Trends in Attention Deficit Hyperactivity Disorder Ambulatory Diagnosis and Medical Treatment in the United States, 2000–2010

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Abstract

Objectives: Because of several recent clinical and regulatory changes regarding attention deficit–hyperactivity disorder (ADHD) in the United States, we quantified changes in the diagnosis of ADHD and its pharmacologic treatment from 2000 through 2010.

Methods: We used the IMS Health National Disease and Therapeutic Index, a nationally representative audit of office-based providers, to examine aggregate trends among children and adolescents younger than 18 years of age. We also quantified how diagnosis and treatment patterns have evolved on the basis of patient and physician characteristics and the therapeutic classes used.

Results: From 2000 to 2010, the number of physician outpatient visits in which ADHD was diagnosed increased 66% from 6.2 million (95% confidence interval 5.5–6.9M) to 10.4 million visits (95% confidence interval 9.3–11.6 million). Of these visits, psychostimulants have remained the dominant treatment; they were used in 96% of treatment visits in 2000 and 87% of treatment visits in 2010. Atomoxetine use decreased from 15% of treatment visits upon product launch in 2003 to 6% of treatment visits by 2010. The use of potential substitute therapies—clonidine, guanfacine, and bupropion—remained relatively constant (between 5% and 9% of treatment visits) during most of the period examined. During this period, the management of ADHD shifted away from pediatricians and towards psychiatrists (from 24% to 36% of all visits) without large changes in illness severity or the proportion of ADHD treatment visits accounted for by males (73%–77%).

Conclusions: In 10 years, the ambulatory diagnosis of ADHD increased by two-thirds and is increasingly managed by psychiatrists. The effects of these changing treatment patterns on children's health outcomes and their families are unknown.

Keywords: attention deficit and hyperactivity disorder; pediatrics; pediatric workforce; mental health

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What's New

We describe recent trends in the diagnosis and pharmacologic treatment of attention deficit hyperactivity disorder, including large increases in attention deficit–hyperactivity disorder visits during the decade, changes in medication use, and shifts in care from pediatricians to psychiatrists.

Attention deficit–hyperactivity disorder (ADHD) is common among children and adolescents in the United States. The prevalence of parent-reported ADHD among children ages 4 to 17 years increased 21.8% during 2003–2007, from 7.8% to 9.5%, representing 5.4 million children.[1] The disease also poses a considerable economic burden on children and families, both because of the direct costs of diagnosis and treatment as well as indirect and downstream costs such as lower educational attainment, occupational instability, and lost income.[2–4]

During the past decade, several important regulatory and clinical changes regarding ADHD have occurred without a clear analysis of the effect on diagnoses, treatments, and practice patterns. In 2000 the American Academy of Pediatrics issued its first clinical practice guideline for the diagnosis and evaluation of ADHD.[5] One year later guidelines for the treatment of school-aged children were released,[6] with the next update occurring nearly a decade later.[7] In addition, new pharmacotherapies have been brought to market, including atomoxetine (Strattera; Lilly USA, Indianapolis, Ind), a norepinephrine reuptake inhibitor initially developed to treat depression but later found to

have efficacy in treating ADHD and FDA approved for its use in 2003.[8] Thus, clinicians currently have a variety of pharmacotherapeutic options available, including psychostimulants—that is, methylphenidate and amphetamine and their derivatives —and atomoxetine and substitute therapies such as clonidine, guanfacine, and bupropion. Finally, during the past decade, safety concerns have been identified regarding many of these therapies, leading the Food and Drug Administration (FDA) to issue a series of communications regarding cardiovascular events associated with amphetamine and dextroamphetamine (Adderall; February 2005), sudden death and suicidal ideation with atomoxetine (September 2005), potential cardiovascular risks or adverse psychiatric symptoms with all approved ADHD medications (February 2007), and exacerbation of behavior and thought disturbances in patients with pre-existing psychosis (June 2008). Also in 2008, concern regarding the use of ADHD medication in children with some underlying cardiovascular abnormalities led to statements from the American Heart Association and the American Academy of Pediatrics suggesting careful assessment of children for heart conditions who need pharmacotherapy,[9,10] although the necessity of such assessments remains debated.[11,12]

The effect of the recent ADHD regulatory and professional society advisories as well as fluctuations in market factors on ADHD management and treatment is largely unknown. We used a nationally representative audit of office-based providers to quantify changes in ADHD diagnoses, medication treatments, and other practice patterns during the past decade. In addition to describing aggregate changes in diagnosis and medical treatment, we examined whether there were changes in ADHD management on the basis of patient characteristics (eg, illness severity), physician specialty, and therapeutic classes used.[13,14]

METHODS

DATA

We quantified diagnosis and treatment patterns among children and adolescents younger than 18 years of age using the IMS Health National Disease and Therapeutic Index (NDTI). The NDTI was established in 1958 by IMS Health, a provider of information services for the health care industry, and provides nationally representative diagnostic and prescribing information on patients treated by nonfederally employed U.S. office-based physicians. As of 2010, the collection of NDTI data uses a two-stage sampling procedure and includes 4300 physicians randomly selected from the American Medical Association and American Osteopathic Association master files within strata defined by specialty and geographic area. Information regarding specialty affiliations is derived from self-report as well as secondary rosters from professional societies. To ensure that all workdays in a report period are covered, participating physicians are randomly assigned to record audit information on all patient contacts during two consecutive workdays in each calendar quarter. The majority of contacts (approximately 85%) occur in office-based settings; the audit also captures information on the basis of patient contacts that may occur by phone or during physician visits to patients in hospitals and nursing homes. For this study, we focused on office-based care alone.

The NDTI generates approximately 350,000 annual contact records. Although the number of annual contact records as well as specialty composition varies year to year, the application of sample weights allows for yearly comparison of nationally representative estimates. For each record, physicians record all applicable diagnoses and then for each diagnosis record the specific medications used to treat that condition. This allows for a direct correspondence between a drug's use and a specific clinical application. Drug reporting reflects the physician's best knowledge of new or continuing medications. Illness severity is coded as mild, moderate, or severe, according to providers' global assessment. Each patient encounter record contains information specific to the encounter organized by diagnosis, as well as additional data specific to the physician and his/her practice. Our previous work and other investigations comparing the NDTI against the most similar publicly available data source, the National Ambulatory Medical Care Survey, a nationally representative survey of office-based providers conducted by the National Center for Health Statistics, suggest that the two audits are similar in breadth and scope.[15–17]

ANALYSIS

We used descriptive statistics to examine trends in the diagnosis and treatment of ADHD from 2000 through 2010 among children younger than 18 years of age. We defined ADHD using diagnostic codes for "Attention Deficit Disorder" and "Overactivity not otherwise specified," which are similar to ICD-9 code 314-Attention Deficit Disorder and ICD-9 code 312.01-Attenion Deficit with Hyperactivity, respectively. We focused on four groups of conventional therapies: (1) stimulants; (2) atomoxetine; (3) three therapy alternatives or substitutes, clonidine, guanfacine and bupropion; and (4) antipsychotics. Stimulants are the mainstay of therapy. We included atomoxetine because it is both a FDA-approved treatment for ADHD and its market debut occurred during the study timeframe. The alternative therapies and antipsychotics were chosen on the basis of clinical expertise and confirmed by review of the top medications prescribed for ADHD that were neither stimulants nor atomoxetine. We calculated 95% confidence intervals for estimates using tables of relative standard errors that account for the NDTI's two-stage stratified cluster sampling design.

We report both total visits where ADHD was coded as a diagnosis and, of these, total visits where one or more treatments was mentioned, which we refer to as treatment visits. Because individuals may have received more than one pharmacotherapy during a clinical encounter, a single office visit may generate more than one treatment visit, and thus the total treatment visits such as those depicted in Table 1 may exceed 100%. Data on nonpharmacological treatments, including behavioral therapies, counseling, or