

# Diagnosing Attention-Deficit/Hyperactivity Disorder in Children

Laurence L. Greenhill, M.D.

Attention-deficit/hyperactivity disorder (ADHD) is a heterogeneous behavioral disorder of uncertain etiology that is always evident first in childhood. The correct diagnosis of the ADHD patient thus requires familiarity with how the diagnosis should be established across the life span. This article provides a description of the DSM-IV syndrome of ADHD, information on prevalence, and an overview of standard methods used in office practice to diagnose ADHD in children. These practice parameters will be examined in the light of the practitioner's current concerns about the validity of the diagnosis.

*(J Clin Psychiatry 1998;59[suppl 7]:31-41)*

Attention-deficit/hyperactivity disorder (ADHD), as diagnosed in the United States, is regarded as a major public health problem. It is a heterogeneous behavioral disorder of uncertain etiology that is always evident first in childhood. The prevalence and chronicity of ADHD, coupled with its ability to interfere with major domains of developmental relevance,<sup>1</sup> make it a major public health condition requiring effective treatment. Clinicians become involved with ADHD patients of various ages and stages of development. The correct identification of the ADHD patient thus requires familiarity with how the diagnosis should be established across the life span.

This article provides a description of the DSM-IV syndrome of ADHD, information on prevalence, and an overview of standard methods used in office practice to diagnose ADHD in children. These practice parameters will be examined in light of the practitioner's current concerns about the validity of the diagnosis. Rates of diagnosis may vary by subspecialty medical discipline, by geographical area, and by the ADHD diagnostic subgroup. This is related to patterns of prescribing, as shown by proprietary database reports, epidemiologic surveys, and public health and

governmental agencies responsible for tracking the diversion of drugs from patients to illicit recreational uses. These sources indicate differential geographical and medical subspecialty rates of medication treatments and suggest that both underdiagnosis and overdiagnosis of the disorder may be occurring.

## DIAGNOSTIC AND ASSESSMENT GUIDELINES

The clinician makes the diagnosis of ADHD in a given case after a careful evaluation. However, there is no single manual for a practitioner to consult that serves as a standard of diagnosis, assessment methods, manner for selecting treatments, or procedures for follow-up and monitoring. Rather, there are a variety of published guidelines for diagnostic criteria, evaluation procedures, treatment algorithms, and practice parameters. These are available in a variety of formats, including textbooks, American Psychiatric Association Diagnostic and Statistical Manuals (DSM), and published practice parameters from professional organizations, including the American Academy of Pediatrics and the American Academy of Child and Adolescent Psychiatry.<sup>2</sup>

Researchers have developed their own treatment algorithms for children with ADHD who are entered into controlled clinical trials, as found in the Medication Treatment Manual of the six-site, National Institute of Mental Health (NIMH) and Department of Education (DOE)-sponsored Multimodal Treatment Study of Attention-Deficit/Hyperactivity Disorder (MTA Study).<sup>3</sup> These algorithms have served to preserve the internal validity of the experimental interventions as these trials involve more complex treatments,<sup>4</sup> but the clarity of the rules makes them relevant for office practice.<sup>3</sup> More recently, specific diagnostic and treatment manuals have been developed for practi-

---

*From the Division of Child and Adolescent Psychiatry, Columbia College of Physicians and Surgeons, Columbia University; New York State Psychiatric Institute; and the Disruptive Behavior Disorders Clinic, Child Psychiatry Outpatient Unit, Columbia Presbyterian Medical Center, New York, N.Y.*

*Presented at the closed symposium "Current Issues in Attention Deficit Disorder," held November 13, 1996, Bloomingdale, Illinois. This supplement was sponsored by The Institute for Medical Studies, and both the meeting and the supplement were supported by an unrestricted educational grant from Wyeth-Ayerst Laboratories.*

*This work was supported, in part, by grant No. 5 UO1-MH50454-02 from the National Institute of Mental Health.*

*Reprint requests to: Laurence L. Greenhill, M.D., Columbia College of Physicians and Surgeons, New York State Psychiatric Institute, 722 West 168th Street, New York, NY 10032.*

tioners in Health Maintenance Organizations and in other practice settings.<sup>4</sup>

### CHANGES IN ADHD DIAGNOSTIC CRITERIA

The first modern diagnostic manual appeared with the publication of the 1980 Diagnostic and Statistical Manual of Mental Disorders, Third Edition (DSM-III).<sup>5</sup> This manual stressed phenomenological and empirical data. The ADHD diagnosis was organized in this manual around a common observed problem, inattention, renaming *minimal brain dysfunction* to a more descriptive *attention deficit disorder (ADD)*, a term that does not imply etiology. The diagnosis of ADD in DSM-III required the presence of three symptom dimensions, inattention (with three of five items present), impulsivity (three of six items present), and hyperactivity (two of five items present). This manual specified subtypes, including attention deficit disorder without hyperactivity and attention deficit disorder, residual type, for adults with the disorder.

In the next version of the manual, the 1987 DSM-III-R, diagnostic criteria for ADHD appeared in a single, unweighted list of 14 items.<sup>6</sup> Symptom criteria are met only if the "behavior is considerably more frequent than that of most people of the same mental age." No subtypes were included, which meant that ADD without hyperactivity diagnosis was no longer included. The DSM-III-R required ADHD to be "A disturbance of at least 6 months during which at least eight of the following are present:

- (1) often fidgets with hands or feet or squirms in seat (in adolescents, may be limited to subjective feelings of restlessness)
- (2) has difficulty remaining seated when required to do so
- (3) is easily distracted by extraneous stimuli
- (4) has difficulty awaiting turn in games or group situations
- (5) often blurts out answers to questions before they have been completed
- (6) has difficulty following through on instructions from others (not due to oppositional behavior or failure of comprehension), e.g., fails to finish chores
- (7) has difficulty sustaining attention in tasks or play activities
- (8) often shifts from one uncompleted activity to another
- (9) has difficulty playing quietly
- (10) often talks excessively
- (11) often interrupts or intrudes on others, e.g., butts into other children's games
- (12) often does not seem to listen to what is being said to him or her
- (13) often loses things necessary for tasks or activities at school or home (e.g., toys, pencils, books, assignments)

- (14) often engages in physically dangerous activities without considering possible consequences (not for the purpose of thrill-seeking), e.g., runs into street without looking

In addition, the onset must be before the age of 7, and the symptoms must not meet criteria for a pervasive developmental disorder.<sup>6</sup>

Shortly after DSM-III-R was published, plans were made for a fourth edition. In 1991, a multisite DSM-IV Field Trial was mounted to help refine and test new DSM-IV concepts underlying the diagnosis of the disruptive behavior disorders<sup>7</sup> before the publication of the DSM-IV manual in 1994. Over 600 clinic-referred children participated in a series of diagnostic interviews using both structured diagnostic instruments and unstructured clinician interviews. The outcome of these trials defined the validity of proposed ADHD symptoms.<sup>8</sup> As a result, major refinements appear in the 1994 DSM-IV<sup>9</sup> that were designed to increase the specificity of the diagnosis at the loss of some sensitivity, leading to a 15% reduction in the diagnosis of the combined subtype of ADHD. DSM-III-R had been accused of setting too low a threshold for the ADHD diagnosis, raising concerns that children were diagnosed who did not have the disorder and may have been placed on medications unnecessarily. Stigmatization is a risk of carrying such a diagnosis, so misdiagnosis could have implications for the child and family.

How did DSM-IV "tighten" the ADHD diagnosis? First, DSM-IV revived the ADD without hyperactivity diagnosis found in DSM-III, retitling it as "ADHD, predominately inattentive subtype."<sup>10</sup> Second, the DSM-IV further specified that inattention "symptoms (should be) present in a structured (e.g., school or occupational) environment." Third, DSM-IV requires that ADHD symptoms cause significant impairment in social or academic (occupational, for adults) functioning or cause marked distress. Exclusionary criteria include substance intoxication or withdrawal, major depressive disorder, schizophrenia, and generalized anxiety disorder. In keeping with its two-factor model of ADHD (inattention, hyperactivity/impulsivity), the DSM-IV instructs clinicians to draw their inquiries from a list of inattentive behaviors and second list of impulsive/hyperactive behaviors.

### ADHD: CORE SYMPTOMS

The childhood ADHD syndrome is characterized by two core dysfunctions consisting of degrees of impulsivity/hyperactivity and inattention, which remain present throughout much of elementary and high school. These symptoms also can vary in degree of impairment, frequency of occurrence, and pervasiveness across different situations. To be endorsed, the symptoms must occur often. Unfortunately, DSM-IV does not operationalize "often."

The symptoms impair both academic performance and peer relationships.

The core features are developmental in course and thus change their presentation as the child gets older. They may appear in a variety of settings, but, by definition, their severity must be great enough to cause functional impairment. In addition, subtypes of the disorder, based on attentional or impulsive/hyperactive symptoms, or both, increase the variation of the clinical picture. Some children display most of their symptoms at home, while others show them in the classroom. In describing the core deficit of ADHD, the DSM-IV<sup>9</sup> states:

The essential feature of Attention-Deficit/Hyperactivity Disorder is a persistent pattern of inattention and/or hyperactivity-impulsivity that is more frequent and severe than is typically observed in individuals at a comparable level of development (Criterion A).<sup>9</sup>

The cardinal symptoms of this disorder address two broad behavioral categories: developmentally inappropriate degrees of inattention and impulsivity/overactivity.<sup>11</sup> DSM-IV adds an impairment criterion (the symptoms must lead to impairment or marked distress), so that the diagnosis is not made too readily.

These problems may present differently and inconsistently, varying between situations, including the home, school, and for adults, the workplace. New one-to-one situations may not bring out ADHD problems as much as performance tasks required in structured vocational or instructional settings. ADHD symptoms are assessed in the context of a structured setting demanding task completion, such as school or work. Parents' reports of ADHD symptoms appearing at home have a high rate of diagnostic validity, while the appearance of ADHD symptoms in school yield greater prognostic validity. Symptoms may worsen when the child is required to sit still and quietly attend, such as during class assignments, completing home chores, or listening to lectures in a classroom. At other times, signs of the disorder may be minimal, particularly when the child is frequently reinforced and refocused (playing a video game) or in a new one-to-one situation (in the physician's office). There has been debate about the need for symptomatology to be "pervasive" to give the ADHD diagnosis construct validity, and the new DSM-IV requires the symptoms to be present in at least two situations for the diagnosis to be made.

#### **DSM-IV ADHD Criteria: Inattention Symptoms**

"Attention" is the first main symptom dimension of ADHD. It is an inferred construct, based on an individual's ability to remain on task, behave in a goal-directed manner, and complete a task with minimal redirection from others. Because it is not a physical event (such as hyperactivity), it cannot be measured directly. Teachers and other observing adults can "infer" a child's attentional abilities,

but there is no single litmus test to rate attention. Rather a series of performance attributes are assessed. One type of attentional attribute is the ability to ignore irrelevant stimuli; ADHD children have great difficulty ignoring extraneous noise or movement. Another attention attribute is the patient's organizational skills, which can be assessed by inquiring if the patient can attend to instructions concerning tasks or has a neat work area. A third type of attentional attribute is selective attending, which can be assessed by asking if the patient has a shortened attention span or is unable to selectively focus on a task. These items, coupled with an inability to attend to details and a tendency to make careless errors, create the appearance of a disorganized approach to goal-directed tasks. Short-lived tasks, such as class discussion, can be handled, but lengthy tasks, such as a term paper or a group project, are daunting.

The DSM-IV specifies that manifestations of attentional dysfunction may be situation specific.<sup>9</sup> Signs of inattention in the classroom are shown by trouble following instructions, not completing tasks, and by being disorganized, as evidenced by a messy desk or cluttered book bag. Work is full of careless mistakes and is often messy in appearance. The teacher often may have an impression that the patient is not listening and has not heard what has been said.

Matters are often not much better at home. Inattention is shown by excessive shifts from one activity to another, without completing any of them. Requests for chores are ignored or attempted halfheartedly, and not completed.

With peers, there are many problems, and parents may spontaneously find this the main reason for requesting help. Inattention is seen by the failure to listen to other children or to follow rules in structured games. During team sports, such as baseball, the ADHD child may be too inattentive to be a good participant, because he or she may be too distracted when playing outfield positions to be able to follow the game.<sup>12</sup> Hyperactivity may interfere in the form of excessive talking ("motor-mouth") or the inability to control one's activity in accordance with rules of the game (e.g., commenting loudly when hiding in hide-and-seek).

Motor symptoms change depending upon the age or developmental level of the child. In preschool children, gross motor hyperactivity may be strongest, with excessive running and climbing in places most children will not, e.g., climbing on top of bookcases. Parents will describe these preschoolers as acting as if they "are driven by a motor." Inattention and impulsiveness are likely to be seen in their frequent shifts from one activity to another. As children get older, they exhibit excessive fidgeting and restlessness rather than gross motor activity. Inattention and impulsiveness lead to failure to complete homework assignments or home chores. In adolescence, impulsiveness may be displayed in social activities, such as initiating a new

plan on the spur of the moment rather than meeting a previous commitment (e.g., skateboarding instead of doing homework).

### **DSM-IV ADHD Criteria:**

#### **Hyperactivity-Impulsivity Symptoms**

Bauermeister et al.<sup>11</sup> suggest that symptoms of hyperactivity and impulsivity cluster together in population surveys using symptom checklists. In school, ADHD children have great difficulty remaining seated and will stroll or run around in the classroom while others are seated. At other times, excessive fidgetiness, squirming in the seat while noisily manipulating objects on the desk, will be seen. At home, hyperactivity may be shown by excessively frantic and noisy play or by difficulty at remaining seated, such as running around between mouthfuls at meals.

Signs of impulsivity vary by situational context. In the classroom, answers to questions are blurted out before the teacher has a chance to finish, and comments are made out of turn. The patient fails to await his or her turn in group situations and may push ahead when waiting in a line. The teacher is often interrupted during a lesson, and other students may be disturbed as the patient talks to them during quiet study periods. Impulsiveness at home is evinced by accident-prone behavior, such as grabbing hot frying pans from the stove or knocking over glasses of milk at the table. Impulsivity with peers occurs when an ADHD child refuses to await his/her turn in games, interrupts, grabs objects, and engages in potentially dangerous activities without considering the possible consequences, e.g., running after a ball into a busy street.

#### **DSM-IV ADHD SUBTYPES**

Three distinct subtypes are defined by DSM-IV. The criteria are arranged in two lists, corresponding to the dimensions of inattention and of hyperactivity/impulsivity. The combined subtype of ADHD is most often seen by medical specialists, such as child psychiatrists and pediatric neurologists. These children meet criteria for diagnosis when six criteria are endorsed in both nine-item lists. Thus, 12 (67%) of 18 symptoms are required for the combined subtype, versus 8 (57%) of 14 criteria in DSM-III-R. On the other hand, the predominately inattentive subtype, requiring six of nine inattention symptoms endorsed, is seen more often in primary care physician's offices in children referred by schools and teachers. There is also a category of ADHD not otherwise specified (NOS) for those children who are impaired but do not meet full criteria based on symptom dimensions.

Criteria for caseness for all subtypes is stricter in DSM-IV than in previous versions. In addition to the requirement that symptoms must occur often, DSM-IV requires—for the first time—that ADHD symptoms must be

associated with impairment in social, academic, or occupational functioning. The symptoms must have lasted for 6 months prior to the interview and must have produced maladaptive behavior inconsistent with the child's developmental level. Impairment from the symptoms, regardless of ADHD subtype, must have caused trouble before the age of 7 years and be present in two or more situations.

#### **COURSE**

Typical age at onset may be quite early. Many parents report an awareness of heightened motoric activity or irregular sleeping or feeding routines as early as the toddler stage, ages 10–18 months. Most of the disruptive behavior disorders present similarly during the preschool phase, with heightened aggressivity, impulsivity, and overactivity, only to become differentiated in the school-age years. Therefore it is hard to make an ADHD diagnosis in the preschool period and feel confident that other problems have been ruled out. The diagnosis depends on teacher's observations while the child is performing academic tasks in the classroom. This allows the teacher to compare the child's patterns of compliance, on-task behavior, and disruptiveness with those of the other children pursuing similar tasks. Perhaps for these reasons, the diagnosis is currently being made most often in a primary school setting around age 9, when the child is in the fourth grade.

The symptoms of ADHD persist throughout childhood. By age 15, approximately 75% of ADHD adolescents continue to show the full disorder.<sup>13</sup> During late adolescence and into early adult life, the number of ADHD patients who continue to meet criteria for any psychiatric diagnosis drops by 50% every five years.<sup>14</sup> Klein and Mannuzza<sup>15</sup> report that fewer than 10% of adults who had an ADHD diagnosis at age 10 will receive an ADHD diagnosis at age 25. On the other hand, the risk of receiving a diagnosis of conduct disorder or antisocial personality disorder increases.

Children with ADHD may grow up to manifest other psychiatric diagnoses. One common outcome is conduct disorder, which appears as the signs of ADHD subside in later adolescence. For those who develop conduct disorder, a significant number go on to develop antisocial personality disorder in adulthood. Prospective follow-up studies of clinic samples indicate that a diminishing number over time show signs of ADHD, with only 10% having all signs of the disorder by age 25. Some studies indicate that the following features may predict a poor course: low IQ, severe mental disorder in the parents, or comorbid conduct disorder.

ADHD manifests itself as a continuous disorder. The summer, because it is less structured and has fewer long-term sedentary cognitive demands, may create a false sense that the child has matured or grown out of the ADHD. Symptoms are most often manifest during instructional or vocational situations. ADHD continues through-

out development, with the comorbid psychiatric conditions and the impairments, not the actual ADHD symptoms, creating the dysfunction and morbidity. Conduct disorder can lead to school suspensions, expulsions, and arrests. Coexisting learning disabilities can affect 20% to 40% of the ADHD children, leading to poor school performance.

### ADHD AND COMORBID DISORDERS

Up to two thirds of clinically referred school-age children with ADHD may have another Axis I disorder.<sup>16</sup> Oppositional defiant disorder (ODD) may occur in more than 50% of ADHD children referred to clinic, while 30% to 50% of children with ADHD in epidemiologic samples have comorbid conduct disorder. Mood disorders, anxiety disorders, and learning disorders have been reported at various prevalence estimates ranging from 10% to 25% of referred ADHD children. ADHD children are more likely than normal children to have trouble with language and communication skills.

Comorbidity is important to identify during the diagnostic process. This is because comorbidity affects prognosis, for some of the long-term impairment in ADHD may be due to associated comorbid conditions. Comorbidity also affects response to treatment. ADHD children with comorbid anxiety disorders show an increased placebo response rate,<sup>17,18</sup> a greater incidence of side effects, and poorer improvements on cognitive tests.<sup>19</sup> Minor involuntary movements, called tics, occur in 18% of school-age children with ADHD, even when treated with placebo.<sup>20</sup> Two controlled studies in ADHD children with Tourette's syndrome have shown inconsistent effects of stimulants, whereby some children show worsening<sup>21</sup> or improving tic frequency patterns.<sup>22</sup> Although ADHD and mood disorders co-occur frequently, there have been no studies of stimulants for children with ADHD alone versus children with ADHD and depression.

Clinicians should have a heightened index of suspicion for other clinically significant Axis I disorders when a diagnosis of ADHD is made in a given child. Because of the overlap between symptoms of ADHD and symptoms of anxiety or depression (all these disorders may show agitation, impulsivity, and decreased concentration), the internalizing disorder may go unrecognized. Conversely, the child with ADHD may seem depressed because of demoralization due to chronic failure and poor peer relationships from the impairments related to ADHD. Therefore, the clinician's assessment must cover the full range of the child's emotional functioning, not just focus exclusively on the child's hyperactive or attentional symptoms.

### PREVALENCE OF ADHD

Attention-deficit/hyperactivity disorder, as diagnosed in the United States, is regarded as one of the most com-

mon childhood mental disorders. Nationwide prevalence estimates for ADHD vary between 3% and 5% of the school-age population, or about 2 million children. It is a major public health problem, responsible for 30% to 50% of referrals to mental health services for children.

The prevalence of ADHD may be gleaned from comprehensive reviews<sup>23,24</sup> of epidemiologic studies conducted in Norway,<sup>25</sup> the Netherlands,<sup>26</sup> Ontario,<sup>27</sup> Mannheim,<sup>28</sup> New Zealand,<sup>29</sup> Pittsburgh,<sup>30</sup> Puerto Rico,<sup>31</sup> and East London.<sup>32</sup> Many have used a multimethod-multistage approach involving symptom checklists, followed by direct interviews of a subsample of children scoring above a predetermined cutoff. Rates for ADHD range between 1.7%<sup>32</sup> and 9.5%,<sup>31</sup> while the prevalence for all subtypes of ADHD shows a wider range, extending to 12.6%.<sup>33</sup>

Prevalence of ADHD subtypes may differ according to source of referral. Although hospital-based clinics, pediatric neurologists, and child psychiatrists see predominately children with ADHD, combined subtype, primary-care pediatricians draw upon other sources, particularly schools and teachers. With an overall 11.5% prevalence of ADHD using DSM-IV ratings, 398 teachers in 16 different schools in Tennessee identified a 5.4% prevalence of inattentive subtype, a 3.6% prevalence of combined subtype, and a 2.4% prevalence of hyperactive subtype.<sup>34</sup>

Based on a review of nine prospective follow-up studies, the rate of ADHD in a given age group appears to decline by 50% approximately every 5 years, leading to the estimates of adult ADHD as 0.8% at age 20 and 0.05% at age 40.<sup>14</sup>

### VALIDITY OF ADHD DIAGNOSIS

The validity of the ADHD diagnostic construct is subject to constant debate. This uncertainty is a result of the unknown etiology of ADHD, the lack of a simple laboratory blood test for its presence, and the inability to be able to predict a specific outcome in adult life for a child presenting with its cardinal symptoms.<sup>35</sup> This controversy is fueled by multiple constituencies—congressional leaders, the media, special interest groups—showing a mounting concern for the popularity and possible overuse of the diagnosis. The diagnosis is the main indication for use of stimulant medications, which have abuse potential, particularly in a population such as ADHD children who are at future risk for substance use and abuse. The United States Drug Enforcement Administration (DEA) has been monitoring the growing prescription rate for these drugs in this country, wary of possible overdiagnosis and overprescription, and the possible diversion of these drugs from children into more recreational channels.

Concern about the validity of this childhood disorder was raised almost 20 years ago. At that time, Shaffer and Greenhill<sup>35</sup> criticized the diagnostic concept of the DSM-II hyperkinetic syndrome because of its poor validity as a

medical disorder. Reexamination of this concern is enlightening, not only because diagnostic systems have progressed beyond the era of the hyperkinetic syndrome and "minimal brain dysfunction," but because more is known about the disorder itself. First, if the symptoms of the disorder (hyperactivity, inattention) were the products of specific etiologic influences, the symptoms would have the value of a pathognomonic sign, directing the diagnostician to the underlying psychopathology. Studies in the intervening years have shown that one single cause of ADHD is unlikely, including food additives<sup>36</sup> or head injury.<sup>37</sup> Low socioeconomic status has also been shown to be a weak etiologic factor, but poor parenting has been shown to be a major contributor to the severity of ADHD symptoms.<sup>38</sup> Recent investigations have drawn attention to possible genetic abnormalities in the dopamine D<sub>4</sub> receptor in children with ADHD.<sup>39</sup> Greater evidence has accumulated for the genetic heritability of ADHD, both from its clustering in families<sup>40</sup> and the high concordance in twin studies.<sup>41</sup> The findings of polymorphism of the D<sub>4</sub> receptor may point to the etiology and mode of transmission of ADHD.

Second, Shaffer and Greenhill<sup>35</sup> were concerned that symptoms of hyperactivity, inattention, and impulsivity by themselves do not discriminate between clinical entities that differ in other respects (concurrent validity). Thus, the presence of "cardinal ADHD symptoms" should allow wider generalizations to be made about clinical state. For example, the symptoms of language impairment, perseverative behavior, and social unrelatedness in children with pervasive developmental disorder allow the clinician to predict profound academic impairments and cross-situational pervasiveness of symptomatology. With ADHD, however, this type of concurrent validity is still problematic 20 years later, particularly with comorbid Axis I disorders, further blurring distinctions between ADHD and other disorders. However, by using brain imaging, differences in symmetry between children with ADHD and normals have been described in key brain structures thought to be involved in the regulation of attention and behavior.<sup>42</sup> Furthermore, brain morphometry of children with ADHD can be distinguished from that in normals<sup>43</sup> and in children with other psychiatric disorders.<sup>44</sup>

Third, Shaffer and Greenhill<sup>35</sup> urged that the syndrome should enable prediction about the natural history of the disorder and response to treatment (predictive validity). Evidence now supports the stability of the disorder through age 18.<sup>45,46</sup> There is an increased risk of substance use and abuse in adolescence for school-age children diagnosed with ADHD,<sup>47</sup> particularly the initiation of early cigarette smoking.<sup>48</sup> In addition, there is a high incidence of ADHD among adolescents in treatment for substance abuse.<sup>49</sup>

These data provide new support for the postdictive, concurrent, and predictive validity of the ADHD diagnosis. However, the ADHD diagnosis still has to be made by

individual practitioners for each patient. What factors are available to help them evaluate the patient in a reliable manner?

### ADHD: PATIENT EVALUATION PROCEDURES

The diagnostic process for determining the presence of ADHD in a given child depends upon careful history taking and observation. These procedures require several visits to be done thoroughly. Even if the clinician is limited to only one visit, at least 1 hour is necessary to carry out an initial assessment. Some primary care practitioners find that their health maintenance organizations (HMOs) authorize only one 15-minute evaluation visit. This is not enough time to rule out or in ADHD, because data must be gathered to determine if the child meets both categorical criteria (whether the mother endorses enough ADHD symptoms) and dimensional criteria (whether the symptoms are severe enough). Both the parent and teacher should be interviewed. Because the level of impairment may shift between home and school, where tasks and demands on the child are very different, reports may not correlate.

Before the visit, the clinician should clarify the parent's chief complaint related to the child's functioning (e.g., the child is failing academically, has no friends, or creates friction at home). This can be done over the telephone. It is also helpful to obtain the results of any developmental screening test, achievement test, or IQ test that has already been conducted. Some clinicians may ask the parent permission to send out standard parent and teacher rating scales for ADHD. These scales may be broadband (checklists covering the symptoms of many disorders) or narrow-range scales (focused just on the symptoms of ADHD). These scales are useful for estimating symptom severity and are used to measure treatment response in controlled drug trials. However, none of the global rating scales used with children who have ADHD can provide a diagnosis.

During the visit, the clinician observes the parent and child to evaluate the symptoms of ADHD or comorbid condition; obtains family history; observes the child's attention and activity level with the parent present and alone with the clinician; and observes the level of compliance during an interaction with the parent. The DSM-IV manual is reviewed with the parent by going over the items in the section on the ADHD diagnosis, plus the other two externalizing childhood disorders. In addition, the first visit can be used to assess the child's physical and neurologic status.

After this first visit, the clinician should contact the child's teacher to obtain school information and have the teacher fill out a teacher global rating form. The clinician then assesses if there is a need for psychoeducational, speech, and language tests. For example, the clinician may order a Wechsler Intelligence Scale for Children, version

III to determine IQ. For determining mental processing, the Wide Range Achievement Test–Revised can estimate grade level, and the Wechsler Individual Achievement Test (WIAT) can be used to yield a more detailed estimate of academic skills. These tests are not diagnostic of ADHD, although they can help plan treatment.

After this information gathering, the clinician can hold an informing interview with the parents to present the findings and recommendations. At that time, the clinician may have treatment recommendations, such as implementing a Daily Report Card procedure or initiating a medication trial. This general evaluation procedure can be used to determine if the patient meets criteria for an ADHD diagnosis across the age range. Typical ADHD clinical presentations are listed below by age.

### Preschool Children (Ages 3–5)

Although this disorder has been recognized in children prior to age 3, research suggests that it is difficult at this early age to differentiate among the other disruptive disorders. Because of the common occurrence of gross motor behavior and aggression in children with psychiatric problems in this age group, it may be difficult to distinguish preschool children with ADHD from those with conduct or oppositional defiant disorder. Most children can be diagnosed by age 6, and approximately 20% of those diagnosed with the disorder have an onset of their symptoms between the sixth and seventh year. Although the diagnosis cannot be made when the symptoms originate after age 7, this point is controversial.

Even with the DSM-IV's 6-month duration criterion and "trouble before age 7" criterion met, it is often difficult for the clinician to determine if symptomatic behavior in preschoolers represents ADHD. Many preschool children would be rated "overactive" or "inattentive" by their parents, but tend to remit within 3 to 6 months. The degree of severity of symptoms may be related to whether a child will be diagnosed with ADHD by age 7. Approximately 50% of hyperactive preschool children followed prospectively since age 3 had a diagnosis of ADHD by age 9, with the best predictors of persistence being the severity of initial symptomatology and the presence of early discordant parent-child interactions.<sup>50</sup> The preschool kindergarten classroom requires less sustained attention, restraint of impulse, or regulated activity from the child. There, the behavior will not differ greatly between those later diagnosed as ADHD and those who are not. However, first grade is a more structured class environment, and so most children are given their first ADHD diagnoses at that time.

Preschool children whose ADHD symptoms remain stable over years are described by their parents as always on the go, getting into things, and acting as if driven by a motor. Temper tantrums are more severe and frequent, noncompliance is a problem, and standard parent management techniques prove to be ineffective.

### School-Age Children (Ages 6–12)

Entering primary school involves new tasks for the developing child with ADHD. Diagnosis is easiest for the clinician, for children are near the 7-year-old criterion age, and their externalizing symptoms (hyperactivity/impulsivity) are most evident. In addition to sitting in class, obeying complex rules, listening, and organizing work, they find they must cooperate with peers. Comorbid learning disorders may be present and produce additional difficulties with completing work. At home, responsibility for chores is usually not accepted by these children, leading to the need for close supervision and the perception that these children are "immature." Such children produce poorly organized work full of careless errors, but mostly do not complete their classwork or homework. They tend to blurt out answers before the question is asked, making them disruptive in class.

The symptoms of ADHD have a major impairing impact on peer relationships. ADHD children can be intrusive, demanding, bossy, and aggressive. They often interrupt or intrude and can not wait their turn in games. As a result, aggression and peer rejections are predictive of later negative outcome. Patterns of conflict in academic, social, and familial domains can become established in grade school. Children with ADHD may then develop one or more symptoms of conduct disorder, such as bragging, fighting, cheating, and petty theft, between ages of 7 and 10.<sup>51</sup>

### Adolescents (Ages 13–18)

Diagnosis of ADHD in adolescence is simplified if the patient has had an ADHD diagnosis since childhood. However, some adolescents present for the first time to clinicians, brought by their parents because of chronic academic underachievement and periods of irritability. With the DSM-IV requirement that ADHD symptoms must have caused trouble before age 7, it is difficult for the parents to recall if major impairment occurred before age 7 when the patient involved is now a junior in high school. Reviewing report cards and early psychological evaluations may be helpful, but not always.

When ADHD is present, the symptoms of inattention and restlessness make it more difficult to meet the adolescent age-appropriate tasks for independent, responsible conduct, developing social relationships and peer group acceptance, and utilizing the adolescent processes of separation and individuation. The common parental concern for this age group is poor schoolwork, which continues to be disorganized and show poor follow-through. In addition, the teenager with ADHD fails to complete independent academic work. There is an inner sense of restlessness that interferes with the adolescent's functioning. Adolescents with ADHD can engage in "risky" behaviors, such as driving a car too fast or recklessly. Other problems occur with peers and with authority figures.<sup>15,45,46,52–54</sup>

Follow-up studies have demonstrated that 70% of 15-year-old adolescents who had ADHD in childhood continue

to have social, academic, and emotional difficulties.<sup>55</sup> The presence of antisocial and conduct disorders in young adults with ADHD leads to an increased risk of criminal activity. Risk factors include low socioeconomic status, a lower intelligence level, a high degree of peer conflict, the presence of conduct problems or aggressive behavior, and parental psychopathology. These problems place adolescents with ADHD at higher risk for school failure, poor social relationships, car accidents, delinquency, drug and alcohol use and abuse, and poor vocational outcome.

### Adults With ADHD

The prevalence of ADHD in adults, its severity, and indications for treatment are unsettled issues. Although it had been assumed that children with ADHD outgrow their problems, recent prospective follow-up studies have shown that ADHD signs and symptoms may continue into adult life.<sup>5</sup> Adults with concentration problems, impulsivity, poor anger control, job instability, and marital difficulties sometimes seek help for problems they believe to be the manifestation of ADHD in adult life. During an evaluation of their ADHD children, parents of children with ADHD may decide that they themselves are impaired by attentional and impulse control problems.

The diagnosis, attention deficit disorder, residual state, (ADD-R) was placed in the 1980 DSM-III,<sup>5</sup> to cover patients over age 18, who had been diagnosed as children with ADD, were no longer motorically hyperactive, but had impairment from residual impulsivity, overactivity, or inattention. The diagnosis of ADD-R was dropped from the 1987 DSM-III-R.<sup>6</sup> Since the publication of DSM-III-R, a small but steady stream of publications has supported the existence of the adult ADD disorder, and clinicians and parent groups find it to be a useful and realistic diagnosis. These clinicians requested that future manuals include ADHD descriptors that would cover both adults and children with ADD difficulties, not just those that applied only to children. These clinicians noted that ADHD is widely viewed as a disorder of childhood, so it may be overlooked in adults.

Although the DSM-IV<sup>9</sup> did not restore the diagnosis of ADD-R, the item lists for the ADHD syndrome are rephrased so that they can apply to adults. Furthermore, the DSM-IV contains a category "in partial remission" that covers the adult with ADHD who retains some, but not all, of the childhood problems. Follow-up studies carried out by Weiss and Hechtman<sup>56</sup> compared adults who had suffered from ADHD as children (index group) with adults who had no mental disorder as children (control group). The index group reported fewer years of education completed and more complaints of restlessness, sexual problems, and interpersonal problems. There was a higher incidence of antisocial personality disorder and lower scores on clinician-rated global assessment scales. Finally, the category "not otherwise specified" (NOS) allows adult pa-

tients whose past childhood histories are unclear, but who have ADHD symptoms as adults, to receive a diagnosis of ADHD NOS. Such patients might not recall if their ADHD symptoms had appeared before the age of 7 years.<sup>57</sup>

Shaffer, in an invited editorial,<sup>58</sup> urged clinicians to be wary of making the diagnosis and treating ADHD in adults. First, the diagnosis of "Adult" ADD is difficult to make because adults cannot easily recall their own childhood history of ADHD symptoms with sufficient accuracy. The high incidence of Axis I (e.g., major depressive disorder) and Axis II (e.g., antisocial personality disorder) comorbid disorders makes it difficult to determine if the adult's current impairment is from the comorbid condition or from the ADHD. Shaffer further notes that "Adult" ADHD may be an infrequent condition. The one controlled prospective follow-up study with low attrition rates<sup>45</sup> showed that only 3% of 25-year-old adults with a childhood history of ADHD had impairment related to present ADHD symptoms.

For an adult, impulsive decisions concerning education, vocation, and personal choices may negatively affect work performance and achievement. The clinical literature suggests that ADHD adults most often have impairment associated with the attentional problems, finding it difficult to complete tasks and showing disorganization in managing long-term tasks.

### DIFFERENTIAL DIAGNOSIS OF ADHD: PITFALLS IN THE DIAGNOSTIC PROCESS

Other conditions and diseases, including anxiety, affective, and conduct disorders, may share some of the ADHD syndrome's cardinal signs of inattention, impulsivity, and agitation. For example, absence seizures can mimic ADHD. Therefore, a thorough medical, psychosocial, cognitive, academic, and psychiatric evaluation should be employed. Comorbid conditions of ADHD with concurrent symptoms must be distinguished from other conditions that exclude the diagnosis of ADHD.

A variety of medical disorders must be kept in mind, including chronic illnesses (hypo/hyperthyroidism), sensory deficits (e.g., hearing loss), seizures, or reactions to drugs. The child can be evaluated for possible medication side effects (e.g., methylxanthines). Pediatric medical problems associated with ADHD can also be present, such as enuresis, encopresis, otitis media, or asthma. Although the physical examination is usually normal in a child with ADHD, minor physical anomalies may suggest genetic or congenital syndromes. For example, children with fragile-X syndrome display intense motor overactivity and have characteristic faces and gaze avoidance. The medical history can be used to assess for pre- and perinatal problems (maternal smoking, alcohol use, low birth weight), developmental history, and current health status.

The drivenness and agitation of bipolar disorder may resemble ADHD, particularly if only a short period of observation is used; only family history and longer observation will reveal the former disorder's history of adults with bipolar symptoms and the syndrome's cyclical, rather than continuous, course. Complicating this situation is the recent finding that up to 15% of a clinic-referred sample of ADHD school-age children were comorbid for bipolar disorder.<sup>59</sup> Children with conduct disorder will show more rule-breaking, aggression, and impulsivity than is seen in ADHD. ADHD adults in partial remission may resemble individuals with the Axis II diagnosis, borderline personality disorder, by showing the excitability, mood lability, and impulsivity. Some authors report that over 70% of adults with a borderline personality disorder diagnosis report a childhood history of ADHD.

Other conditions share symptoms with ADHD, but do not carry the full clinical picture or impairment. Overactivity is a common finding in children; as many as 15% of boys meet criteria for motor hyperactivity, without manifesting other signs of ADHD or its impairment.<sup>60</sup> High levels of gross motor activity may occur in response to a wide variety of stressors, but may not be persistent for the 6 months required for the ADHD diagnosis. Overactivity for most children does not have the stimulus-driven, haphazard, or poorly organized quality of ADHD children. Children growing up in chaotic, crowded, disorganized homes associated with neglect or abuse may have more difficulty than most sustaining attention or demonstrating goal-directed behavior. High levels of overactivity may be found in children with mental retardation; only if their overactivity is out of proportion to that seen at their mental age, could a diagnosis be made.

Because the diagnostic process of diagnosing ADHD involves multiple informants across situations, it has pitfalls. First, there is no specific test for ADHD, in spite of the fact there are a variety of rating scales, cognitive and developmental screening tests, and special research tests used to assess children with ADHD. The differential diagnosis of children with symptoms of ADHD and comorbid disorders presents the clinician with a complex, compound clinical picture.

A variety of problems can arise.<sup>61</sup> The child may not exhibit signs of ADHD during the office interview. There may be conflict between reports from the parent and teacher. Parents may be confused because the child can focus for hours on a video game, despite reports of inattention from teachers. The parent may lack a comparison with normally developing children available to the teacher.

#### **GUIDELINES: DECISION TO TREAT ADHD**

Fortunately, ADHD has proved to be one of the most effectively treated child disorders. A quarter-century of published treatment studies and clinical experience attest

to the short-term effectiveness of both behavioral and pharmacologic strategies.<sup>62</sup> It has been estimated that between 2% and 2.5% of all school-aged children in North America receive some pharmacologic intervention for hyperactivity,<sup>63</sup> with more than 90% being treated with the psychostimulant methylphenidate.<sup>64,65</sup> Estimates<sup>66</sup> suggest that, from 1990 to 1993, the number of outpatient visits for ADHD increased from 1.6 to 4.2 million per year and the amount of methylphenidate manufactured increased from 1784 to 5110 kg.

The decision to treat the child with ADHD with stimulants is based on the diagnostic criteria for ADHD being met. The child's ADHD symptoms must also be persistent and cause functional impairment at home, school, or with peers. Careful physical examination and medical history must reveal no medical contraindication to treatment. The patient should be 6 years or older. The pill-taking must be supervised by an adult. Both the parents and the school must be reminded that the stimulant drugs are classified as drugs of abuse. The physician should ascertain that no relative living with the patient is currently abusing stimulants. School personnel must be willing to supervise medication administration if the pill is taken midday. These criteria are spelled out in detail in recently published practice parameters for child psychiatrists.<sup>2</sup>

#### **ADHD DIAGNOSING IN THE UNITED STATES (SWANSON ET AL., 1995)**

Physician drug and diagnosis audits by Scott-Levin Associates reveal that outpatient visits devoted to ADHD have increased from 1.6 to 4.2 million per year during the years 1990–1993.<sup>66</sup> During those visits, 90% of the children were given prescriptions, 71% of which were for the stimulant methylphenidate. The same report indicates that methylphenidate production in the United States increased from 1784 kg to 5110 kg during the same time period. The Drug Enforcement Administration (DEA) reports a sixfold increase in U.S. quotas for methylphenidate production over the past 5 years. Safer et al.<sup>67</sup> points out that these quotas are not based on patient usage, but rather on drug inventories on hand, exports, and industry sales projections. Quotas did not increase between 1976–1986, even though there was strong evidence for a substantial increase in methylphenidate prescribing during that period.

What is the cause of this increase in stimulant prescribing? A current review<sup>67</sup> included time-trend data from two population-based (Baltimore County, Maryland, Medicare of 200,000 people), and four pharmaceutical databases (ARCOS, National Prescription Audit from IMS America, Scott-Levin National Physician's Drug and Diagnosis Audit, and the Rhode Island Division of Drug Control). It also included large sources with a single assessment of prevalence, including triplicate surveys in Michigan,<sup>68</sup> New York State,<sup>69</sup> and the Northwest Region Kaiser Perma-

nente HMO, and two large population-based data sources. This analysis showed that a 2.5-fold increase in methylphenidate treatment for ADD appeared to be related to an increased duration of treatment; more girls, adolescents, and inattentive youths on medication; and a recently improved public image of this medication treatment. Other factors that may be increasing stimulant medication use are school pressures to prescribe, changing parental attitudes toward medication, and the extension of stimulant treatment to include adults and preschoolers as well as learning-disordered and conduct-disordered youth with ADHD. Working against that increasing trend to prescribe stimulants are lingering parental concerns about drug safety and potential stimulant abuse, and the present lack of research evidence that stimulant treatment changes the long-term outcome of ADHD.

Others have noted that office-based ADHD diagnosis and stimulant treatment remain imprecise. Jensen<sup>70</sup> found that only one eighth of ADHD children from a rigorously diagnosed community sample of 1100 were being treated with stimulants. Triplicate-based stimulant prescribing rates for school-age children vary widely across communities, ranging from 0.4% in Suffolk County to 1.9% in Michigan. Most prescriptions (88%) are written by primary care physicians and pediatricians, and the majority are written by a small proportion of doctors. Many primary care physicians see a higher proportion of ADHD children with attentional and learning problems than with behavior problems.<sup>34,71</sup> Schachar and colleagues' review<sup>21</sup> suggests very inconsistent practice standards, with no single method of arriving at the diagnosis or deciding which child should be medicated. Furthermore, reports from Long Island<sup>72</sup> and from North Carolina's Smoky Mountain Region<sup>73</sup> suggest very poor monitoring, with only one 30-day prescription written annually for most patients. Zito and colleagues' data would suggest an ethnic bias in stimulant prescribing, with white youth having twice the opportunity to be prescribed stimulants as African Americans.<sup>74</sup>

## CONCLUSIONS

The diagnosis of ADHD in children represents the convergence of a number of forces on the practitioner. This article has reviewed some of the background to the diagnostic approach, as well as an overview of the office-practice procedure for diagnosing ADHD. By sticking close to the DSM-IV manual and following its criteria, and taking a minimum of an hour, most clinicians can generate a reliable and appropriate diagnostic evaluation. The varied rate of prescribing across different geographical regions reported by the DEA suggests that both underdiagnosis and overdiagnosis may be occurring. The publication of practice parameters and the development of treatment and diagnostic algorithms in managed care settings mean that the diagnostic procedures necessary to reach a diagnosis of

ADHD in an office-practice setting are undergoing increasing scrutiny and refinement.

*Drug name:* methylphenidate (Ritalin).

## REFERENCES

- Hinshaw S. Attention Deficits and Hyperactivity in Children. Thousand Oaks, Calif: Sage; 1994:1-155
- Dulcan M, AACAP Work Group. Practice parameters for the assessment and treatment of children, adolescents, and adults with attention-deficit/hyperactivity disorder. *J Am Acad Child Adolesc Psychiatry* 1997;36(10, suppl):855-1215
- Greenhill L, Abikoff H, Conners CK, et al. Medication treatment strategies in the MTA: relevance to clinicians and researchers [abstract]. *J Am Acad Child Adolesc Psychiatry* 1996;35:444-454
- Maryary D, Brandt P, Koalesky A. Children With ADHD: A Manual With Decision Tree and Clinical Path. Seattle, Wash: University of Washington; 1996:1-117
- American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, Third Edition. Washington, DC: American Psychiatric Association; 1980:41-45
- American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, Third Edition, Revised. Washington, DC: American Psychiatric Association; 1987:80-90
- Lahey B, Appelgate B, Barkley R, et al. DSM-IV field trials for oppositional defiant disorder and conduct disorder in children and adolescents. *Am J Psychiatry* 1994;151:1163-1171
- Frick P, Lahey B, Appelgate B, et al. DSM-IV field trials for the disruptive and attention deficit disorders: diagnostic utility of symptoms. *J Am Acad Child Adolesc Psychiatry* 1994;33:529-539
- American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition. Washington, DC: American Psychiatric Association; 1994:78-85
- Lahey B, Carlson C. Validity of the diagnostic category of attention deficit disorder without hyperactivity. *Journal of Learning Disabilities* 1991;24:110-120
- Bauermeister J, Alegria M, Bird H. Are attentional-hyperactivity deficits unidimensional or multi-dimensional syndromes? [abstract] *J Am Acad Child Adolesc Psychiatry* 1992;31:423-429
- Pelham WE, McBurnett K, Harper G, et al. Methylphenidate and baseball playing in ADD children: who's on first [abstract]? *J Consult Clin Psychol* 1990;22:131-135
- Barkley R, Fischer M, Edelbroch C, et al. The adolescent outcome of hyperactive children diagnosed by research criteria: an 8-year prospective follow-up. *J Am Acad Child Psychiatry* 1990;29:546-557
- Hill J, Schoener E. Age-dependent decline of attention-deficit hyperactivity disorder [abstract]. *Am J Psychiatry* 1996;153:1143-1146
- Klein RG, Mannuzza S. Long-term outcome of hyperactive children: a review. *J Am Acad Child Adolesc Psychiatry* 1991;30:383-387
- Biederman J, Newcorn J, Sprich S. Comorbidity of attention deficit hyperactivity disorder with conduct, depressive, anxiety, and other disorders. *Am J Psychiatry* 1991;148:564-577
- DuPaul G, Barkley R, McMurray M. Response of children with ADHD to methylphenidate: interaction with internalizing symptoms. *J Am Acad Child Adolesc Psychiatry* 1994;33:894-903
- Pliszka SR. Comorbidity of attention-deficit hyperactivity disorder and overanxious disorder. *J Am Acad Child Adolesc Psychiatry* 1992;31:197-203
- Tannock R, Ickowicz A, Schachar R. Differential effects of MPH on working memory in ADHD children with and without comorbid anxiety. *J Am Acad Child Adolesc Psychiatry* 1995;34:886-896
- Barkley R, McMurray M, Edelbroch C, et al. Side effects of MPH in children with attention deficit hyperactivity disorder: a systematic placebo-controlled evaluation. *Pediatrics* 1990;86:184-192
- Schachar RJ, Ickowicz A, Tannock R. Pharmacotherapy of ADHD. In: Quay H, Hogan A, eds. *Handbook of Disruptive Behavior Disorders*. New York, NY: Plenum; 1997:555-565
- Gadow K, Sverd J, Sprafkin J, et al. Efficacy of methylphenidate for attention deficit hyperactivity in children with tic disorder. *Arch Gen Psychiatry* 1995;52:444-455
- Bauermeister J, Canino G, Bird H. Epidemiology of disruptive behavior

- disorders [abstract]. *Child and Adolescent Psychiatric Clinics of North America* 1994;3:177-194
24. Szatmari P. The epidemiology of attention-deficit hyperactivity disorders [abstract]. *Child Adolesc Psychiatric Clinics* 1992;1:361-371
  25. Vikan A. Psychiatric epidemiology in a sample of 1510 ten-year-old children, I: prevalence [abstract]. *J Child Psychol Psychiatry* 1985;26:55-60
  26. Verhulst F, Eussen M, Berden G. Pathways of problem behaviors from childhood to adolescence [abstract]. *J Am Acad Child Adolesc Psychiatry* 1985;32:388-392
  27. Szatmari P, Offord D, Boyle M. Ontario child health study: prevalence of attention deficit disorder with hyperactivity. *J Child Psychol Psychiatry* 1989;30:219-230
  28. Esser G, Schmidt M, Woerner W. Epidemiology and course of psychiatric disorders in school-age children: results of a longitudinal study [abstract]. *J Child Psychol Psychiatry* 1996;31:243-253
  29. Anderson J, Williams S, McGee R, et al. DSM-III disorders in pre-adolescent children; prevalence in a large sample for the general population. *Arch Gen Psychiatry* 1987;44:69-76
  30. Costello E. Developments in child psychiatric epidemiology. *J Am Acad Child Adolesc Psychiatry* 1989;28:836-841
  31. Bird HR, Canino G, Rubio-Stipec M, et al. Estimates of the prevalence of childhood maladjustment in a community sample in Puerto Rico. *Arch Gen Psychiatry* 1988;45:1120-1126
  32. Taylor E, Sandberg S, Thorley G, et al. The epidemiology of childhood hyperactivity. *Maudsley Monograph*. London, England: Oxford University Press; 1991:1-122
  33. Velez C, Johnson J, Cohen P. A longitudinal analysis of selected risk factors for childhood psychopathology [abstract]. *J Am Acad Child Adolesc Psychiatry* 1989;28:861-871
  34. Wolraich M, Hannah J, Pinnock T, et al. Comparison of diagnostic criteria for attention-deficit hyperactivity disorder in a county-wide sample [abstract]. *J Am Acad Child Adolesc Psychiatry* 1996;35:319-324
  35. Shaffer D, Greenhill LL. A critical note on the predictive validity of the hyperactive syndrome. *J Child Psychol Psychiatry* 1979;20:61-72
  36. Connors CK. *Food Additives and Hyperactive Children*. New York, NY: Plenum; 1980
  37. Shaffer D, McNamara N, Pincus J. Controlled observations on patterns of activity, attention and impulsivity in brain damaged and psychiatrically disturbed boys [abstract]. *Psychol Med* 1974;4:4-18
  38. Pine D, Coplon J, Wasserman G, et al. Neuroendocrine response to fenfluramine challenge in boys. *Arch Gen Psychiatry* 1997;54:839-846
  39. LaHoste G, Swanson J, Wigal S, et al. Dopamine D4 receptor gene polymorphism is associated with attention deficit hyperactivity disorder [abstract]. *Molecular Psychiatry* 1996;1:121-124
  40. Biederman J, Faraone S, Keenan K, et al. Familial association between attention deficit disorder and anxiety disorders. *Am J Psychiatry* 1991;148:251-256
  41. Gjone H, Stevenson J, Sundet J. Genetic influence on parent-reported attention-related problems in a Norwegian general population twin sample [abstract]. *J Am Acad Child Adolesc Psychiatry* 1996;35:588-596
  42. Semrud-Clikeman M, Filipek P, Biederman J, et al. Attention-deficit hyperactivity disorder: magnetic resonance imaging morphometric analysis of the corpus callosum. In: *Scientific Proceedings of the 41st Annual Meeting of the American Academy of Child and Adolescent Psychiatry*; October 1994; New York, NY. 33(6):875-881
  43. Porrino LJ, Rapoport JL. A naturalistic assessment of the motor activity of hyperactive boys, I: comparison with normal controls. *Arch Gen Psychiatry* 1983;40:681-687
  44. Teischer M, Polcari A, Anderson C, et al. Methylphenidate effects on hyperactivity and fMRI in children with ADHD. In: *Proceedings of the 43rd Annual Meeting of the American Academy of Child and Adolescent Psychiatry*; October 1996; Philadelphia, Pa. Abstract 12:120
  45. Mannuzza S, Klein R, Bessler A, et al. Adult outcome of hyperactive boys: educational achievement, occupational rank and psychiatric status. *Arch Gen Psychiatry* 1993;50:565-576
  46. Mannuzza S, Klein RG, Bonagura N, et al. Hyperactive boys almost grown up, V: replication of psychiatric status. *Arch Gen Psychiatry* 1991;48:77-83
  47. Biederman J, Wilens T, Mick E, et al. Is ADHD a risk factor for psychoactive substance use disorder? Findings for a four-year prospective follow-up study [abstract]. *J Am Acad Child Adolesc Psychiatry* 1997;36:21-30
  48. Milberger S, Biederman J, Faraone S, et al. ADHD is associated with early initiation of cigarette smoking in children and adolescents [abstract]. *J Am Acad Child Adolesc Psychiatry* 1997;36:37-44
  49. Horner B, Schiebe K. Prevalence and implications of attention-deficit hyperactivity disorder among adolescents in treatment for substance abuse [abstract]. *J Am Acad Child Adolesc Psychiatry* 1997;36:30-37
  50. Campbell S, Breaux A, Ewing L, et al. Correlates and predictors of hyperactivity and aggression: a longitudinal study of parent-referred problem pre-schoolers. *J Abnorm Child Psychol* 1986;14:217-234
  51. Pelham W. *Attention Deficit Hyperactivity Disorder: A Clinician's Guide*. New York, NY: Plenum Press; 1994:1-233
  52. Weiss G, Hechtman L. *Hyperactive Children Grown Up*. 2nd ed. New York, NY: Guilford Press; 1993
  53. Weiss G, Minde K, Werry J, et al. Studies on the hyperactive child, VIII: five-year follow-up. *Arch Gen Psychiatry* 1971;24:409-414
  54. Weiss G, Hechtman L. Hyperactives as young adults: a controlled prospective ten-year follow-up of 75 children. *Arch Gen Psychiatry* 1979;36:675-681
  55. Barkley R, Anastopoulos A, Goevremont D, et al. Adolescents with ADHD: patterns of behavioral adjustment, academic functioning, and treatment utilization. *J Am Acad Child Adolesc Psychiatry* 1991;30(5):752-761
  56. Weiss G, Hechtman L. Psychiatric status of hyperactives as adults: a controlled prospective 15-year follow-up of 63 hyperactive children. *J Am Acad Child Adolesc Psychiatry* 1985;24:211-220
  57. American Psychiatric Association Workgroup on DSM-IV: *DSM-IV Options Book*. Washington, DC: American Psychiatric Association; 1991
  58. Shaffer D. Attention deficit hyperactivity disorder in adults [editorial]. *Am J Psychiatry* 1994;151:633-638
  59. Wozniak J, Biederman J, Kiely K, et al. Mania-like symptoms suggestive of childhood-onset bipolar disorder in clinically referred children [abstract]. *J Am Acad Child Adolesc Psychiatry* 1995;34:867-876
  60. Lapouse R, Monk M. An epidemiologic study of behavioral characteristics in children. *Am J Public Health* 1953;48:1134-1144
  61. DuPaul GJ, Barkley RA. Medication therapy. In: Barkley RA, ed. *Attention Deficit Hyperactivity Disorder: A Handbook for Diagnosis and Treatment*. 2nd ed. New York, NY: Guilford Press; 1990:573-612
  62. Richters J, Arnold L, Abikoff H, et al. The national institute of mental health collaborative multisite multimodal treatment study of children with Attention-Deficit Hyperactivity Disorder (MTA), I: background and rationale. *J Am Acad Child Adolesc Psychiatry* 1995;34:987-1000
  63. Bosco J, Robin S. Hyperkinesis: prevalence and treatment. In: Whalen C, Henker B, eds. *Hyperkinetic Children: The Social Ecology of Identification and Treatment*. New York, NY: Academic Press; 1980:173-187
  64. Greenhill L. Attention-deficit hyperactivity disorder: the stimulants. *Child and Adolescent Psychiatric Clinics of North America* 1995;4:123-168
  65. Wilens TE, Biederman J. The stimulants. *Psychiatr Clin North Am* 1992;15:191-222
  66. Swanson JM, Lerner M, Williams L. More frequent diagnosis of attention deficit-hyperactivity disorder [letter]. *N Engl J Med* 1995;333:944
  67. Safer D, Zito J, Fine E. Increased methylphenidate usage for attention deficit hyperactivity disorder in the 1990s. *Pediatrics* 1996;98:1084-1088
  68. Rappley M, Gardiner J, Jetton J, et al. The use of methylphenidate in Michigan. *Arch Pediatr Adolesc Med* 1995;149:675-679
  69. Sherman M. Prescribing practice of methylphenidate: the Suffolk County study. In: Osman B, Greenhill LL, eds. *Ritalin: Theory and Patient Management*. New York, NY: Mary Ann Liebert; 1991:401-420
  70. Jensen PS. Development and implementation of multimodal and combined treatment studies in children and adolescents: NIMH perspectives. *Psychopharmacol Bull* 1993;29:19-26
  71. Copeland L, Wolraich M, Lindgren S. Pediatrician's reported practices in the assessment and treatment of attention deficit disorders. *J Dev Behav Pediatr* 1987;21:95-101
  72. Green SM, Loeber R, Lahey BB. Stability of mother's recall of the age of onset of their child's attention and hyperactivity problems. *J Am Acad Child Adolesc Psychiatry* 1991;30:135-137
  73. Angold A, Costello E. Stimulant medication: a general population perspective. *Psychopharmacol Bull* 1997. In press
  74. Zito JM, Safer D, Riddle M, et al. Methylphenidate among medicated youths. In: *Abstracts of the 36th Annual Meeting of the New Clinical Drug Evaluation Unit*; May 29, 1996; Boca Raton, Fla. Abstract 14

For "Online Discussion" of this article visit <http://www.imsme.com> and click on "Online CME."