Journal of Attention Disorders
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J Atten Disord 2007; 10; 335
DOI: 10.1177/1087054707299597

The online version of this article can be found at:
http://jad.sagepub.com/cgi/content/abstract/10/4/335

Published by:
SAGE Publications
http://www.sagepublications.com

Journal of Attention Disorders
Volume 10 Number 4
May 2007 335-342

10.1177/1087054707299597
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Trends in Medication Treatment for ADHD

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Objective: This study examines demographic trends in the use of medications to treat ADHD in adult and pediatric populations. **Method:** Using pharmacy claims data for a large population of commercially insured Americans, the study measures ADHD treatment prevalence and drug use from 2000 to 2005. **Results:** In 2005, 4.4% of children (ages 0 to 19) and 0.8% of adults (ages 20 and older) used ADHD medications. Treatment rates were higher in boys (6.1%) than in girls (2.6%), but the rates for men and women were approximately equal (0.8%). During the period of the study, treatment prevalence increased rapidly (11.8% per year) for the population as a whole. Treatment rates grew more rapidly for adults than for children, more rapidly for women than for men, and more rapidly for girls than for boys. **Conclusion:** Improved identification of ADHD in adult and female patients has contributed to rapid growth in ADHD medication use. (*J. of Att. Dis. 2007; 10(4) 335-342*)

Keywords: *ADHD; ADD; prescriptions; medications; medication treatment; medication trends; children; adults*

ADHD is defined by a persistent pattern of inattentive or hyperactive-impulsive symptoms that cause significant impairment in social, academic, or occupational functioning (American Psychiatric Association, 1994). Although the diagnostic criteria are neutral with respect to gender and age, the condition has been most closely associated with school-age boys—especially those with hyperactive-impulsive symptoms. National survey data indicate that school-age boys (ages 4 to 17) are approximately 2.5 times more likely than girls to be diagnosed with ADHD (Centers for Disease Control and Prevention [CDC], 2005). Some of this disparity may reflect different identification rates, as the disorder may be less prominent in girls in an educational setting (Bren, 2004).

Although ADHD has historically been perceived as a childhood disorder, there is growing public and professional awareness that it is a significant (and treatable) source of impairment for many adults (Secnik, Swensen, & Lage, 2005; Weiss & Murray, 2003; Wender, Wolf, & Wasserstein, 2001). Studies of national and community samples suggest that between one third and two thirds of children with ADHD will continue to have disabling symptoms as adults (Kessler et al., 2005; Weiss & Murray, 2003; Wender et al., 2001). Some individuals with the condition may be diagnosed for the first time as adults when accelerating demands at home or work become difficult to manage (Bren, 2004). Population data on diagnostic rates in adults are not available, but community samples suggest that diagnostic prevalence may be roughly equal for men and women (Weiss & Murray, 2003).

Clinical guidelines support the use of pharmacotherapy as one of several treatment options for ADHD in children and adults (American Academy of Child and Adolescent Psychiatry, 2002; American Academy of

Authors' Note: This research was conducted by the authors as part of their employment with Medco Health Solutions. The research was not funded by, or subject to the review of, any outside company or organization. Please address correspondence to Lon Castle, MD, Department of Medical and Analytical Affairs, Medco Health Solutions, Inc., Mail Stop F2-2, 100 Parsons Pond Drive, Franklin Lakes, NJ 07417; e-mail: lon_castle@medco.com.

Pediatrics, 2001; Goldman, Genel, Bezman, & Slanetz, 1998; National Institutes of Health, Consensus Development Panel, 1998). Medications to treat ADHD in children have been available since the 1950s, but it is only in the past few years that some ADHD medications have been approved for use with adult patients (McDonagh & Peterson, 2005). National survey data indicate that 4.3% of children (ages 4 to 17) took medications for ADHD in 2003; this was about 56% of the children who had a history of ADHD diagnosis (CDC, 2005). These survey results are informative, but they are based on self-report by parents and guardians; records of patients' prescription histories are likely to provide a more reliable measure of treatment. The survey data are also limited in scope—they only apply to pediatric populations, and they are based on a single measurement year. Data for adult populations are needed to determine treatment levels in adults and compare them to treatment levels in children. Time-series data for adult and pediatric populations are needed to gauge whether the demographic patterns of treatment have changed in response to changing perceptions of the disorder. The objective of this article is to provide a comprehensive profile of ADHD medication use across all age groups and to ascertain how that profile has changed during the past 6 years.

Method

Study Samples

The study population comprised participants in prescription benefit plans offered by employers, health plans, government organizations, and labor groups. These prescription plans were managed by Medco Health Solutions during the period of the study, January 2000 through December 2005. The study population is broadly representative of regional and national prescription benefit plans.

For each analysis year (2000 through 2005), a study sample was identified from the larger study population. Participants were initially identified for the study sample if they had continuous eligibility for prescription drug benefits throughout the analysis year. Participants were then selected randomly from the eligible population within defined demographic constraints. The constraints were designed to ensure that the final study sample matched the overall study population in age, gender, and geographic distribution. The nine National Center for Health Statistics census regions were used for matching geographic region.

Measures

Drug use data were drawn from an administrative database that tracks the pharmacy claims of plan participants. For each analysis year, prescription claims were identified for the following medications (all of which are predominantly used for the treatment of ADHD): amphetamine salt mixtures, dextroamphetamine, methamphetamine, methylphenidate, dexmethylphenidate, pemoline, and atomoxetine. The analysis included all of the available formulations of these drugs.

Treatment prevalence was defined as the percentage of participants in a study sample that received one or more prescriptions for ADHD drugs during the year. Prevalence was measured for each sample as a whole and for various subgroups defined by age and gender.

Annual prevalence growth rates were computed for the 6-year study period, using prevalence data for 2000 and 2005 as endpoints. The annual growth rate is a smoothed measure of growth; it accounts for the overall change in prevalence rates when compounded over five annual intervals.

Utilization was defined as the total days' supply of ADHD medications received by a medication user during the analysis year. It provides a measure of the intensity of medication use by individual patients.

Annual use growth rates were computed for the 6-year study period, using usage data for 2000 and 2005 as endpoints. The annual growth rate accounts for the overall change in use when compounded over five annual intervals.

Generic dispensing rate was defined as the percentage of prescriptions that were dispensed using generic products.

All measures, including exact confidence intervals, were computed using SAS version 8.0 (SAS Institute Inc, Cary, NC).

Results

Characteristics of Study Samples

The demographic characteristics of participants in the study samples are shown in Table 1. By design, these match the age and gender distribution of the overall study population.

Treatment Prevalence

The prevalence of ADHD medication use by adult and pediatric patients is shown in Table 2 for analysis years 2000 through 2005. In the most recent analysis year (2005), 4.4% of children received one or more prescriptions for ADHD medications. Use of these medications was more common among older children (ages 10 to 19) than younger children (ages 0 to 9), and boys were 2.3 times more likely to use these medications than girls. Older boys (ages 10 to 19) showed the highest prevalence

Table 1
Demographic Characteristics of Study Samples

Characteristic	Year					
	2000	2001	2002	2003	2004	2005
Sample size (*N*)	2,529,753	2,128,907	2,926,294	2,487,055	2,496,551	2,509,010
Age (%)						
0 to 9	8.9	8.7	9.3	9.1	9.0	9.1
10 to 19	13.4	13.7	14.0	13.7	13.7	13.8
20 to 44	29.4	27.2	28.8	27.7	27.8	28.3
45 to 64	28.7	30.7	29.9	30.9	32.3	32.2
65 and older	19.6	19.8	18.0	18.5	17.2	16.5
Gender (%)						
Male	49.1	48.6	49.7	48.8	48.8	48.5
Female	50.9	51.4	50.3	51.2	51.2	51.5

Table 2
Prevalence of ADHD Medication Use by Adults and Children

Age Group	Gender	Prevalence of ADHD Medication Use (%)						Annual Growth Rate (%)[a]
		2000	2001	2002	2003	2004	2005	
Pediatric								
0 to 9	Male	2.0	2.5	2.8	3.2	3.4	3.2	10.1
	Female	0.7	0.9	1.0	1.2	1.2	1.2	11.9
10 to 19	Male	5.6	5.7	6.3	7.3	8.0	8.1	7.7
	Female	1.9	2.0	2.4	2.9	3.4	3.5	13.7
All (0 to 19)	Male	4.2	4.4	4.9	5.6	6.2	6.1	8.2
	Female	1.4	1.6	1.8	2.2	2.5	2.6	13.3
	Combined	2.8	3.1	3.4	4.0	4.4	4.4	9.5
Adult								
20 to 44	Male	0.6	0.6	0.7	0.9	1.1	1.2	17.0
	Female	0.4	0.5	0.6	0.7	0.9	1.1	21.4
45 to 64	Male	0.4	0.5	0.5	0.6	0.7	0.6	7.3
	Female	0.4	0.4	0.5	0.6	0.8	0.8	16.9
65 and older	Male	0.2	0.2	0.2	0.2	0.2	0.2	0.7
	Female	0.2	0.2	0.2	0.2	0.2	0.2	5.5
All (20 and older)	Male	0.4	0.4	0.5	0.6	0.7	0.8	12.6
	Female	0.4	0.4	0.5	0.6	0.7	0.8	18.1
	Combined	0.4	0.4	0.5	0.6	0.7	0.8	15.3

a. Annual rate of increase in prevalence, on a compounded basis, from 2000 to 2005.

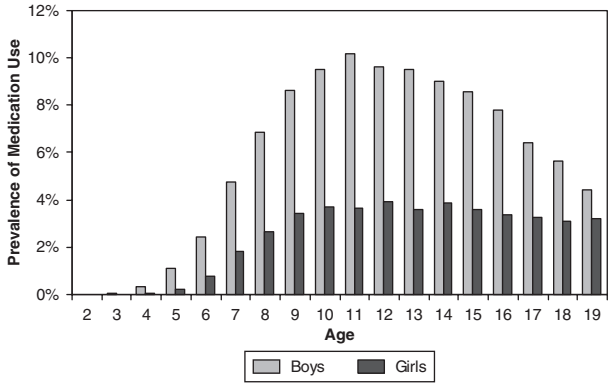
of use; 8.1% of boys in this age range used ADHD medications during 2005. Among adults, treatment prevalence was relatively low, and there was essentially no difference in treatment rates between men and women. Younger adults (ages 20 to 44) were more likely to use ADHD medications than older adults (ages 45 to 64) and seniors (ages 65 and older).

Results of a more detailed analysis of treatment prevalence in the pediatric population are presented in Figure 1. In 2005, the highest medication treatment rates were observed for boys between the ages of 10 and 13. Treatment rates for adolescent boys declined rapidly after age 13. Treatment rates for girls peaked between ages 12 and 14, and they declined only gradually after age 14.

Prevalence Trends

During the 6-year period of the study (2000 to 2005), the use of ADHD medications grew rapidly in all demographic groups except seniors (Table 2). Treatment rates increased more rapidly for adults than for children; the annual prevalence growth rate for adults was 15.3%, compared to 9.5% for children. Among adults, usage grew most rapidly for younger adults (ages 20 to 44), and

Figure 1
Age Distribution of Pediatric Users of ADHD Medications (2005)



usage grew more rapidly for women (18.1%) than for men (12.6%). Women between the ages of 20 and 44 showed the highest annual growth rate of any demographic group (21.4%). Among children, the use of ADHD medications increased more rapidly for girls (13.3%) than for boys (8.2%). Annual prevalence growth rates were higher for older girls (ages 10 to 19) than for younger girls (ages 0 to 9). Younger boys (ages 0 to 9) showed a more rapid increase in treatment rates than older boys (ages 10 to 19). For most demographic groups, the rate of prevalence growth appears to have slowed; treatment rates in 2005 were similar to those in 2004.

Usage Trends

Table 3 summarizes the average use of ADHD medications for each demographic group. In the most recent analysis year (2005), use was highest for the pediatric groups and for older adult patients (ages 45 to 64), and it was lowest for younger adult patients (ages 20 to 44) and seniors. Treatment intensity tended to be higher for boys than for girls and higher for women than for men.

During the 6-year study period (2000 to 2005), the intensity of ADHD medication treatment increased for patients in most demographic groups; annual growth rates are shown in Table 3. Use grew most rapidly for younger children (ages 0 to 9) and for adults (ages 20 to 64). Lower growth rates were observed for older children (ages 10 to 19) and for seniors. Use growth rates were similar for boys and girls, as well as for men and women.

The distribution of ADHD medication use by agent and formulation is summarized in Table 4. In the most recent analysis year (2005), pediatric patients were more likely than adult patients to use methylphenidate and atomoxetine products, and adults were more likely to use amphetamine mixtures and dextroamphetamine products. Pediatric patients were far more likely to use extended-release products than adult patients.

The profile of medication use changed markedly during the 6-year study period (Table 4). As a proportion of total days' supply, the use of methylphenidate and dextroamphetamine products declined for both children and adults, and the adult use of amphetamine mixtures increased. The new nonstimulant medication (atomoxetine) rapidly

Table 3
Utilization of ADHD Medications

Patient Group	Subgroup	Days' Supply of Medication Mean (95% CI) 2000	2005	Annual Growth Rate (%)[a]
Pediatric	Age 0 to 9	186.8 (181.8 to 191.8)	227.4 (222.9 to 231.9)	4.0
	Age 10 to 19	190.0 (187.4 to 192.6)	212.8 (210.6 to 214.9)	2.3
	Male	193.0 (190.3 to 195.7)	219.9 (217.6 to 222.3)	2.7
	Female	178.1 (173.7 to 182.6)	205.3 (201.9 to 208.7)	2.9
	All pediatric	189.4 (187.1 to 191.8)	215.7 (213.8 to 217.6)	2.6
Adult	Age 20 to 44	152.5 (148.1 to 156.8)	187.5 (184.4 to 190.7)	4.2
	Age 45 to 64	175.8 (170.5 to 181.1)	209.9 (206.1 to 213.8)	3.6
	Age 65+	158.8 (149.5 to 168.0)	180.1 (170.6 to 189.5)	2.6
	Male	159.5 (155.1 to 163.9)	192.2 (188.7 to 195.6)	3.8
	Female	165.6 (161.1 to 170.1)	198.8 (195.6 to 202.1)	3.7
	All adult	162.4 (159.2 to 165.5)	195.8 (193.4 to 198.1)	3.8

a. Annual rate of increase in use, on a compounded basis, from 2000 to 2005.

Table 4
Use of ADHD Medications by Agent and Formulation

	Pediatric (Age 0 to 19)		Adult (Age 20 and Older)	
Medication Type	2000	2005	2000	2005
Agent				
Amphetamine mix	34.1	32.4	24.5	43.4
Dextroamphetamine	9.2	1.4	14.5	6.3
Methamphetamine[a]	0.0	0.0	0.4	0.2
Methylphenidate	55.8	46.9	54.9	34.5
Dexmethylphenidate[b]	—	2.5	—	0.9
Pemoline[c]	0.9	0.0	5.6	1.1
Atomoxetine[b]	—	16.7	—	13.7
Formulation				
Extended release	8.9	68.3	6.1	43.7
Immediate release	91.1	31.7	93.9	56.3

Note: The table reports use as a percentage of the total days' supply of dispensed medications for the indicated age group. Numbers may not add because of rounding.
a. Pediatric use of methamphetamine products was less than 0.02% in each analysis year.
b. Dexmethylphenidate and atomoxetine products were first approved by the Food and Drug Administration in late 2001 and late 2002, respectively.
c. Pemoline products were withdrawn from the market in 2005.

Figure 2
Pediatric Use of Immediate-Release (IR) and Extended-Release (ER) Formulations of ADHD Medications

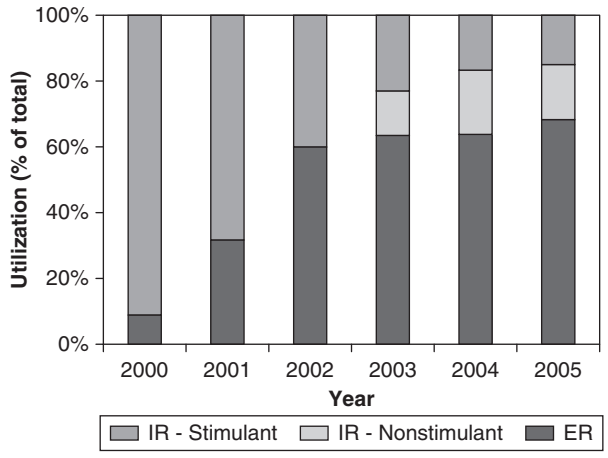
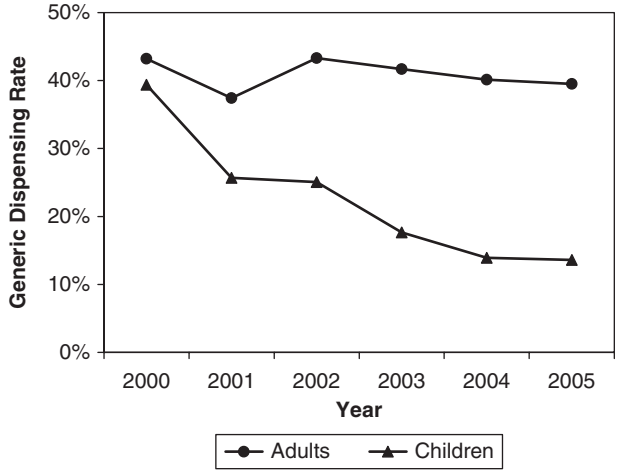


Figure 3
Use of Generic ADHD Medications (as a Percentage of Total Prescriptions)



gained market share for both children and adults following its introduction in late 2002. The use of extended-release products increased dramatically during the 6-year period, particularly for pediatric patients, as new extended-release formulations were introduced into the market. The changing profile of pediatric medication use is illustrated in Figure 2.

Generic Use

The use of generic ADHD medications declined sharply between 2000 and 2005 as a percentage of total dispensed prescriptions. Only 22.7% of ADHD prescriptions in 2005 were for generic medications, down from 40.5% in 2000. The decline was primarily associated with the pediatric use of generic drugs, which dropped sharply from 39.4% in 2000 to 13.6% in 2005 (see Figure 3). The use of generic drugs by adults changed little during the same period; the generic dispensing rate for adults declined from 43.2% in 2000 to 39.5% in 2005.

Discussion

The percentage of adults and children using ADHD medications has increased rapidly during the past 6 years.

Treatment prevalence has increased 11.8% per year in the population as a whole. Growth rates have varied by age and gender, yielding a progressive shift in the demographics of ADHD treatment. Treatment rates have been growing more rapidly for girls than for boys, more rapidly for adults than for children, and more rapidly for women than for men. Although the typical user of ADHD medications continues to be a preteen or young adolescent male (see Figure 1), the prevalence differences compared to other demographic groups have been narrowing.

The continuing disparity between ADHD treatment rates for boys and girls may be due, in part, to underdiagnosis of the condition in girls. The condition may be less visible or less identifiable in some girls (especially those with the inattentive subtype), which may lead to a delay in diagnosis or a failure to identify the condition at all. The age distribution of medication use (see Figure 1) shows a disparity in treatment rates between boys and girls at all age levels, although the disparity narrows markedly for older teenagers. The age distribution provides suggestive evidence that the diagnosis and treatment of ADHD in girls typically occurs later than in boys. The peak treatment range for girls (ages 12 to 14) is somewhat later than the peak treatment range for boys (ages 10 to 13), and treatment rates do not decline among older girls as rapidly as they decline for older boys. Prevalence growth rates also suggest a higher incidence of ADHD diagnosis among older girls (ages 10 to 19); girls in this age range showed a much faster increase in treatment rates (13.7% annually) compared to boys (7.7%). The rapid increase in ADHD treatment rates for girls is probably due to higher overall diagnostic rates, reflecting improved recognition of the condition by educators, parents, and health care professionals.

The rapid increase in ADHD treatment rates among adults may also be the result of improved diagnostic rates. ADHD has historically been viewed as a childhood disorder, and it is likely that this has resulted in underdiagnosis and undertreatment of the disorder in adults. During the past decade, clinical recognition of adult ADHD has broadened considerably, and many tools and strategies have been developed to support its diagnosis and treatment in clinical practice (American Academy of Child and Adolescent Psychiatry, 2002; Bren, 2004; Weiss & Murray, 2003; Wender et al., 2001). Increased public awareness of adult ADHD may also have contributed to the rapid growth in treatment rates. Some parents may seek professional help when they realize, through their own child's experience with ADHD, that they had similar symptoms as children and that they continue to be disabled by these symptoms in adult life (Bren, 2004).

Researchers have generally estimated that one third to two thirds of children who have ADHD will continue to be impaired by the condition as adults (Kessler et al., 2005; Weiss & Murray, 2003; Wender et al., 2001). In the current study, the treatment rate for adults in 2005 was only 18% of the treatment rate for children; this ratio is well below the 33% to 66% range one would expect based on the estimates of relative prevalence. Although treatment rates in adults have increased rapidly, the rates remain relatively low. In this study population, only 1.2% of young adults (ages 20 to 44) received treatment for ADHD; this is well below the 4.4% estimated prevalence of the condition in a national sample of adults (ages 18 to 44; Kessler et al., 2006).

The expansion of ADHD treatment in adults has been most prominent among women; treatment prevalence has increased by 18.1% per year for women compared to 12.6% per year for men. Treatment rates for women are equal, on average, to the treatment rates for men, and they exceed the treatment rates for men in certain age groups (e.g., adults age 45 to 64). This is a remarkable finding given the disparities in treatment rates between girls and boys. There are several possible reasons why the same gender-based disparities may not be found among adults. The higher relative prevalence in adult women may reflect a delayed diagnosis of ADHD in women whose condition was undiagnosed in childhood. Some women may find symptoms of an attention disorder to be less manageable in a work or childrearing environment than it had been in a school or college setting where less multitasking was required, so the symptoms may first manifest themselves as a serious problem in adulthood (Bren, 2004). The prevalence levels in adults could also reflect higher rates of treatment seeking by adult women or lower diagnostic or treatment rates in adult men. Future research will be required to identify the primary factors driving ADHD treatment rates in adults.

The average use of ADHD medications is high (approximately 200 therapy days per year), which suggests that ADHD is generally being treated as a chronic health condition. Use was especially high for children under 10 years old, who averaged 227 days of medication per year in 2005; this corresponds to roughly 7 months of daily therapy or 10 months of weekday-only therapy. The average days' supply was lower for young adults (ages 20 to 44), suggesting that some of the medication use in this age range may be associated with short-term needs (such as improving focus or alertness). Average days' supply also tended to be lower for seniors (age 65 and older), for whom these medications are sometimes prescribed on a short-term basis for diagnoses different from ADHD (IMS Health, 2005).

Therapy duration may also be limited in some older patients whose health conditions put them at higher risk of side effects from long-term use of these medications.

During the past 6 years, the average use of ADHD medications has increased for all age groups; days' supply increased at an average annual rate of 2.6% for children and 3.8% for adults. This may indicate a trend toward long-term (rather than episodic) treatment of the condition. For some children, weekday-only therapy may be expanding to include weekends, or school-year therapy may be expanding to year-round therapy, to help control symptoms outside the school setting. For some patients, increased use may also indicate improvement in adherence to the prescribed frequency of dosing.

The use of generic ADHD medications has dropped sharply during the past 6 years, from 40.5% to 22.7% of total prescriptions. This is a striking finding, given the general trend toward increased use of generic medications in other therapeutic areas. In ADHD therapy, the shift toward brand-name products has been driven by a rapid increase in the use of new extended-release formulations, which are not yet available in generic form. Several extended-release medications for ADHD were introduced during the period of this study, including Concerta (methylphenidate) in 2000, Adderall XR (amphetamine mixture) and Metadate CD (methylphenidate) in 2001, and Ritalin LA (methylphenidate) in 2002. Extended-release formulations have proven popular with pediatric patients (and their parents and caretakers) for the convenience of once-a-day administration, particularly for school-time use. The shift toward brand-name products has also been driven by the widespread use of Strattera (atomoxetine), a new nonstimulant drug that was introduced in late 2002. Although out-of-pocket costs are generally higher for brand-name drugs than for generic drugs, many benefit plan participants have apparently been willing to pay a premium for the convenience offered by the extended-release products or for the different side-effects profile offered by a nonstimulant medication.

The findings of this study are subject to a few important cautions and limitations. First, the analysis is based on a study population with commercial health insurance, and the results may not generalize to uninsured populations. Medication treatment rates for uninsured patients tend to be lower than for insured patients (CDC, 2005). Second, the study is designed to measure the prevalence of medication treatment for ADHD. It is not designed to measure the prevalence of diagnosed ADHD or the overall rate of ADHD treatment (which may use social or behavioral interventions exclusively). The medication treatment rates reported here may be interpreted as lower bound estimates of the rates of diagnosed and treated ADHD in the study population. Finally, using a defined set of medications as markers for ADHD yields some imprecision in the measurement of treatment prevalence. To the extent these medications were prescribed to treat other conditions, the analysis is likely to overestimate treatment rates for ADHD. For pediatric populations, the impact on measured rates is likely to be negligible, as pediatric use of these medications is almost exclusively associated with a diagnosis of ADHD (IMS Health, 2005). Treatment rates for adult populations may be somewhat overestimated, as the use of these medications in adults is sometimes associated with non-ADHD diagnoses (such as depression or narcolepsy), especially in adults age 65 and older (IMS Health, 2005).

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