by race/ethnicity. In comparison to whites, blacks (AOR = 0.62; 95% CI, 0.58–0.69), Hispanics (AOR = 0.71; 95% CI, 0.60–0.83), and others (AOR = 0.78; 95% CI, 0.69–0.88) were all significantly less likely to have a parent-reported diagnosis of ADHD.

Analyses of sociodemographic predictors across race/ethnic groups indicated a consistent association with higher prevalence of ADHD for males, children aged 10–17 years, and children with single mothers. A consistent association with lower ADHD prevalence was found for non-English speakers. White, black, Hispanic, and "other" non-English speakers were 60%, 76%, 78%, and 92% less likely to have a parent report an ADHD diagnosis compared to English speakers within their respective racial/ethnic groups. Additional significant covariates for whites included living below 200% of the poverty level, having no health insurance, living with a stepparent or with parents in "other" marital situations, and living in neighborhoods described as "usually safe," "sometimes safe," and "never safe." Additional significant covariates for blacks included living below 100% of the poverty level; having no health insurance; living with a stepparent, single mother, or with parents in "other" marital situations; and living in neighborhoods described as "sometimes safe" and "never safe." The only additional significant covariate in Hispanics was living in neighborhoods described as "never safe." Additional significant covariates for the other race/ethnic group included living below 200% of the poverty level, living with a stepparent or with parents in "other"

Figure 1. Adjusted Prevalence of Parent-Reported Attention-Deficit/Hyperactivity Disorder by Race/Ethnicity and Survey Year



marital situations, and living in neighborhoods described as "sometimes safe."

Adjusted prevalence of ADHD was calculated across race/ethnic groups by using the overall logistic model (Figure 1). Between 2003 and 2011, the adjusted prevalence of ADHD increased 42% for whites, 66% for blacks, 79% for Hispanics, and 31% for other race/ethnic groups, although the prevalence for others was decreased between 2007 and 2011.

DISCUSSION

Overall prevalence of parent-reported ADHD in children ages 5–17 years has risen from 8.4% in 2003 to 12.0% in 2011; this corresponds to a 43% increase, or, in terms of current population size, 5.8 million youth and young adults with an ADHD diagnosis nationwide. Trends across race/ethnicity indicate that ADHD prevalence is increasing linearly for whites, blacks, and Hispanics, whereas a curvilinear pattern was observed for those classified as in the other race/ethnic group. Although ADHD is more likely to be diagnosed in boys, parent-reported prevalence for girls has risen from 4.7% in 2003 to 7.3% in 2011; this corresponds to a 55.3% increase, compared to a 39.8% increase in boys. This may reflect an increased understanding of ADHD symptoms in girls, which can manifest differently than in boys.[26,29] Another notable rise in ADHD prevalence was found for children aged 15–17, rising from 9.6% in 2003 to 14.6% in 2011, a 52% increase. In comparison, from 2003 to 2011, prevalence rose 46.5% for children aged 10–14 years and 33.3% for children aged 5–9 years. In fact, in 2011, children aged 15–17 years reported the highest ADHD prevalence of all 3 age groups. The larger increase in ADHD prevalence for this age group is of concern because the effects of ADHD are often expected to weaken in later adolescence or postadolescence, and many diagnosed children will discontinue medication around this time.[4,5] Although it is speculation to give reason for this rise, factors that may play a role include the greater acceptance of adult-ADHD as a legitimate disorder, increased academic pressures for adolescents, or simply the aging of child populations diagnosed in the early 2000s.[5,30]

Rising ADHD prevalence has been a growing concern during the past 3 decades, as parent-reported surveys indicate prevalence is nearly 1 in every 10 children. This has created demand for greater availability of special-education programs and health resources while also prompting many health professionals to call for stricter diagnostic procedures, as concern of overdiagnosis increases. Results from this study substantiate the increasing ADHD prevalence across all racial/ethnic groups and provide support for these concerns. Growing demand for ADHD medication is also indicative of rapidly growing diagnosis rates. Since 1998, at least 14 new brands of ADHD medication have been approved by the US Food and Drug Administration, yet only 9 brands were approved during the period from 1936 to 1998.[31]

Despite recent advances in complexity and availability of large-sample mental health data, factors explaining racial/ethnic differences in ADHD are still not well understood. Although results from this study did not support the hypothesis that sociodemographic factors explained all racial/ethnic differences in ADHD, results indicated that particular factors were highly influential, including socioeconomic, family, and insurance status, as well as neighborhood safety and primary language. More specifically, the following sociodemographic factors were found to predict ADHD: gender, age, language, poverty level, health insurance status, family status, and neighborhood safety.

Previous research[15,20,27] has given considerable focus to the relationship between economic factors and ADHD. In particular, a prior study[27] reported that children of lower economic levels have higher ADHD prevalence. However, many studies[6,7,18,19] find insignificant results once additional sociodemographic variables are controlled for. Our results indicate that living in the lowest poverty level was related to ADHD, after we controlled for other sociodemographic variables, among all race/ethnic groups, except Hispanics. This should be of particular concern, as the percentage of children living at or below 100% of the poverty level grew by 26.4% from 2003 to 2011. We also observed variation between racial/ethnic groups in the significance of other poverty levels, which may explain the conflicting results from previous studies. Consistent with previous research, having no health insurance was also associated with lower ADHD prevalence across race/ethnic groups, except Hispanics. Being uninsured may lead to lower utilization of mental health services; thus, some uninsured children may likely be undiagnosed because of their inability to see a mental health professional.

The increased likelihood for children of single mothers to have ADHD has been documented in previous studies.[7,8] We also found a significantly higher ADHD prevalence for children living in a blended family (stepparent) or living in other parent marital situations (eg, single father, legal guardian, grandparent, etc). Living with a stepparent or in other family situations was not related to ADHD among Hispanic children. Previous research[28] on Hispanic mental health has suggested that the extended family is likely to work together to understand a child's behavior and its causes,

rather than seeking the advice of a medical professional. It is possible this familial approach may decrease the defiant behaviors associated with a nonstable family situation that are often misinterpreted as symptoms of ADHD.[22] It is also possible that Hispanics, in response to mental health symptoms, will be more likely to alert either a general physician or alternative medicine sources, which can include family members and religious authorities.[32] In these cases, Hispanic parents would be less likely to receive an ADHD diagnosis for their child from a mental health professional. In addition, ADHD has been associated with less time spent in family activities.[33] If an unstable family situation indicates less time spent in family activities, then the extended family may also be beneficial in this domain.

Children living in families that used a non-English language at home were also significantly less likely to have had a diagnosis of ADHD across all racial/ethnic groups. A language barrier may limit parents' awareness of ADHD and its symptoms[34] and impact subsequent health service utilization and diagnosis, potentially explaining the lower observed prevalence of ADHD.

Despite the lower prevalence of parent-reported ADHD in both Hispanics and non-English speakers, these groups experienced the largest increases in ADHD prevalence from 2003 to 2011: 107.1% for non-English speakers and 83.3% for Hispanics. This may reflect increasing Spanish-language mental health resources, as well as greater cultural acceptance of the illness within the Hispanic community; however, further research is needed to explain the observed changes.

Limitations

This study has limitations that merit consideration. First, the NSCH is a telephone survey. Data were limited not only by low response rates (most notably in 2011) but also by means of collection that entailed parental or guardian report only. The weighting techniques employed by NSCH are effective at reducing nonresponse bias[27]; however, estimates can still differ from nationally representative in-person surveys, such as the National Health Interview Survey.[12] In addition, the inclusion of cell-phone surveys in 2011, while allowing for better estimates of hard-to-reach individuals, may create bias in comparisons across survey years. Recent evidence[35] also suggests that parent or guardian report provides appropriate estimates of ADHD prevalence. The largest limitation of this study may be that if parent reports of ADHD (or any of the predictor variables) were biased due to poor recall or stigma, then the true prevalence may differ from that observed in this study. Parent reports of ADHD *symptoms* have been found to differ significantly from teacher reports.[36] However, recent evidence[35] suggests that parent or guardian reports provide appropriate estimates of ADHD prevalence and that geographic variation can explain some of the variation between studies. Another limitation was that some variables were not consistently available across study years or were restricted to certain age groups. Thus, examining the impacts of low birth weight and obesity on ADHD prevalence was not possible. Finally, the NSCH data were cross-sectional, limiting support for causal inferences about factors related to developing ADHD.

CONCLUSION

Our study showed that, among US children aged 5–17 years, parent-reported ADHD prevalence across racial/ethnic groups has risen considerably from 2003 to 2011. While the reasons for this increase in prevalence remain unclear, ADHD diagnoses, treatment, and service utilization represent a growing economic cost to the United States and merit continued monitoring. We observed in this study significant differences of the impact of sociodemographic factors across racial/ethnic subgroups. These factors, and possible interactions, represent topics for future study, which may help us to explain racial/ethnic disparities in ADHD.

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