Factors Associated with Attention Deficit Hyperactivity Disorder Medication Use in Community Care Settings

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Objectives To examine patient- and provider-level factors associated with receiving attention-deficit/hyperactivity disorder (ADHD) medication treatment in a community care setting. We hypothesized that the likelihood of ADHD medication receipt would be lower in groups with specific patient sociodemographic (eg, female sex, race other than white) and clinical (eg, comorbid conditions) characteristics as well as physician characteristics (eg, older age, more years since completing training).

Study design A retrospective cohort study was conducted with 577 children (mean age, 7.8 years; 70% male) presenting for ADHD to 50 community-based practices. The bivariate relationship between each patient- and physician-level predictor and whether the child was prescribed ADHD medication was assessed. A multivariable model predicting ADHD medication prescription was conducted using predictors with significant ($P < .05$) bivariate associations.

Results Sixty-nine percent of children were prescribed ADHD medication in the year after initial presentation for ADHD-related concerns. Eleven of 31 predictors demonstrated a significant ($P < .05$) bivariate relationship with medication prescription. In the multivariable model, being male (OR, 1.34; 95% CI, 1.01-1.78; $P = .02$), living in a neighborhood with higher medical expenditures (OR, 1.11 for every $100 increase; 95% CI, 1.03-1.21; $P = .005$), and higher scores on parent inattention ratings (OR, 1.06; 95% CI, 1.03-1.10; $P < .0001$) increased the likelihood of ADHD medication prescription.

Conclusions We found that some children, based on sociodemographic and clinical characteristics, are less likely to receive an ADHD medication prescription. An important next step will be to examine the source and reasons for these disparities in an effort to develop strategies for minimizing treatment barriers. *(J Pediatr 2019;213:155-62).*

Attention-deficit/hyperactivity disorder (ADHD) is the most common neurodevelopmental disorder in childhood, affecting 8%-12% of US school-aged children.[1-3] Current guidelines recommend stimulant medication and/or behavioral therapies as first-line treatments.[4,5] Despite the evidence of stimulant efficacy in treating ADHD, only one-half to two-thirds of those diagnosed with ADHD receive ADHD medications.[1-3,6,7] Receipt of ADHD medication has been associated with several factors, including patient-level sociodemographic characteristics (eg, sex, race, age, income, health insurance, and geographic region). Specifically, prior studies have reported an association between higher rates of stimulant use and patient sociodemographic characteristics such as male sex,[6,8-17] white race,[8,9,11-13,18-22] younger latency age,[6,13,14,19,20] and urban residence.[6,13,14,19,20,23,24] However, evidence for the role of income and health insurance in receipt of ADHD medication is mixed; some studies have linked low income to decreased ADHD medication use[1,2,7,8,13,22,25] and others have linked low income to increased medication use.[10,15,24] Furthermore, although some studies have shown that children with ADHD who have health insurance[1,12,15,17,20,25] are more likely to receive medication, others have reported no association.[3,26]

Studies examining patient clinical characteristics have found associations between more severe ADHD symptoms and impairments and increased stimulant medication use.[3,6,8,14,16,17] However, the impact of mental health comorbidities is less clear. Some studies have reported higher stimulant medication use in children with ADHD and comorbid mental health conditions, such as conduct disorder[27] or oppositional/defiant disorder,[3,6] and others have shown no influence[14] or lower use of stimulants[8] among children who have mental health comorbidities.

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ADHD	Attention-deficit/hyperactivity disorder
QI	Quality improvement
VAPRS	Vanderbilt ADHD Parent Rating Scale
VATRS	Vanderbilt ADHD Teacher Rating Scale

Prior investigators have also examined the link between physician characteristics (eg, provider's age, sex, and years since residency) and ADHD medication prescription. Higher rates of stimulant prescription have been found in areas with younger physicians, and no association with physician sex has been shown.[25,26] A plausible explanation for the higher prescribing rate among younger physicians is that they likely received more training on ADHD medication treatment than older physicians,[25] although no published studies have examined this association.

Many of these sociodemographic, clinical, and physician characteristics will be correlated. However, most prior studies have used only a few predictors and have not examined them simultaneously.[9,22,23,27] Not including the full range of relevant variables in an analysis may lead to confounding and possibly incorrect conclusions regarding the associations between the predictors and ADHD medication receipt.[28] An additional limitation of much of the prior literature is the use of epidemiological samples.[1,3,6,8,13,15-17,22-25,29,30] In epidemiological studies, because a representative sample population is obtained irrespective of families' interest or concern about ADHD, the absence of an ADHD medication prescription may be due to ADHD under-recognition. In contrast, reasons for not pursuing ADHD medication treatment are likely quite different in community pediatrics samples composed of families specifically seeking ADHD care.

Our study addresses these limitations by enrolling a large sample of children self-referred for ADHD from 50 primary care practices and investigating the combined contribution of both patient and clinician characteristics on ADHD medication prescription receipt. Given the findings in the prior literature as discussed, we hypothesized that the likelihood of children receiving ADHD medication treatment would be lower based on patient sociodemographic (eg, female sex, race other than white) and clinical (eg, comorbid conditions) characteristics as well as physician characteristics (eg, older age, more years since completing training).

Methods

Patients and Settings

We contacted 128 pediatric practices in central and northern Ohio via mail to request their participation in an ADHD care quality improvement (QI) study. From August 2010 to December 2012, we selected the first 50 practices (consisting of 195 primary care pediatricians, 4 nurse practitioners, and 14 pediatric resident physicians) that responded and met our inclusion and exclusion criteria to participate. The inclusion and exclusion criteria were that the practice had to have at least 2 practicing physicians, used electronic billing, had Internet access, and did not have co-located mental health care. Excluding residents, the mean provider age was 44.1 years (SD, 8.6 years), 15% were not white, and 52% were female. The average time since training completion was 13.4 years (SD, 8.5 years). There was diversity in terms of practice location (urban, 30.6%; suburban, 59.5%; rural, 11.1%) as well as the population served based on the percentage of patients receiving Medicaid assistance (range, 0%-99%; mean, 39.8%; SD, 30.6%).

QI Intervention

Practices were randomly assigned to a QI intervention or to a control condition where they waited 2 years to receive the intervention.[31,32] The QI intervention's goal was to improve ADHD patient outcomes through the use of an ADHD web portal to provide physicians with feedback on several key indicators of ADHD care (eg, time lapse between prescribing ADHD medication and collection of follow-up Vanderbilt ADHD Parent Rating Scale [VAPRS] and Vanderbilt ADHD Teacher Rating Scale [VATRS]). The QI intervention consisted of didactic trainings that focused on evidence-based ADHD care per the American Academy of Pediatrics ADHD guidelines,[4] ADHD patient flow redesign, periodic systematic tests of change to improve the quality of ADHD care, and access to an ADHD web portal (www.myADHDportal.com) that facilitated the collection, scoring, and interpretation of parent and teacher ratings of ADHD symptoms and medication side effects.

Study Design

For the first year after random assignment, pediatricians across both groups identified patients in grades 1-5 who presented to their office with parents reporting an ADHD-related concern and had no history of taking ADHD medications. The study did not specifically collect data regarding whether or not teachers had expressed ADHD-related issues to parents, thereby stimulating parent concern.

When contacted via telephone for study consent before ADHD treatment started, parents provided the child's sex, age, and race. Research staff also administered the VAPRS[33] and then contacted the child's teacher to administer the VATRS. Both scales ask parents/teachers to rate the child on each of the 18 *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition, ADHD symptoms as occurring 0 (never), 1 (occasionally), 2 (often), or 3 (very often). Summary scores for the 2 ADHD symptom domains are created by summing the 9 inattention and the 9 hyperactivity/impulsivity items. The VAPRS/VATRS also includes items about common ADHD comorbidities (ie, oppositional/defiant disorder, conduct disorder, anxiety, and depression), which are rated on the same scale. A summary externalizing comorbidity score (oppositional/defiant disorder and conduct disorder items) and a summary internalizing comorbidity score (anxiety and depression items) were created. The scales also include 8 scale-specific items measuring the degree of impairment across several domains. These items ask whether the child's performance is 1 (excellent), 2 (above average), 3 (average), 4 (somewhat of a problem), or 5 (problematic) in each domain. To decrease the number of impairment items, parent and teacher ratings of reading, math, and writing were summed to create an academic impairment score. Impairment domains included peer relationships (parent and teacher),

Table I. Descriptive statistics and bivariate relationships between pediatrician- and patient-level predictors and whether children were prescribed ADHD medication

Predictors	Mean (SD) or %	N	Logistic slope estimate	OR
Patient sociodemographics				
Patient age	7.82 (1.45)	577	−.06	0.94
Patient sex (% female; 0 = female; 1 = male)	29.46%	577	.14*	1.15
Patient race (% non-white)	36.74%	577	−.05	0.95
Per capita income (dollars; GIS[A])	29 389 (10 766)	451	.04	1.04
Number of people in household (GIS[A])	3.16 (.20)	561	.04	1.04
Rural-urban county size (GIS[A])	2.14 (2.10)	511	.004	1.00
Average household expenditure for medical services (GIS[Z]; in hundreds of dollars)	10.77 (1.97)	561	.23*	1.26
Percent population unemployed (GIS[Z])	5.01 (2.01)	561	−.10	0.90
Patient clinical characteristics				
Inattention score (parent)	17.93 (4.85)	577	.32*	1.38
Inattention score (teacher)	17.62 (6.39)	367	.33*	1.39
Hyperactivity-impulsivity score (parent)	15.25 (6.52)	577	.15*	1.16
Hyperactivity-impulsivity score (teacher)	12.72 (8.19)	367	.08	1.08
Externalizing comorbidity score (parent)	13.54 (9.04)	577	.07	1.07
Externalizing comorbidity score (teacher)	4.61 (5.93)	366	−.04	0.96
Internalizing comorbidity score (parent)	5.73 (3.89)	577	.06	1.06
Internalizing comorbidity score (teacher)	4.48 (3.91)	365	.07	1.07
Academic impairment score (parent)	3.23 (.89)	577	.16*	1.17
Academic impairment score (teacher)	3.73 (.94)	366	.15†	1.16
Overall school performance (parent)	3.34 (1.13)	575	.03	1.03
Relationship with peers (parent)	2.68 (1.05)	576	.04	1.04
Relationship with peers (teacher)	3.46 (.95)	363	−.05	0.95
Participation in activities (parent)	2.88 (1.12)	571	.17*	1.19
Relationship with siblings (parent)	2.79 (1.39)	567	.06	1.06
Relationship with parents (parent)	2.15 (1.07)	577	.06	1.06
Organization of materials (teacher)	4.09 (.93)	365	.24*	1.27
Following directions (teacher)	4.09 (.90)	366	.29*	1.34
Disrupting class (teacher)	3.72 (1.20)	363	.03	1.03
Assignment completion (teacher)	3.93 (1.00)	365	.24*	1.27
Pediatrician characteristics				
Physician age	44.07 (8.57)	530	.01	1.01
Physician sex (% female)	52.63%	532	.01	1.01
Number of years since residency	13.38 (8.45)	532	.01	1.01
Percent of patients receiving Medicaid assistance	39.79% (30.59)	514	−.001	1.00

A, address; *GIS*, geographic information system; *Z*, zip code.
*P < .01.
†P < .05.

relationship with parents, participation in activities (parent), overall school performance (parent), following directions (teacher), disrupting class (teacher), and assignment completion (teacher). Pediatricians did not have access to the VAPRS/VATRS scores collected by the research staff. However, clinically collected parent and teacher rating scales were available to the pediatrician at the initial ADHD assessment visit for 79% of the children.

To quantify additional sociodemographic information, patient addresses were geocoded and used to retrieve sociodemographic data on both household- and neighborhood-levels from the geographic information system, Alteryx Designer.[34] Geographic information system variables were selected based on literature about the association between sociodemographic status and ADHD.[35-38] Alteryx software (Alteryx, Inc, Irvine, California) was used to spatially retrieve household-level variables including estimated household income, number of people living in household, and rural-urban county size (range from 1 [metro county with >1 000 000 residents] to 9 [rural county with <2500 residents]). To quantify the characteristics of the patients' neighborhood, we retrieved zip code-

level variables including the percentage of unemployed residents and average household expenditure for medical services (in 100s of dollars).

At the QI study conclusion, we extracted the date, medication, and dosage of any medications prescribed in the 365 days after the first ADHD-related contact in the patient's medical records. Data collection ended on January 12, 2015. The Cincinnati Children's Hospital Medical Center and Nationwide Children's Hospital Institutional Review Boards approved this study.

Statistical Analyses

All analyses used Mplus, version 8 (Muthen and Muthen, Los Angeles, California) and accounted for the multilevel clustering of the data. Missing data ranged between 2.8% and 37.8% for variables in the final model and was handled via the default 3-level Bayesian parameter estimation algorithm (**Appendix**; available at www.jpeds.com). The dependent variable for all analyses was a dichotomous (0, 1) variable indicating whether children were prescribed ADHD medication in the year after the first visit with parents reporting an ADHD-related concern. Thirty-one different

predictors (Table I) were derived including physician-level (eg, physician age), patient-level sociodemographics (eg, household income), and clinical characteristics (eg, ADHD symptoms). The bivariate relationship between each of the 31 predictors and whether an ADHD medication was prescribed was investigated using point biserial correlations within a 3-level cross-sectional research design. Using all predictors that demonstrated significant ($P < .05$) bivariate associations, a 3-level multivariable regression model predicting the binary prescription of ADHD medication was conducted.

Results

A total of 577 patients (258 from intervention practices; 319 from control practices) were enrolled and 574 charts were reviewed. Sample mean age was 7.8 years (SD, 1.5), 70% were male, and 37% were not white (Table I). Based on chart reviews, 395 patients (177/258 [68.6%] from intervention practices; 218/319 [69.0%] from control practices) were prescribed ADHD medication (stimulants: n = 385; atomoxetine: n = 15; guanfacine: n = 12) in the year after the initial ADHD presentation. The majority of patients (340/395) received a prescription at their initial visit. The remaining 55 patients received a prescription between 1 and 281 days (mean, 87.8 days; SD, 79.7 days) after initial presentation.

Eleven variables (male sex; higher household medical expenditures; higher/worse parent ratings of inattention, hyperactivity-impulsivity, academic functioning, and participation in activities; and higher/worse teacher ratings of inattention, academic functioning, following directions, organization of materials, and assignment completion) demonstrated significant ($P < .05$) bivariate relationships with being prescribed ADHD medication (Table I). The predictors that did not relate to receipt of an ADHD medication included patient age and race, per capita income, number of people in the household, rural-urban

county size, parent- and teacher-reported externalizing/internalizing symptoms and impaired relationship with peers, parent-reported impaired overall school performance and relationship with siblings and parents, teacher-reported hyperactive-impulsive symptoms and disrupting class, and physician characteristics (ie, physician age, sex, years since residency, and percent of patients receiving Medicaid assistance).

The 11 significant variables were entered into a multivariable logistic regression. Three variables were statistically significant in the final model, accounting for 25.8% ($P < .0001$) of the variance in whether a child was prescribed ADHD medication (Table II). Male sex (OR, 1.34; 95% CI, 1.01-1.78; $P = .02$), living in a neighborhood with higher household medical expenditures (OR, 1.11 for every $100 increase; 95% CI, 1.03-1.21; $P = .005$), and higher scores on parent ratings of inattention (OR, 1.06; 95% CI, 1.03-1.10; $P < .0001$) were associated with the receipt of an ADHD prescription. In addition, correlations between our predictors varied between .09-.68 (mean correlation = .17). This magnitude of correlations does not constitute serious collinearity and should not have biased slope estimates (Table III; available at www.jpeds.com).

To explore the hypothesis that male sex predicted ADHD medication prescribing because males are more likely to have ADHD than females,[39] we conducted a follow-up analysis. For the purpose of this analysis, children were categorized as meeting ADHD diagnostic criteria if the parent or teacher endorsed at least 6 inattention symptoms and/or 6 hyperactive/impulsive symptoms and at least 1 functional area was recognized as being problematic, 344 of 577 children met these study-defined ADHD criteria. A multivariable regression was then conducted with patient sex, study-derived ADHD diagnosis, and their interaction. Although the study-derived ADHD diagnosis variable strongly predicted ADHD medication prescription (OR, 1.71; $P = .001$), the sex × ADHD diagnosis interaction was not significant (OR, 1.15; $P = .62$). As depicted in the Figure, although having an ADHD diagnosis and being male increased the likelihood that ADHD medicine was prescribed, males were more likely than females to be prescribed medicine irrespective of ADHD diagnostic status.

Discussion

Contrary to our hypotheses, several patient-level characteristics, such as child's race and the presence of a comorbid mental disorder, did not predict ADHD medication receipt. Moreover, no physician-level characteristics were related to ADHD medication prescription.

Prior epidemiological studies have shown higher rates of ADHD medication prescription in boys than girls.[6,9,13-17] For example, Angold et al reported that 80% of boys with ADHD received stimulant medication compared with only 41% of girls with ADHD.[6] This observed sex bias in epidemiological samples may be due to a greater propensity

Table II. Multivariable regression results predicting whether children (n = 577) were prescribed ADHD medication

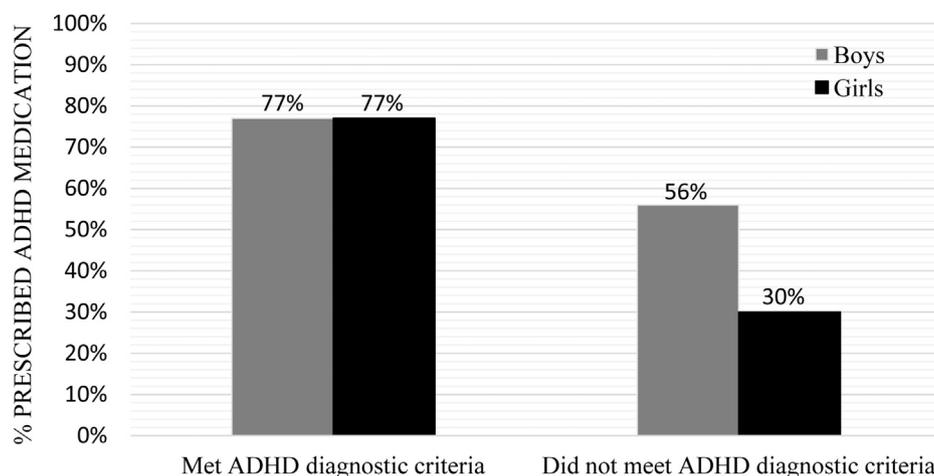| Predictors	Regression estimate	OR	P value
Patient sex	.30	1.34	.02
Inattention score (parent)	.06	1.06	<.0001
Average household expenditure for medical services (GIS[Z]; in hundreds of dollars)	.11	1.11	.005
Inattention score (teacher)	.03	1.03	.06
Hyperactivity-impulsivity score (parent)	.003	1.00	.39
Academic impairment score (parent)	.04	1.04	.34
Academic impairment score (teacher)	.03	1.03	.41
Participation in activities (parent)	.04	1.04	.27
Organization of materials (teacher)	−.01	.99	.46
Following directions (teacher)	.19	1.20	.09
Assignment completion (teacher)	−.14	.87	.16

Figure. Rates of ADHD medication prescriptions among children presenting for ADHD at community pediatric offices.

toward ADHD evaluation and treatment referrals for boys owing to their more disruptive clinical presentations (eg, hyperactive/impulsive symptoms).[41-44] Girls, however, are more likely to have a primarily inattentive presentation, to be less disruptive, and may not be referred for evaluation and/or treatment of their ADHD.[43,44] Our use of a sample presenting to their pediatricians for ADHD care controls for referral bias, because all of our participants came to their pediatricians for ADHD evaluation and/or treatment. In this referred sample, males continued to receive more ADHD prescriptions, even after controlling for ADHD symptom severity in multivariable models and testing whether males were more likely to meet ADHD diagnostic criteria (**Figure**). However, the sex difference in ADHD medication prescribing rates was attenuated compared with epidemiological study findings. This bias toward prescribing ADHD medications to boys may be due to unmeasured factors, such as parental or physician preference to use ADHD medication as a first-line treatment for boys vs girls.

We also found that higher parent-reported inattention scores predicted medication prescription. Whereas prior epidemiological studies found a relationship between receiving medication and ADHD symptoms, unlike the present study, most previous studies have not evaluated the relationship between specific symptom domains and medication receipt.[3,6,16,17] In our study, although both higher inattention and hyperactivity/impulsivity levels were associated with being prescribed an ADHD medication in univariate models, when both symptom domains were entered into multivariate models, only parent-reported inattention symptoms retained their effect. A possible explanation is that inattention symptoms are more strongly associated with academic impairments than hyperactivity/impulsivity symptoms.[45-48] Academic impairments, in turn, lead parents to seek ADHD evaluation and treatment.[49,50] In fact, Fiks et al reported that the goal of improving child academic performance predicted parental preference for ADHD medication as opposed to behavioral treatment.[49] Further

evidence of the role of academic impairments in explaining the relationship between inattention symptoms and medication prescribing comes from the strong univariate relationship between parent and teacher ratings of academic impairment and medication prescribing documented in our study.

Children from neighborhoods with higher household medical expenditures were more likely to receive ADHD prescriptions. Prior studies—with varied findings—have examined socioeconomic status as a predictor of ADHD medication use: some found that higher income predicts increased medication use,[1,2,7,8,13,22,25,40] and others linked higher income to decreased prescriptions.[10,15,24] Our study did not find an association between household income and ADHD medication prescription, possibly because we used a referred sample. Most prior studies were conducted in epidemiological samples, in which medication receipt is assessed regardless of the family's concern about ADHD or interest in ADHD treatment. Hence, decreased medication prescription in low-income participants in epidemiological studies may be reflective of ADHD under-recognition. In contrast, variation in ADHD care seeking was not a factor in our study because all our families sought ADHD care. A possible reason why higher household expenditure might predict ADHD medication prescribing in the absence of an income-related effect may be that certain neighborhoods have a culture that prioritizes healthcare-seeking behaviors, as reflected in their healthcare spending. Therefore, people living in these neighborhoods may be more likely to seek best practice care: for ADHD in school-aged children, stimulant medications and/or behavioral therapy are recommended as first-line treatment.[4,5]

Variables not significantly associated with ADHD medication prescribing include child race and living in an urban/suburban/rural area. In previous epidemiological studies, the relationship between race and stimulant use has been mixed; some studies reported higher stimulant use in white non-Hispanic children[8,9,11-13,18-22] compared with

African American and Hispanic children, whereas other investigations did not document this association.[1,3,26] Similarly, some studies found increased ADHD medication use in children living in urban areas[6,13,14,19,20,23,24] and other studies did not.[3,10] Potential reasons why some epidemiological studies may have linked race and region of residence include possible racial or geographic variation in pre-referral factors, such as differential access to healthcare or different parental attitudes about ADHD and ADHD medication. However, when examining the roles of race, income, and geography among a sample of children who are all presenting for ADHD care, these factors become nonissues.

Previous studies have not documented a consistent association between mental health comorbidities and ADHD medication use. Although some studies have reported higher use of ADHD medications in children with comorbid mental health conditions, especially externalizing problems,[3,6,27] other studies have shown no association[14] or even lower rates of ADHD medications[8] among children who have mental health comorbidities. We found that dimensional ratings of broad-band comorbid externalizing and internalizing problems did not predict receipt of medication prescriptions.

Contrary to our hypotheses, we did not find any physician characteristic that was linked to ADHD medication prescription. Previously, Bokhari et al reported increased ADHD medication use in areas with more younger physicians (<55 years old) and hypothesized that more recent medical education programs offer more ADHD care training.[25] The physicians in our sample tended to be younger: we lacked many older physicians (≥55 years old), which could explain why we found no age effect.

This study's findings must be interpreted in light of study limitations. First, the participating community-based practices may differ from typical practices because all of them volunteered to participate in a QI intervention focused on improving ADHD care. Thus, they were likely highly interested in ADHD care and may have been more cognizant of ADHD best practices. Despite this factor, our rates of ADHD medication receipt were comparable with the rates from nationally representative data of outpatient visits (68% vs 73%).[40] Two major occurrences in the past decade may have impacted prescribing patterns for children with ADHD: the 2011 release of the updated American Academy of Pediatrics ADHD Clinical Practice Guideline (which likely increased physician awareness of ADHD and recommended diagnostic and treatment practices)[4] and the 2013 release of the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders*, fifth edition[51] (which likely increased ADHD diagnostic and treatment rates due to changes in the age of onset criteria from 7 to 12 years old).[52] Because our data collection occurred from August 2010 to December 2012, a significant portion of our collected data overlapped with the American Academy of Pediatrics 2011 ADHD Guidelines release and likely reflects changes in prescribing patterns due to these national awareness and training efforts.

However, our data do not capture changes in prescribing patterns related to the *Diagnostic and Statistical Manual of Mental Disorders*, fifth edition.

Even though our sample was limited geographically (ie, central and northern Ohio) and the results may not generalize to practices outside our study region, the rates of ADHD diagnosis (11.4% [US range, 4.9%-14.3%]) and medication use (6.7% [US range, 2.4%-11.1%]) in Ohio are mid-range according to the 2016-2017 National Survey of Children's Health.[53] Nonetheless, results may not generalize to states where ADHD medication rates are in particularly low (eg, 2.4% of children in California) or high (eg, 11.1% of children in Mississippi). Further, the small sample size may have limited the statistical power of our study and our results can only be generalized to pediatric settings because family responsiveness to pharmacologic treatment could theoretically be different if the child is diagnosed in a different setting (eg, by a psychologist or psychiatrist). In addition, our study did not specifically examine whether or not each child was evaluated by his or her pediatrician according to all elements of the ADHD clinical practice guidelines (including collection of family and psychosocial histories). Nonetheless, in this sample both parent and teacher rating scales at assessment were collected for 79% of children. The congruence of this rate with those reported in the literature for primary care clinicians' collection of parent and teacher rating scales at ADHD assessment (68%-77% for parent ratings and 67%-84% for teacher ratings)[54,55] supports the generalizability of our findings. Ultimately, however, we are unable to ascertain why some children received ADHD medication, even though their study-collected ADHD rating scale results did not meet ADHD diagnostic thresholds. Thus, further study is needed to better understand the reasons why treatment choices may in some cases be discrepant from apparent diagnostic status both in research studies and in real-world clinical settings.

Furthermore, our data related to household income, number of people in the household, and household medical expenditures were derived from zip code-level variables from the American Community Service data and thus characterize the neighborhoods in which families live, but may not accurately capture individual family characteristics. Unfortunately, the American Community Service data do not have information on the availability of community mental health clinics, specialty mental health facilities, or behavioral health providers in each geographic area so we are not able to evaluate these factors. In addition, we studied elementary school-aged children, which may explain why we did not find an association between age and ADHD medication prescription. Prior studies that found an age effect compared adolescent with elementary school-aged children.[6,13,14,19,20] Last, our study did not measure some factors that may impact ADHD medication prescribing (eg, parental attitudes and beliefs about medication and medical comorbidities such as tics or heart problems).

We found that pediatricians are less likely to prescribe ADHD medications to children with certain sociodemographic and

clinical characteristics. An important next step will be to better understand the source (ie, child, parents, pediatrician) and reasons (eg, attitudes and beliefs about medications) for these disparities, thereby providing a foundation for developing strategies to minimize these barriers and improve treatment delivery for children with ADHD from diverse populations. ■

Data Statement

Data sharing statement available at www.jpeds.com.

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Table III. Correlations between predictors of ADHD medication prescription

Predictors	Sex	Inattention (parent)	Hyperactivity-impulsivity (parent)	Academic impairment (parent)	Participation in activities (parent)	Inattention (teacher)	Following directions (teacher)	Assignment completion (teacher)	Organization of materials (teacher)	Household expenditures for medical services	Academic impairment (teacher)
Sex		−0.01	0.04	−0.01	0.04	0.08	0.07	0.08	0.06	−0.01	0.02
Inattention (parent)			0.38*	0.18*	0.30*	0.16†	0.12‡	0.17*	0.16†	0.07	0.6
Hyperactivity-impulsivity (parent)				−0.05	0.25*	0.06	0.08	0.06	0.05	−0.04	−0.04
Academic Impairment (parent)					0.19*	0.22*	0.07	0.14†	0.13†	−0.03	0.57*
Participation in activities (parent)						0.15*	0.07	0.14*	0.13*	−0.03	0.57
Inattention (teacher)							0.68*	0.67*	0.63*	0.03	0.42*
Following directions (teacher)								0.58*	0.54*	0.03	0.31*
Assignment completion (teacher)									0.65*	−0.05	0.40*
Organization of materials (teacher)										−0.04	0.23*
Household expenditure for medical services											−0.09
Academic impairment (teacher)											

*P < .001.
†P < .01.
‡P < .05.