Treatment of Attention Deficit/Hyperactivity Disorder among Children with Special Health Care Needs

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Objectives To describe the parent-reported prevalence of treatments for attention deficit/hyperactivity disorder (ADHD) among a national sample of children with special health care needs (CSHCN), and assess the alignment of ADHD treatment with current American Academy of Pediatrics guidelines.

Study design Parent-reported data from the 2009-2010 National Survey of Children with Special Health Care Needs allowed for weighted national and state-based prevalence estimates of medication, behavioral therapy, and dietary supplement use for ADHD treatment among CSHCN aged 4-17 years with current ADHD. National estimates were compared across demographic groups, ADHD severity, and comorbidities. Medication treatment by drug class was described.

Results Of CSHCN with current ADHD, 74.0% had received medication treatment in the past week, 44.0% had received behavioral therapy in the past year, and 10.2% used dietary supplements for ADHD in the past year. Overall, 87.3% had received past week medication treatment or past year behavioral therapy (both, 30.7%; neither, 12.7%). Among preschool-aged CSHCN with ADHD, 25.4% received medication treatment alone, 31.9% received behavioral therapy alone, 21.2% received both treatments, and 21.4% received neither treatment. Central nervous system stimulants were the most common medication class (84.8%) among CSHCN with ADHD, followed by the selective norepinephrine reuptake inhibitor atomoxetine (8.4%).

Conclusion These estimates provide a benchmark of clinical practice for the period directly preceding issuance of the American Academy of Pediatrics' 2011 ADHD guidelines. Most children with ADHD received medication treatment or behavioral therapy; just under one-third received both. Multimodal treatment was most common for CSHCN with severe ADHD and those with comorbidities. Approximately one-half of preschoolers received behavioral therapy, the recommended first-line treatment for this age group. *(J Pediatr 2015; ■: ■-■).*

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Attention deficit/hyperactivity disorder (ADHD) is a neurodevelopmental disorder[1] commonly managed by pediatricians.[2] Professional guidelines describe best practices for diagnosis[1] and treatment.[3,4] The 2011 American Academy of Pediatrics (AAP) guidelines were expanded to include all children aged 4-18 years, with special considerations for preschoolers and adolescents. The AAP now recommends behavioral therapy first for preschool-aged children, with short-acting methylphenidate prescribed if therapy does not sufficiently improve symptoms. For older children, a Food and Drug Administration–approved ADHD medication with or without behavioral therapy is recommended.[3] Combination therapy (medication and behavioral therapy) is preferred, particularly for elementary-aged children.

In 2011, 6.4 million children aged 4-17 years (11%) had a parent report of an ADHD diagnosis by a health care provider.[5] Prevalence estimates of parent-reported ADHD increased by 33% from 1997 to 2008.[6] As ADHD diagnoses have increased, so has the prevalence of children taking medications for ADHD (ie, medicated ADHD).[2,7,8] Although there is earlier evidence of increased stimulant use among preschoolers with ADHD,[9] less is known about recent treatment patterns in very young children. Many children with ADHD

AAP	American Academy of Pediatrics
ADHD	Attention deficit/hyperactivity disorder
CNSS	Central nervous system stimulant
CSHCN	Children with special health care needs
NS-CSHCN	National Survey of Children with Special Health Care Needs
SNRI	Selective norepinephrine reuptake inhibitor

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S.C. receives support for research on navigated transcranial magnetic stimulation from Nextstim Oy. The other authors declare no conflicts of interest. The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention or the Health Resources and Services Administration.

0022-3476/$ - see front matter. Published by Elsevier Inc.
http://dx.doi.org/10.1016/j.jpeds.2015.02.018

not treated with medication receive behavioral or alternative therapies; however, little is known about the prevalence of these therapies. Epidemiologic research suggests that families of black and Hispanic children with ADHD are less likely to choose pharmacologic treatments and to regard behavioral treatments more positively[10,11]; however, population-based data on the relative frequency of nonpharmacologic ADHD treatment across racial and ethnic groups are needed to fully characterize ADHD treatment and identify any potential treatment gaps.[5]

The goals of this study were to: (1) describe the prevalence of medication, behavioral therapy, and dietary supplement use for ADHD among a national sample of children with special health care needs (CSHCN) with ADHD; (2) identify differences in prevalence by relevant demographic factors; and (3) assess the alignment of treatment patterns to the AAP's age group–specific guidelines.[3]

Methods

The 2009-2010 National Survey of Children with Special Health Care Needs (NS-CSHCN) is a nationally representative, population-based telephone survey conducted by the Centers for Disease Control and Prevention with funding and direction from the Health Resources Services Administration. Data were collected between July 2009 and March 2011.[12] Secondary analyses of these de-identified, existing survey data was considered exempt from Centers for Disease Control and Prevention institutional review board review. A knowledgeable parent or guardian in the household responded to a 5-part screen to determine whether any children aged 2-17 years in the household met the criteria of having a special health care need. A child was considered a CSHCN if he or she met one or more of the following criteria because of a medical, behavioral, or other health condition that had lasted or was expected to last 12 or more months: needs or uses medicine other than vitamins prescribed by a doctor; needs or uses more medical care, mental health, or educational services than is usual for most children of the same age; is limited or prevented in any way in his or her ability to do the things most children of the same age can do; needs or gets special therapy, such as physical, occupational, or speech therapy; or has any kind of emotional, developmental, or behavioral problem for which he or she needs treatment or counseling.[13]

Nationally, a total of 372 698 children were screened for a special health care need; of these, detailed interviews were completed for 40 242 CSHCN (1 selected at random per eligible household). The overall response rate was 25.5%, which incorporates a 43.7% response rate among those contacted by landline and a 15.2% response rate among those contacted by cell phone. The interview completion rate among eligible families was 81% overall, including 84% of landline households and 77% of cell phone families.

The survey included questions on family demographics, health care services, and presence of selected health conditions, including ADHD. Parents were asked whether their child had ever been diagnosed with ADHD by a doctor or other health care provider, and if so, whether the child currently had ADHD. For those with current ADHD, follow-up questions assessed parent-reported severity level (mild, moderate, or severe) and ADHD medication use during the past week and past year. Parents completing the survey in the last 5 of 6 quarters were also asked a series of more specific ADHD treatment questions. If medication was used in the past week, then the parent was asked to list medication(s) taken; because many respondents were at home during the telephone survey, they were asked to read the medication names directly from the medication bottles.

Medications were grouped into 6 categories: central nervous system stimulants (CNSSs), selective norepinephrine reuptake inhibitors (SNRIs), selective serotonin reuptake inhibitors, atypical antipsychotics, centrally acting alpha-agonist hypotensive agents, and centrally acting alpha-adrenergic receptor agonists (**Appendix**; available at www.jpeds.com). Parents were also asked whether their child had received behavioral treatment for attention deficit disorder or ADHD, including classroom management, peer interventions, social skills training, or cognitive-behavioral therapy in the past year, and whether their child had taken dietary supplements to treat ADHD in the past week or past year.

Weighted analyses using SAS-callable SUDAAN version 11.0.0 (RTI International, Durham, North Carolina) were conducted to produce estimates of current ADHD prevalence among CSHCN aged 4-17 years as well as the prevalence of ADHD medication use overall and by medication class, behavioral therapy, and dietary supplement use to treat ADHD among CSHCN at the national and state levels. National estimates of combination therapy (defined as past week medication treatment and past year behavioral therapy) were described as well. National treatment estimates were compared using the χ^2 test, stratified by child sex, child age, child race/ethnicity, US region of residence, health insurance status, presence of a medical home (a model of primary care that is patient-centered, comprehensive, team-based, coordinated, accessible, and focused on quality and safety),[14] parent perception of ADHD severity, and presence of current co-occurring mental or developmental conditions (referred to as co-occurring conditions). Co-occurring conditions included in this analysis were depression, anxiety problems, behavioral or conduct problems (eg, oppositional defiant disorder, conduct disorder), autism spectrum disorders, developmental delay, and intellectual disability. Multiple imputation was used by the National Center for Health Statistics to create values for respondents with missing data on household income (7.9% missing), parental education (0.9%), race/ethnicity (0.7%), and household language (0.5%); imputed values were incorporated into the analyses for these variables.[12]

Results

Among all completed NS-CSHCN interviews (n = 40 242), 9459 CSHCN aged 4-17 years had current ADHD, valid responses to the ADHD treatment questions, and complete data on sex. The demographic profile of the sample and this population is presented in **Table I** (available at www.

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jpeds.com). Among all CSHCN, the weighted estimate of parent-reported current ADHD was 32.3% (95% CI, 31.5%-33.2%).

Medication Treatment

Of the CSHCN with parent-reported current ADHD, 82.6% (95% CI, 81.1%-84.1%) had taken medication for ADHD in the past year and 74.0% (95% CI, 72.3%-75.7%) had done so in the past week. Young CSHCN (aged 4-5 years) with current ADHD were least likely to have taken medication in the past week. A larger percentage of boys had taken medication in the past week compared with girls, although this difference did not reach statistical significance (P = .06; Table II).

CSHCN who were uninsured, without a medical home, lived in the west, with mild ADHD, or with a co-occurring condition were less likely to have taken medication in the past week (Table II and Figure 1). Compared with non-Hispanic white CSHCN, CSHCN of other racial and ethnic groups were less likely to have taken medication for ADHD in the past week. State-level prevalence of current medication treatment among CSHCN with ADHD ranged from 56.6% (California) to 87.5% (Michigan) (Figure 1).

Past Year Behavioral Therapy

Among CSHCN with current ADHD, 44.0% (95% CI, 42.2%-45.8%) had received behavioral therapy in the past year. CSHCN with ADHD aged ≥12 years were less likely than the youngest children (aged 4-5 years) to have received behavioral therapy in the previous year. CSHCN with current ADHD living below the federal poverty level were more likely to receive behavioral therapy than those above 200% of the federal poverty level. Other groups more likely to have received behavioral therapy included those with public insurance (relative to nonpublic insurance), those without a medical home, and those with moderate or severe ADHD (compared with mild ADHD) (Table II and Figure 2). Behavioral therapy in the past year was less common

Table II. Prevalence of treatment for ADHD among CSHCN aged 4-17 years with parent-reported current ADHD by demographic subgroups, NS-CSHCN, 2009-2010

	Took ADHD medication in past week		Used behavioral therapy in past year		Used dietary supplements in past year	
Characteristics	% (95% CI)	PR*	% (95% CI)	PR*	% (95% CI)	PR*
Overall	74.0 (72.3-75.7)		44.0 (42.2-45.8)		10.2 (9.2-11.4)	
Sex						
Boys	75.1 (73.1-77.1)	1.05 (1.00-1.11)	44.4 (42.3-46.5)	1.03 (0.94-1.13)	10.2 (9.0-11.6)	1.00 (0.78-1.28)
Girls	71.5 (68.3-74.5)	Ref.	43.2 (39.9-46.5)	Ref.	10.2 (8.3-12.6)	Ref.
Age, y						
4-5	46.6 (36.9-56.7)	Ref.	53.2 (42.9-63.1)	Ref.	15.3 (9.8-23.2)	Ref.
6-11	77.2 (74.5-79.6)	**1.66 (1.33-2.06)**	47.5 (44.7-50.2)	0.89 (0.73-1.09)	11.4 (9.8-13.3)	0.75 (0.47-1.18)
12-17	73.1 (70.8-75.3)	**1.57 (1.26-1.95)**	40.4 (38.0-42.8)	**0.76 (0.62-0.93)**	8.8 (7.5-10.4)	**0.57 (0.36-0.91)**
Non-Hispanic White†	78.2 (76.5-79.8)	Ref.	40.9 (39.0-42.9)	Ref.	9.6 (8.5-10.8)	Ref.
Non-Hispanic Black†	66.8 (61.5-71.7)	**0.85 (0.79-0.92)**	49.4 (44.1-54.7)	**1.21 (1.07-1.36)**	10.7 (7.7-14.8)	1.12 (0.79-1.59)
Hispanic†	69.5 (63.3-75.0)	**0.89 (0.81-0.97)**	50.8 (44.5-57.0)	**1.24 (1.09-1.42)**	13.1 (9.4-18.0)	1.37 (0.97-1.94)
Other†	59.8 (51.4-67.6)	**0.76 (0.67-0.88)**	48.6 (41.3-55.9)	**1.19 (1.01-1.39)**	9.7 (6.4-14.4)	1.01 (0.66-1.55)
Parental education						
Less than high school†	74.6 (68.6-79.8)	1.01 (0.93-1.10)	41.0 (34.5-47.8)	0.91 (0.77-1.08)	9.6 (6.1-14.7)	0.83 (0.53-1.31)
High school graduate†	74.6 (70.9-77.9)	1.01 (0.96-1.07)	43.0 (39.1-46.9)	0.96 (0.86-1.06)	6.6 (4.9-8.8)	**0.57 (0.42-0.78)**
More than high school†	73.8 (71.7-75.7)	Ref.	44.9 (42.9-47.0)	Ref.	11.6 (10.3-13.0)	Ref.
<100% poverty level†	74.3 (71.0-77.3)	1.01 (0.96-1.06)	47.6 (43.9-51.4)	**1.13 (1.03-1.25)**	8.0 (6.1-10.4)	**0.69 (0.52-0.93)**
100%-200% poverty level†	74.7 (71.0-78.0)	1.01 (0.96-1.07)	44.6 (40.6-48.6)	1.06 (0.95-1.18)	9.6 (7.5-12.3)	0.83 (0.63-1.10)
>200% poverty level†	73.6 (71.2-76.0)	Ref.	42.1 (39.7-44.5)	Ref.	11.5 (10.1-13.2)	Ref.
English as primary language†	74.5 (72.7-76.1)	Ref.	43.5 (41.7-45.3)	Ref.	10.2 (9.1-11.4)	Ref.
Other language as primary†	61.5 (48.8-72.9)	0.83 (0.68-1.01)	59.4 (47.1-70.6)	**1.36 (1.11-1.68)**	11.2 (6.6-18.4)	1.10 (0.65-1.87)
Northeast	70.2 (66.2-73.9)	**1.12 (1.01-1.24)**	53.2 (48.9-57.4)	1.08 (0.95-1.24)	10.2 (8.0-12.8)	0.73 (0.51-1.03)
Midwest	81.0 (78.1-83.4)	**1.29 (1.17-1.42)**	42.9 (39.7-46.2)	0.87 (0.77-1.00)	7.1 (5.7-8.9)	**0.51 (0.36-0.72)**
South	76.2 (73.8-78.5)	**1.21 (1.11-1.33)**	39.1 (36.5-41.7)	**0.80 (0.70-0.90)**	10.5 (8.9-12.3)	0.75 (0.55-1.02)
West	62.7 (57.1-68.0)	Ref.	49.1 (43.9-54.3)	Ref.	14.0 (10.7-18.0)	Ref.
Nonpublic insurance	74.4 (72.1-76.5)	Ref.	38.2 (35.9-40.5)	Ref.	11.2 (9.8-12.7)	Ref.
Public insurance	75.1 (72.4-77.6)	1.01 (0.96-1.06)	49.9 (47.1-52.7)	**1.31 (1.20-1.42)**	8.9 (7.3-10.7)	**0.79 (0.63-1.00)**
No insurance	50.0 (40.1-59.9)	**0.67 (0.55-0.82)**	44.0 (34.4-54.0)	1.15 (0.91-1.45)	17.9 (10.6-28.6)	1.60 (0.95-2.69)
Medical home	81.3 (79.1-83.3)	Ref.	34.3 (31.8-36.9)	Ref.	7.1 (5.8-8.6)	Ref.
No medical home	70.3 (67.9-72.6)	**0.86 (0.83-0.90)**	49.9 (47.5-52.3)	**1.45 (1.33-1.59)**	12.0 (10.5-13.7)	**1.70 (1.34-2.16)**
Mild ADHD	64.8 (61.8-67.7)	Ref.	31.7 (29.0-34.6)	Ref.	9.3 (7.5-11.5)	Ref.
Moderate ADHD	77.1 (74.7-79.3)	**1.19 (1.13-1.26)**	45.6 (43.0-48.3)	**1.44 (1.29-1.60)**	9.8 (8.3-11.4)	1.05 (0.80-1.36)
Severe ADHD	82.7 (78.2-86.5)	**1.28 (1.19-1.37)**	60.5 (56.0-64.8)	**1.91 (1.70-2.14)**	12.7 (10.2-15.5)	**1.36 (1.01-1.83)**
Co-occurring condition‡	71.2 (68.8-73.4)	**0.91 (0.87-0.95)**	55.9 (53.5-58.3)	**2.10 (1.89-2.34)**	12.4 (10.9-14.0)	**1.74 (1.36-2.23)**
No co-occurring condition	78.2 (75.6-80.5)	Ref.	26.6 (24.1-29.3)	Ref.	7.1 (5.7-8.8)	Ref.

PR, prevalence ratio.
*PR in bold indicates statistically significant difference than reference group at the P = .05 level.
†Multiple imputation used to estimate value for respondents with missing data on household income (7.9% missing), parental education (0.9%), race/ethnicity (0.7%), and household language (0.5%).
‡Co-occurring conditions included parent-reported current depression, anxiety, behavioral or conduct problems (eg, oppositional defiant disorder, conduct disorder), autism spectrum disorder, developmental delay, and intellectual disability.

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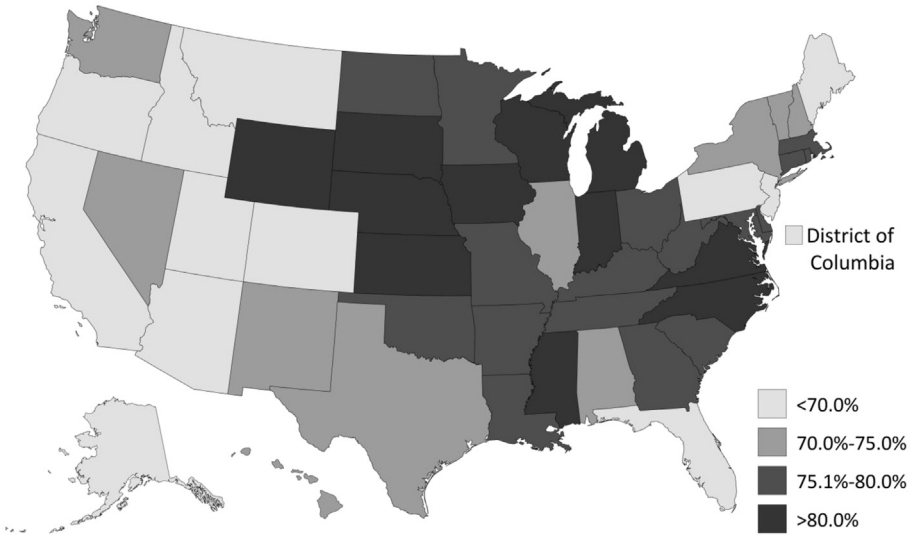

Figure 1. Parent-reported ADHD medication use in the past week among children (aged 4-17 years) with special health care needs and ADHD, 2009-2010.

among non-Hispanic white CSHCN compared with other racial/ethnic groups and was less common in the south than in the west. CSHCN with ADHD and a co-occurring condition were twice as likely as those without a co-occurring condition to have had behavioral therapy in the past year. State-level prevalence of behavioral therapy in the past year among CSHCN with ADHD ranged from 32.5% (Tennessee) to 60.6% (Hawaii) (Figure 2). There was an inverse correlation between the state-based estimates of past year behavioral therapy and past week medication treatment for ADHD (r = -0.399; P < .01).

Dietary Supplement Use

Of CSHCN with current ADHD, 10.2% (95% CI, 9.2%-11.4%) took dietary supplements for ADHD in the past year, and 6.4% (95% CI, 5.6%-7.4%) did so in the past week. CSHCN with ADHD who lived in the midwest (compared with the west) or were aged ≥12 years (compared with those aged 4-5 years) were less likely to have taken dietary supplements within the past year. Those who did not have a medical home and those with a co-occurring condition were more likely to have received dietary supplements within the past year (Table II). Dietary supplement use was

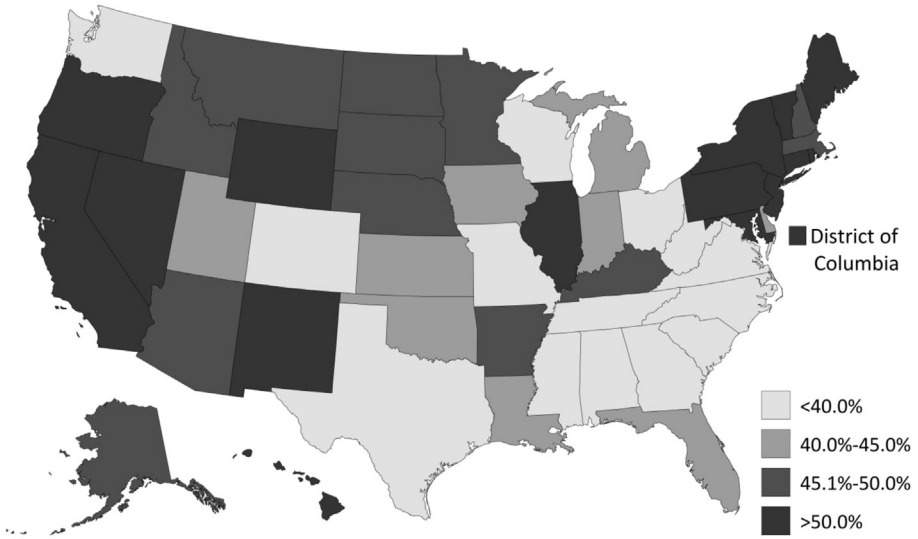

Figure 2. Parent-reported behavioral therapy for ADHD in the past year among children (aged 4-17 years) with special health care needs and ADHD, 2009-2010.

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less common among those whose parents were high school graduates (compared with those with parents with more than a high school education), with household income <100% of the federal poverty level (compared with those with a household income >200% of the federal poverty level), and with public insurance (relative to nonpublic insurance). State-level estimates of dietary supplement use in the past year among CSHCN with ADHD ranged from 3.7% (Missouri) to 18.1% (Montana) (**Figure 3**; available at www.jpeds.com).

Combination Therapy

Overall, 30.7% (95% CI, 29.1%-32.4%) of CSHCN with current ADHD were receiving both medication and behavioral therapy for ADHD (**Table III**). The percentage of CSHCN receiving either or both medication treatment or behavioral therapy to treat ADHD was 87.3% (95% CI, 85.9%-88.6%). An additional 1.2% (95% CI, 0.9%-1.6%) were taking dietary supplements alone for ADHD treatment. Thus, 88.6% (95% CI, 87.2%-89.8%) of CSHCN with ADHD were receiving at least 1 of the 3 therapies. Among the potential combinations of medication and behavioral therapy, medication treatment alone was the most common current treatment modality overall (43.3%) and for most demographic subgroups (**Table III**). Nearly one-half of CSHCN with ADHD in the following demographic groups were receiving medication treatment without behavioral therapy: non-Hispanic white CSHCN, CSHCN living in the midwest or south, CSHCN with nonpublic health insurance, and CSHCN with mild ADHD. More than one-half of CSHCN with a medical home or without a co-occurring condition were receiving medication treatment without behavioral therapy.

Descriptively, the CSHCN subgroups with the highest rates of medication and behavioral therapy were those who lived in the northeast, had public insurance, had severe

Table III. Mutually exclusive combinations of past year behavioral therapy and past week medication treatment for ADHD among CSHCN aged 4-17 years with parent-reported current ADHD by demographic subgroups, NS-CSHCN, 2009-2010

Characteristics	Behavioral therapy and medication treatment		Medication treatment only		Behavioral therapy only		Neither behavioral therapy nor medication treatment		*P* value*
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	
Overall	30.7	(29.1-32.4)	43.3	(41.6-45.1)	13.3	(12.1-14.6)	12.7	(11.4-14.1)	
Sex									
Boys	31.8	(29.9-33.8)	43.3	(41.2-45.5)	12.6	(11.2-14.1)	12.3	(10.7-14.0)	.14
Girls	28.2	(25.3-31.3)	43.3	(40.1-46.6)	15.0	(12.6-17.7)	13.5	(11.4-16.0)	
Age, y									
4-5	21.2	(15.1-29.1)	25.4	(17.4-35.5)	31.9	(23.5-41.8)	21.4	(13.5-32.4)	
6-11	34.7	(32.2-37.3)	42.5	(39.8-45.2)	12.8	(11.0-14.7)	10.1	(8.1-12.5)	<.001
12-17	27.9	(25.7-30.1)	45.3	(42.8-47.7)	12.5	(10.9-14.4)	14.3	(12.7-16.1)	
Non-Hispanic White†	29.9	(28.1-31.8)	48.3	(46.3-50.3)	11.0	(9.8-12.3)	10.8	(9.6-12.1)	
Non-Hispanic Black†	32.3	(27.7-37.2)	34.5	(29.6-39.7)	17.1	(13.5-21.5)	16.2	(12.4-20.9)	<.001
Hispanic†	33.8	(28.1-40.0)	35.7	(30.0-41.9)	17.0	(12.5-22.7)	13.5	(10.0-18.0)	
Other†	29.0	(23.6-35.1)	30.7	(25.4-36.7)	19.6	(14.8-25.5)	20.7	(13.1-31.1)	
Parental education less than high school†	32.3	(26.2-39.0)	42.3	(35.7-49.1)	8.7	(5.9-12.6)	16.7	(12.4-22.3)	
<100% poverty level†	34.7	(31.2-38.4)	39.6	(36.0-43.3)	12.9	(10.8-15.4)	12.8	(10.6-15.5)	
100%-200% poverty level†	32.5	(28.9-36.3)	42.2	(38.3-46.2)	12.1	(9.7-14.9)	13.2	(10.7-16.3)	.03
>200% poverty level†	28.0	(26.0-30.2)	45.6	(43.2-48.0)	14.0	(12.2-16.0)	12.4	(10.5-14.5)	
English as primary language	30.4	(28.8-32.0)	44.1	(42.3-45.9)	13.1	(11.9-14.5)	12.4	(11.1-13.9)	<.001
Other language as primary	40.8	(27.8-55.1)	20.8	(13.6-30.5)	18.6	(10.6-30.8)	19.8	(12.5-30.1)	
Northeast	36.3	(32.2-40.6)	33.9	(29.9-38.1)	16.9	(14.1-20.2)	12.9	(10.4-16.0)	
Midwest	32.7	(29.7-35.9)	48.2	(44.9-51.5)	10.2	(8.3-12.4)	8.9	(7.2-11.1)	<.001
South	27.8	(25.5-30.2)	48.4	(45.7-51.2)	11.3	(9.7-13.2)	12.5	(10.8-14.4)	
West	29.9	(25.5-34.8)	32.8	(28.7-37.3)	19.2	(15.2-24.0)	18.1	(13.6-23.7)	
Nonpublic insurance	26.0	(24.0-28.0)	48.4	(46.1-50.8)	12.2	(10.6-14.0)	13.4	(11.8-15.2)	
Public insurance	36.1	(33.5-38.7)	39.0	(36.4-41.8)	13.9	(12.1-15.9)	11.0	(9.1-13.4)	<.001
No insurance	22.5	(15.8-31.0)	27.5	(19.5-37.3)	21.5	(14.1-31.4)	28.6	(20.2-38.7)	
Medical home	25.5	(23.3-27.9)	55.8	(53.1-58.4)	8.8	(7.4-10.4)	9.9	(8.4-11.7)	
No medical home	34.2	(31.9-36.5)	36.2	(33.9-38.5)	15.8	(14.0-17.7)	13.9	(12.1-16.0)	<.001
Mild ADHD	16.6	(14.6-18.7)	48.2	(45.3-51.2)	15.1	(12.9-17.7)	20.1	(17.7-22.7)	
Moderate ADHD	32.6	(30.2-35.2)	44.5	(41.8-47.1)	13.0	(11.2-14.9)	10.0	(8.4-11.7)	<.001
Severe ADHD	49.6	(45.3-53.9)	33.1	(29.3-37.2)	10.9	(8.5-13.8)	6.4	(3.6-11.2)	
Co-occurring condition‡	38.9	(36.7-41.2)	32.3	(30.1-34.6)	17.0	(15.3-18.9)	11.8	(10.1-13.8)	<.001
No co-occurring condition	18.7	(16.6-21.0)	59.5	(56.7-62.2)	7.9	(6.3-9.9)	13.9	(12.1-16.0)	

*The χ^2 *P* value testing for difference in distribution among the 4 treatment categories (past year behavioral therapy and past week medication, past week medication alone, past year behavioral therapy alone, neither past week medication nor past year behavioral therapy) between demographic groups.
†Multiple imputation used to estimate value for respondents with missing data on household income (7.9% missing), parental education (0.9%), race/ethnicity (0.7%), and household language (0.5%).
‡Co-occurring conditions included parent-reported current depression, anxiety, behavioral or conduct problems (such as oppositional defiant disorder or conduct disorder), autism spectrum disorder, developmental delay, and intellectual disability.

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ADHD, and had a co-occurring condition (Table III). The CSHCN subgroups with the highest rates of no ADHD medication treatment and no behavioral therapy were those aged 4-5 years, of another race, who spoke a primary language other than English, who lived in the West, who did not have health insurance, and who had mild ADHD. There was no statistically significant difference in treatment modalities between boys and girls.

Of CSHCN who were receiving both medication treatment and behavioral therapy, 14.2% (95% CI, 12.1%-16.5%) were also taking dietary supplements. The rate of dietary supplement use was 5.1% (95% CI, 4.1%-6.4%) in CSHCN receiving medication treatment but not behavioral therapy and 18.4% (95% CI, 14.4%-23.3%) in CSHCN receiving behavioral therapy but not medication treatment. Overall, 9.3% (95% CI, 6.9%-12.5%) of CSHCN who received neither medication treatment nor behavioral therapy were taking dietary supplements.

Among CSHCN aged 4-5 years, 25.4% (95% CI, 17.4%-35.5%) were receiving medication treatment alone, 31.9% (95% CI, 23.5%-41.8%) were receiving behavioral therapy alone, and 21.2% (95% CI, 15.1%-29.1%) were receiving both treatments (Table III). The remaining 21.4% (95% CI, 13.5%-32.4%) of CSHCN aged 4-5 years did not receive either behavioral therapy or medication treatment.

Medication Treatment by Medication Class

Of CSHCN with ADHD who took medication for ADHD in the past week, 84.8% (95% CI, 83.3%-86.3%) took a CNSS medication, with a little more than one-half of these being methylphenidate formulations (55.8%; 95% CI, 53.6%-58.0%). Of all CSHCN taking medication for ADHD, 47.3% (95% CI, 45.3%-49.4%) took a methylphenidate formulation. The second most commonly reported medication class was SNRIs; use of the SNRI atomoxetine was reported in 8.4% (95% CI, 7.4%-9.6%) of CSHCN who were taking medication for ADHD. A smaller proportion of children were taking medication from each of 4 other drug classes reported for the treatment of ADHD: atypical antipsychotics, 5.7% (95% CI, 4.7%-6.8%); selective serotonin reuptake inhibitors, 3.1% (95% CI, 2.4%-4.0%); centrally acting alpha-agonist hypotensive agents (clonidine), 4.1% (95% CI, 3.3%-5.0%); and centrally acting alpha-adrenergic receptor agonists (guanfacine), 4.3% (95% CI, 3.6%-5.2%).

Discussion

This US study establishes the relative national prevalence of reported ADHD treatments, specifically medication treatment and behavioral therapy, as well as the use of dietary supplements for the treatment of ADHD, among CSHCN in 2009-2010. In this national sample of CSHCN, approximately 87% of children with parent-reported current ADHD were receiving either medication treatment or behavioral therapy, with an additional 1.2% receiving dietary supplements alone as an alternative treatment. Medication treatment alone was the most common treatment for ADHD, with nearly one-half of CSHCN with current ADHD taking medication alone for treatment. The most common drug class of ADHD medications was CNSSs, with nearly 85% taking a medication in this drug class.

The inverse relationship observed between state-level medication and behavioral treatment estimates informs previous discussions about the geographic variability in ADHD medication treatment,[5,15-17] and suggests that states with lower statewide estimates of behavioral therapy tend to have higher estimates of medication treatment.

ADHD treatment results in important and measurable improvements in the core symptoms of ADHD, with published effect sizes ranging from 0.6 for behavioral strategies and 0.7 for nonstimulant medications to 1.0 for stimulant medications.[3] In the present study, just under one-third of CSHCN with ADHD were receiving both medication treatment and behavioral therapy for ADHD. Children with severe ADHD and those with comorbidities were among those most likely to receive combination treatment. However, 56.0% of CSHCN had not received behavioral therapy in the past year. This is an important finding, given previous research suggesting the benefits of multimodal (medication plus behavioral therapy) treatment for childhood ADHD on core and peripheral features of the disorder and the AAP's recommendation of combination therapy for children aged 6-11 years.[3,11,18,19] Future research is warranted to investigate barriers to receipt of behavioral therapies for ADHD, including a lack of access owing to eligibility requirements, lack of availability in the geographic area, or cost barriers (including insurance coverage).

This study reveals that non-Hispanic white CSHCN were more likely to receive medication treatment for ADHD, whereas CSHCN of all other races and ethnicities were more likely to receive behavioral therapy for ADHD, and rates of combination therapy (medication and behavioral therapy) were similar across racial groups. These findings are consistent with research suggesting more favorable perceptions of behavioral therapy and less favorable views of medications among black and Hispanic parents compared with white parents.[20] Approximately 20% of the CSHCN of "other" races and children who were reported to speak a primary language other than English were receiving neither medication treatment nor behavioral therapy for ADHD, representing a potential service gap.

For preschool-aged (4-5 years) CSHCN with an ADHD diagnosis, the prevalence rates of each of the 4 treatment groups (medication alone, medication plus behavioral therapy, behavioral therapy alone, and neither behavioral nor medication treatment) were similar. Although recommended as a first-line treatment for ADHD,[3] behavioral therapy was provided to only slightly more than one-half (53.2%) of preschool-aged CSHCN with ADHD in the past year. These data provide an important benchmark for clinical practice, because they were collected in the years just before the release of the AAP's 2011 diagnostic and treatment guidelines for ADHD.[3] The AAP guidelines currently recommend behavioral therapy as a first-line treatment for ADHD among

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preschoolers, with methylphenidate prescribed when persistent, significant functional impairment persists.

A recent comparative effectiveness study identified 4 behavioral interventions for preschool-aged children with ADHD,[21] but these and other high-quality interventions might not be available to children in medically underserved settings in which there is limited access. Ongoing surveillance and future research on ADHD practice patterns for preschoolers will improve our understanding of the barriers to providing behavioral services that may be limiting our ability to more closely align clinical practice with best practices.

Strengths of this study include analysis of a large, nationally representative sample of CSHCN; collection of ADHD medication treatment by asking parents to read the name of the medication directly from available prescription bottles, thereby reducing recall bias; and concurrent collection of medication treatment, behavioral therapy, and dietary supplement use for ADHD treatment. Our results should be considered within the context of certain limitations, however. The analyses were based on parent-reported data that were not clinically validated. As reported previously,[13] the vast majority of children with ADHD meet the criteria for classification as CSHCN; however, approximately 13% of children with ADHD do not meet these criteria[22] and thus are not represented by these data. The children with ADHD who met the criteria for CSHCN included in this study may be more impaired and have different treatment patterns than children with ADHD who do not meet these CSHCN.

In addition, the behavioral therapy question was somewhat broad, asking about "behavioral treatment for ADHD, such as classroom management, peer interventions, social skills training, or cognitive-behavioral therapy"; the data did not allow differentiation of treatment intensity or treatment quality, and thus low-intensity school-based interventions were counted with intensive multimonth, structured behavioral therapy programs. Furthermore, some children were likely receiving other treatments for ADHD that were not included in the survey (eg, neurofeedback), and thus the total prevalence of any treatment for ADHD likely was underestimated. Finally, the response rates of the NS-CSHCN (landline, 43.7%; cell phone, 15.2%; combined, 25.5%) were low and could have led to biased results, despite the fact that weighting accounted for nonresponse.

This study represents the first nationally representative US study to estimate behavioral treatment and dietary supplement use in the treatment of ADHD, alongside estimates of medication treatment for ADHD. The relative percentages reveal that medication was the most common single ADHD treatment in 2009-2010, followed by combination therapy (medication and behavioral therapy), and then behavioral therapy alone. Future research can help improve our understanding of the barriers to the provision of behavioral therapy for childhood ADHD, particularly among the preschool population. ■

Submitted for publication Oct 24, 2014; last revision received Jan 2, 2015; accepted Feb 6, 2015.

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Appendix. Categories of medications taken in the past week to treat ADHD by parent report, NS-CSHCN, 2009-2010

Drug class*	Medications included†
CNSS	Adderall, Adderall XR, amphetamine Concerta Daytrana Patch Dexedrine, Dexedrine Spansule, Dextrostat, dextroamphetamine Dexmethylphenidate Focalin, Focalin XR Metadate, Metadate CD Methylin methylphenidate Ritalin, Ritalin LA, Ritalin SR Vyvanse, lisdexamfetmine
SNRI	Strattera, atomoxetine
SSRI	Celexa, citalopram Prozac, fluoxetine Zoloft, sertraline
Atypical antipsychotics	Abilify Risperdal, risperidone, Risperdol
Centrally acting alpha-agonist hypotensive agents	Clonidine
Centrally acting alpha 2A adrenergic receptor agonists	Guanfacine, Intuniv, Tenex

SSRI, selective serotonin reuptake inhibitor.
*Drug class determined from http://www.nlm.nih.gov/medlineplus/medlineplus.html.
†Seroquel, Trazadone, and Wellbutrin were reported by a small number of families, but were excluded from analyses owing to low sample size.

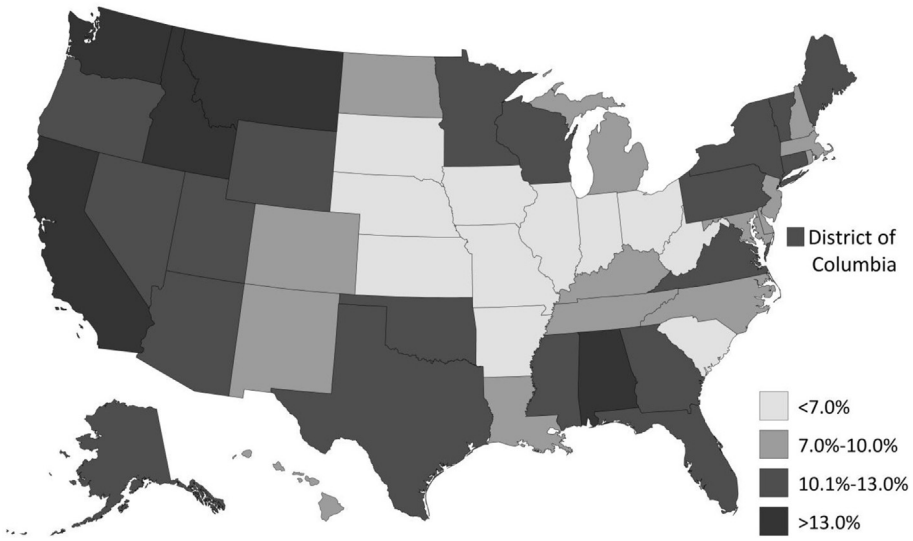

Figure 3. Parent-reported dietary supplement use for ADHD in the past year among children (aged 4-17 years) with special health care needs and ADHD, 2009-2010.

Table I. Characteristics of CSHCN aged 4-17 who currently have ADHD by parent report, NS-CSHCN, 2009-2010

Characteristics	Unweighted, n	Weighted, %	95% CI
Sex			
Boys	6769	69.8	(68.1-71.5)
Girls	2690	30.2	(28.5-31.9)
Age, y			
4-5	280	3.4	(2.8-4.1)
6-11	4235	45.1	(43.3-46.9)
12-17	4944	51.5	(49.7-53.3)
Non-Hispanic White, single race*	6845	64.9	(63.0-66.7)
Non-Hispanic Black, single race*	896	15.1	(13.7-16.6)
Hispanic, any race(s)*	871	12.9	(11.5-14.5)
Non-Hispanic other single race or multiple races*	847	7.1	(6.2-8.2)
Highest education of a resident parent			
Less than high school*	575	12.3	(10.8-13.8)
High school graduate*	1680	22.4	(20.9-24.0)
More than high school*	7204	65.3	(63.5-67.1)
% federal poverty level			
<100%*	1896	25.0	(23.4-26.6)
100%-200%*	1955	22.6	(21.1-24.2)
>200%*	5608	52.5	(50.6-54.3)
English as primary household language*	9292	96.9	(95.9-97.6)
Other language as primary*	167	3.1	(2.4-4.1)
Region of US			
Northeast	1614	17.0	(15.8-18.3)
Midwest	2191	23.0	(21.8-24.4)
South	3572	43.4	(41.8-45.1)
West	2082	16.6	(15.2-18.1)
Type of health insurance			
Nonpublic insurance	5263	48.7	(46.9-50.5)
Public insurance	3937	48.6	(46.8-50.4)
No insurance	247	2.7	(2.2-3.3)
Medical home	3836	38.5	(36.8-40.3)
No medical home	5344	61.5	(59.7-63.2)
Parent-reported ADHD severity			
Mild	3420	33.7	(32.1-35.4)
Moderate	4279	45.2	(43.4-47.0)
Severe	1719	21.1	(19.6-22.7)
Any co-occurring conditions†	5381	59.4	(57.7-61.2)
No co-occurring condition	4013	40.6	(38.8-42.3)

*Multiple imputation used to estimate value for respondents with missing data on household income (7.9% missing), parental education (0.9%), race/ethnicity (0.7%), and household language (0.5%).

†Co-occurring conditions included parent-reported depression, anxiety, behavioral or conduct problems (eg, oppositional defiant disorder, conduct disorder), autism spectrum disorder, developmental delay, and intellectual disability.

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