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Attention-Deficit/Hyperactivity Disorder Among Adolescents: A Review of the Diagnosis, Treatment, and Clinical Implications

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ABSTRACT. Attention-deficit/hyperactivity disorder (ADHD) is the most common mental disorder in childhood, and primary care clinicians provide a major component of the care for children with ADHD. However, because of limited available evidence, the American Academy of Pediatrics guidelines did not include adolescents and young adults. Contrary to previous beliefs, it has become clear that, in most cases, ADHD does not resolve once children enter puberty. This article reviews the current evidence about the diagnosis and treatment of adolescents and young adults with ADHD and describes how the information informs practice. It describes some of the unique characteristics observed among adolescents, as well as how the core symptoms change with maturity. The diagnostic process is discussed, as well as approaches to the care of adolescents to improve adherences. Both psychosocial and pharmacologic interventions are reviewed, and there is a discussion of these patients' transition into young adulthood. The article also indicates that research is needed to identify the unique adolescent characteristics of ADHD and effective psychosocial and pharmacologic treatments. *Pediatrics* 2005;115:1734-1746; *attention-deficit/hyperactivity disorder, ADHD, adolescents, diagnosis, treatment.*

ABBREVIATIONS. ADHD, attention-deficit/hyperactivity disorder; ADD, attention-deficit disorder.

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Attention-deficit/hyperactivity disorder (ADHD) is the most common mental disorder in childhood,¹ and primary care clinicians provide a major component of the care for children with ADHD.² To improve the care of those children, the American Academy of Pediatrics developed practice guidelines for the diagnosis and treatment of ADHD among children 6 to 12 years of age who are evaluated by primary care clinicians.^{2,3} However, because of limited available evidence, the guidelines did not include adolescents and young adults.

Contrary to early views of the disorder that indicated that it might represent a maturational lag and suggested that children would grow out of it,⁴ it has become clear that, in most cases, ADHD does not resolve once children enter puberty. For the majority of children diagnosed with ADHD, as many as 65%,^{5,6} the diagnosis persists into adolescence. When the diagnosis of ADHD is made during childhood, the task for clinicians is to continue treatment as long as needed. However, some adolescents present without having been diagnosed, and the symptoms of the disorder may be subtler during the teenage years. Therefore, it is important for clinicians who care for adolescents and young adults to be knowledgeable about diagnosing and treating ADHD. It is the intent of this article to review the current evidence about the diagnosis and treatment of adolescents and young adults with ADHD and to indicate how the information informs practice.

CLINICAL PICTURE

Clinical Manifestations in Adolescence

The most obvious adolescents to identify as needing treatment are those who were diagnosed with ADHD in childhood. Studies have shown repeatedly that the majority of those diagnosed with ADHD while in elementary school continue to have significant manifestations of ADHD throughout adolescence and continue to need treatment.^{5,6} Many studies have also shown that the most salient manifestations of ADHD change during adolescence. Hyperactivity, although still present, becomes much less visible during this age period.⁷ Academic problems that might have been less noticeable or were treated effectively during elementary school may become much more of a problem. In middle school and high school, cognitive demands increase significantly, and the adolescent is expected to become more independent of adult supervision.⁸ Students

are exposed to multiple teachers and classes, and the amount of assigned homework increases. Finally, problems with peer relationships become more obvious as the social environment changes with adolescence and peer interactions assume a new importance.

These changes in context, expectations, and maturation result in very different case presentations than among school-aged children. In fact, the diagnosis of ADHD may be missed if an adolescent has the predominantly inattentive subtype.⁹ Although studies addressing differences between the subtypes with an adolescent population do not exist, it is our clinical impression that many of the differences reported for children persist in adolescence. For example, children with the inattentive subtype have been described by teachers as exhibiting less disruptive behavior but higher degrees of social impairment, unhappiness, and anxiety or depression, compared with children with the combined type.¹⁰ These problems may produce greater impairment in adolescence than in childhood because the demands for independence and the complexity of social functioning increase. Similarly, Milich et al¹¹ summarized data indicating that the age of referral and recognition of the problem is older for children with the inattentive type, compared with the combined type. These children are more likely to be female than are children with the combined type, although male students still outnumber female subjects.¹¹ The absence of disruptive behavior problems in this group disguises its identity, but these adolescents suffer significantly from problems such as disorganization, inability to follow through on academic tasks, and difficulty sustaining attention for extended academic projects.

Other Characteristics of Adolescents With ADHD

Adolescents with ADHD often seem emotionally immature, compared with their same-age peers.¹² They often do best when interacting with younger children or in the environment of adults who tolerate their immature behaviors. Adolescents and children with ADHD often display affect, both negative and positive, that is excessive for the situation.¹³ The symptoms include becoming frustrated easily and having a "short fuse," with sudden outbursts of anger. In the extreme, the symptoms reflect co-occurring oppositional defiant disorder, as described below. Cognitive impairments become increasingly problematic during adolescence. These impairments may have widespread effects that often seem like behavioral problems and are not recognized as part of the ADHD. The adolescents procrastinate and, after having started, are distracted easily or have difficulty tracking and completing their projects, especially when the task requires a good deal of time and effort.¹⁴

Children with ADHD have been reported to have significant sleep disturbances, unrelated to medication status, that are characterized by dyssomnias, parasomnias, and sleep-related involuntary movements.¹⁵ Sleep disturbances among adolescents with ADHD have not been studied as thoroughly as has

been the case with children and are complicated by the fact that adolescence is a developmental period that often includes sleep disturbances.¹⁶ Although stimulant medication does disrupt the sleep of adolescents with ADHD frequently,¹⁶ it is important for prescribing physicians to establish a baseline of sleep behavior before initiating stimulant treatment, to provide a valid comparison for the determination of medication-induced sleep disturbances.

Co-occurring Disorders

Between 25% and 75% of adolescents with ADHD also meet diagnostic criteria for oppositional defiant disorder or conduct disorder,¹⁷ which results in significant additional impairment that increases the difficulty of treating these adolescents. Others reported similar increased risk for conduct disorder and increased risk for adolescents with ADHD to meet diagnostic criteria for a substance use disorder or mood disorder.¹⁸ Long-term follow-up studies of children diagnosed with ADHD found that, in late adolescence and early adulthood, there is increased risk for antisocial personality disorder,^{19–22} substance use disorders, and depression.¹⁹ In a sample of 9- to 16-year-old subjects who met criteria for attention-deficit disorder (ADD) with or without hyperactivity,²³ 48% had comorbid depression/dysthymic disorder, 36% had comorbid oppositional defiant disorder/conduct disorder, and 36% had comorbid anxiety disorder. These incidence rates are comparable to the Multimodal Treatment Study of ADHD data for younger children regarding the comorbidity of anxiety and oppositional defiant disorder with ADHD but reflect a 12-fold increase in the reported incidence of depressive/dysthymic symptoms, with an incidence that is much closer to that found for depressive comorbidity in samples of adults with ADHD.²⁴ The high rate of comorbidity makes working with these comorbid disorders an inevitable part of treating adolescents with ADHD, leading to a need for assessment and treatment that target a range of impairments.

Cognitive Deficits

In addition, children and adolescents with mild to moderate degrees of mental retardation, for example, may have behavioral symptoms consistent with a diagnosis of ADHD and may also respond to medication and other ADHD treatments.²⁵ Although the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*,⁹ excludes individuals with pervasive developmental disorders from having a co-occurring diagnosis of ADHD, children and adolescents with these disorders may also have symptoms of ADHD and may benefit from treatment for this condition as well as treatment for their pervasive developmental disorders.

Oppositional Defiant Disorder

The most noticeable psychiatric disorder that often occurs with ADHD in adolescence is oppositional defiant disorder. Adolescents with oppositional defiant disorder are chronically much more argumentative, negativistic, and defiant than most other ad-

olescents, even most others with ADHD.²⁶ Although most adolescents with ADHD and oppositional defiant disorder do not manifest the more severe behavioral problems of conduct disorder, a serious pattern of delinquent behavior, those with oppositional defiant disorder often suffer significant problems in school, family, and social relationships. A central factor underlying this disorder is impairment in the adolescent's ability to modulate and to cope with the routine frustrations of daily life.

Anxiety Disorders

Children with anxiety disorders may be tense and chronically anxious, quick to panic and often asking for reassurance, or they may tend to be socially phobic, extremely shy, and avoidant of unstructured interactions with any unfamiliar persons.⁹ Others with ADHD may have obsessive-compulsive disorder, characterized by persistent obsessional fears that remain unspoken or tightly constrained by compulsive behaviors of checking, repeating, counting, cleaning, arranging, or hoarding that may be carried on only in private.⁹ Adolescents with comorbid ADHD and anxiety may present a complicated clinical picture, because these disorders are characterized by thinking too little (ADHD) and thinking too much (anxiety). Careful assessment is important when attempting to diagnose these comorbid conditions.

Mood Disorders

ADHD is also associated with an elevated risk of dysthymia, sometimes in combination with anxiety disorders or oppositional defiant disorder.²⁷ These disorders may be manifested by persistent profound unhappiness, with weeks and months of being unable to find any real pleasure, even in activities that once were enjoyable. The unhappiness may manifest as a persistently irritable mood. Dysthymic symptoms often are alleviated among adolescents who receive effective treatment for their ADHD but, in cases in which such symptoms persist despite effective ADHD interventions, specific counseling and medication treatment for depressive symptoms may be indicated.²⁸ Symptoms such as hypersomnia or hyposomnia, extremes of excessive or insufficient appetite, marked loss of energy, intense feelings of worthlessness, and persistent feelings of "not caring any more" may indicate the presence of comorbid major depressive disorder.⁹ This is a potentially life-threatening comorbid condition, because the combination of depression and a disruptive behavior disorder has been identified as a particularly high-risk condition for a suicide attempt.²⁹ As a result, screening for depression among patients diagnosed as having ADHD is highly recommended. When signs of this morbid syndrome appear, careful assessment of depressive severity and the risk of self-injurious or life-threatening behaviors is needed, and conventional ADHD treatments alone are not likely to be sufficient.

There is a great deal of debate about the overlap of bipolar disorder and ADHD³⁰ and, until an accepted definition and diagnostic criteria appropriate for

children and adolescents are developed, this debate will probably continue. Generally, bipolar disorder can be distinguished from severe ADHD by the presence of elated mood, grandiosity, flight of ideas or racing thoughts, and a decreased need for sleep.³¹ Whenever possible, adolescents with complicated psychiatric presentations related to both ADHD and bipolar disorder should be referred to specialists in the area.

Substance Use and Abuse

Children with ADHD are at increased risk for developing substance abuse as they grow older. Studies of adults with substance use disorders⁹ show an overrepresentation of those with ADHD, with several reports indicating that between 15% and 25% of adults with substance use disorders have ADHD.^{32,33} The presence of ADHD is also associated with greater severity of substance use disorders, including higher rates of substance-related motor vehicle accidents and treatment episodes.³³⁻³⁵ One study found that the risk of developing substance use disorders over the lifespan for individuals with ADHD was twice that of individuals without ADHD.³⁶

Prospective studies of children with ADHD found increased drinking and risk of substance use disorders during adolescence, which might be compounded by co-occurring conduct disorder or bipolar disorder.^{34,37-39} In addition, individuals with ADHD start smoking at a younger age⁴⁰ and have higher rates of smoking than do individuals without ADHD.⁴¹ Although adolescents with ADHD are at greater risk of substance use, the evidence suggests that appropriate treatment of ADHD, including the use of psychostimulant medication, does not increase that risk. A recent meta-analysis by Wilens,⁴² which identified a total of 7 studies on this topic, found that stimulant pharmacotherapy was protective with respect to substance use disorders later in life (odds ratio: 1.9) and the effect was stronger among adolescents, compared with adults.

When the question of ADHD first arises during the adolescent years among individuals without previous diagnoses, the presence of substance use confounds the diagnostic process. Recurrent use of alcohol or drugs, including cannabis, may cause inattentiveness and other cognitive impairments.⁴³⁻⁴⁶ Clinicians should therefore be cautious in making an ADHD diagnosis during adolescence when substance use is present and childhood symptoms are absent. It may be best to reassess an adolescent suspected of having ADHD after at least a 1-month period of abstinence from all psychoactive drugs.

ASSESSMENT AND DIAGNOSIS

Assessment of ADHD among adolescents is often more challenging than assessment among younger children. Students in preschool and early elementary grades are usually supervised closely by parents and, for most of the school day, by 1 teacher, who is able to observe much of the child's academic performance and social interaction. Observations by parents and the primary classroom teacher are usually a

rich source of information to guide assessment for possible ADHD among younger children.

In contrast, adolescents usually have 5 to 7 different teachers, each of whom are responsible for 100 to 150 students and see each student for just a small portion of each school day. Outside school, adolescents are often involved in many activities where parents have very little direct contact to observe details of their strengths and problems. Parents can usually provide helpful information about homework patterns, school grades, and daily routines of their adolescent son or daughter but little direct information on school function, social interactions, and peer relationships.

A study by Mitsis et al⁴⁷ reported that parent-teacher agreement regarding the diagnosis of ADHD was only moderate (74%). Teachers tended to report a greater number of school symptoms than did parents, and parent reports of school behaviors were found to be influenced by their observations of behaviors in the home. The authors concluded that parent reports of ADHD behaviors in school settings are not an adequate substitute for direct teacher input. The subjects in that study were in elementary school, and parents frequently profess to know more about their child's behavior at the elementary school level than at the middle or high school level, which suggests that parent reports of school behaviors may be more inadequate in secondary schools than they were found to be in elementary school. Adolescents' needs for independence and privacy make it even more difficult for parents to obtain information about how their son or daughter is really doing in school, extracurricular activities, and social relationships.

Although obtaining assessment information from secondary school teachers may be important, there are many obstacles. First, teacher ratings do not provide information on symptoms and functioning manifested in less-structured settings such as the cafeteria, hallway, and bus. Second, inter-rater reliability is poor with secondary school teachers.⁴⁸ Agreement is best for questions pertaining to hyperactivity and academic progress and improves over the academic year from fall to spring semesters.⁴⁹ Given these problems, clinicians are encouraged to collect information from multiple teachers and from other sources such as counselors. If the adolescent has an individual education plan or 504 plan,⁵⁰ then it may be possible to receive help from the school in organizing the assessment effort.

Given the limitations of teacher and parent reports, it would be ideal if adolescents could provide reliable self-reports about symptoms and impairment; however, this does not seem to be the case. Consistent with studies reporting information for younger children, adolescents with ADHD tend to under-report dramatically their level of impairment and symptoms.⁵¹⁻⁵³ Interviewing adolescents and using self-report scales such as the Brown ADD Scales for Adolescents⁵⁴ or the Conners-Wells Adolescent Self-Report Scale⁵⁵ remain important components of the clinical evaluation. However, the information should be interpreted with the under-

standing that frequently it is an under-representation of impairment.

The presenting problems of adolescents continue to include many of the same behaviors as exhibited by children with ADHD. Their context, complexity, and potential for serious harm, however, change considerably. As a result, assessment and treatment must address not only the core symptoms of the disorder but also associated sequelae, including academic problems, impaired peer relationships, delinquent behavior, dangerous driving, substance use, impulsive sexual activity, and defiance.^{8,56}

ADHD evaluation of an adolescent should include a review of recent report cards and school progress reports, especially noting patterns in teacher comments, and a review of psychoeducational testing results, if testing has already been completed. Reviewing previous school reports may be helpful in documenting problems before the age of 7 years. Psychoeducational testing cannot establish an ADHD diagnosis, but it may offer useful information. Results can indicate the range of an adolescent's cognitive abilities and can identify specific areas of strengths and weaknesses. Extensive batteries of neuropsychologic tests are usually not indicated for assessment of ADHD, unless there are questions about other neurologic impairments.

Adolescents with ADHD may be eligible for special education services under the category of "Other Health Impaired."⁵⁰ They are also at elevated risk for specific learning disorders involving reading, math, and/or written expression.⁵⁷ It can be helpful for clinicians to encourage parents to request, in writing, that the school complete a multidisciplinary evaluation if there are problems with their child at school. The process can be aided by a report from the clinician documenting the diagnosis of ADHD. If school personnel initiate the evaluation process, then they are likely to include an individually administered achievement test such as the Wechsler Individual Achievement Test-Second Edition or Woodcock-Johnson Achievement Tests-Third Edition, to be compared with the student's grades and ability, as measured with an individually administered IQ test, to determine the presence or absence of impairment. Definitions of impairment vary according to the state and school district, but some comparison of these scores is used frequently to determine impairment.

Adequate assessment for ADHD among adolescents requires screening for other psychiatric disorders. As noted above, individuals with ADHD have two- to fivefold greater risk of developing ≥ 1 additional psychiatric disorder at some point in their lives, and many have multiple disorders, with onsets at various points in the life cycle. Broad-based rating scales such as the Child Behavior Check List⁵⁸ or the Behavior Assessment System for Children⁵⁹ are standardized scales to screen for possible co-occurring disorders. The Brown ADD Diagnostic Form for Adolescents-Revised⁵⁴ and an interview outline in a book by Robin⁶⁰ provide probe questions that can be used to inquire about indicators of possible co-occurring disorders.

Evaluating clinicians should also ask the parents

and, privately, the adolescent about risk-taking behaviors. These behaviors include the use of tobacco, marijuana, alcohol, and other drugs and association with others who tend to engage in illegal or dangerous behaviors. For those old enough to drive a motor vehicle, clinicians should inquire about attitudes and behaviors when driving (eg, speeding). Adolescents with ADHD are at increased risk of having car accidents associated with injuries.⁶¹ To obtain adequate information about driving habits, pediatricians usually need to reassure adolescents that confidential disclosures will not be passed back to the parents.

TREATMENT

Treatment Model

The National Initiative for Children's Healthcare Quality, adapting a "chronic care model"^{62,63} from the work of others, proposed that children with ADHD, including teens and adolescents, and their families require ≥ 6 supports in addition to an individualized and appropriate clinically based program.^{62,63} These supports are (1) community resources and policies (such as schools), (2) health care systems and organizations (such as health insurance), (3) clinical information systems (such as public health community-based monitoring), (4) decision support, ie, application of evidence-based guidelines such as the American Academy of Pediatrics ADHD assessment and treatment guidelines, (5) delivery system design, ie, planned interventions by a coordinated, multidisciplinary, professional team, and (6) family and self-management support; families and individuals are those who must implement treatment interventions, and such individuals must be educated adequately about these treatments. The following review refers to these supports and is consistent with treatment characterized as a chronic care model.

Education and Adherence

All individuals with ADHD need a basic understanding of the disorder, including the fact that this is a neurobiological disorder. It may be helpful to "destigmatize" ADHD by comparing it with a less-stigmatizing condition such as poor eyesight or asthma. With these conditions, individuals are not deemed to be at fault for having the disorder, because they were born with it. However, individuals can be limited in life by the disorder unless it is treated. People who have these disorders need to be reminded frequently that they are not "bad," "damaged," "stupid," or "mentally deranged," just people who need help in certain areas. Having ADHD is no different. It is also critical to inform adolescents that having ADHD is not a reflection of their intelligence.

Adolescents with ADHD may have negative attitudes toward medication use and may be nonadherent with pharmacotherapies. In their longitudinal follow-up study of 358 clinic-referred children with ADHD, Pelham, Molina, and co-workers⁶⁴ reported that psychoactive medication usage decreased precipitously throughout adolescence, which indicates that stimulants or other psychoactive medications

become an increasingly unpopular method of treatment as children mature beyond the elementary school period. In their sample, among the 87% of children who were medicated at some time in their lives, 27.9% had stopped taking medication by the age of 11 years and 67.9% had stopped by the age of 15 years. Starting medication in this age range was uncommon. Only 0.7% to 4.7% of the sample began taking medication between the ages of 11 and 15 years. Most individuals (86.5%) had started taking medication by the age of 10 years. Finally, one half of the participants in that study were in the adolescent age range at the time of their interviews (1998–2000), which suggests that recently improved, long-acting, stimulant preparations were available and might not ameliorate adolescent discontent with medication treatment for ADHD. In a separate, 3-year, longitudinal study,⁶⁵ it was reported that 48% of the children between the ages of 9 and 15 years had discontinued medication. Age was a significant moderator of adherence, such that older children were less likely to be continuing with their medication.

The lack of treatment adherence is not always obvious to prescribing physicians, because it may be manifested by the absence of visits. Unless the physician is monitoring the patient in such a way as to note omissions and to follow up actively when they occur, the discontinuation of therapies may go unnoticed. When children reach adolescence, they are better able to defy parent requests; this is accompanied frequently by a belief that they do not have a problem and therefore do not need treatment.

Physicians and parents can often be frustrated by a lack of adherence to prescribed regimens when they have a strong belief in the value of behavioral and medical interventions for ADHD but have little control over whether the adolescent will actually take the medications or follow behavioral contracts.⁶⁶ Important factors promoting adherence include self-concept,^{67,68} family stability,^{69–72} internal locus of control,^{68,70,73} increased motivation,^{74,75} simplified medication regimens,⁷⁶ lack of adverse effects,^{70,77–79} and characteristics of the doctor-patient relationship, such as the physician's verbal and nonverbal communication skills and satisfaction of both the patient and the physician.⁸⁰ The use of motivational interviewing techniques by physicians can help adolescents feel in control and make their own decisions about the use of medications and behavioral interventions^{81–85} (although the techniques have not been evaluated among adolescents with ADHD). This use can help diminish resistance and activate the motivation of the adolescents, 2 critical factors in successful treatment.⁸⁶ If an adolescent prefers to forego medication at a given time, it may be helpful to concur and then to develop a plan with the adolescent that helps him or her achieve goals through the use of tutors, behavioral interventions, organizational help, or whatever he or she thinks will help. A reevaluation of this plan in 2 to 4 weeks can identify whether it is working and what needs to be changed. If the adolescent chooses to start medication at a later time, it is at his or her request and the physician may

then be seen as an ally, rather than as an enforcer and an authority figure.

Medication

The pharmacologic management of ADHD relies on agents that affect dopaminergic and noradrenergic neurotransmission, namely, the stimulants, antidepressants, and antihypertensives.^{87–88} A new agent, a noradrenergic reuptake inhibitor, has also become available.

The most commonly used stimulants are methylphenidate (Ritalin, Ritalin LA, Ritalin SR, Concerta, Focalin, Methylin, Methylin ER, Metadate ER, and Metadate CD) and amphetamine compounds (Adderall, Adderall XR, Dexedrine, Dexedrine Spanule, and DextroStat). Stimulants have been shown to be effective for ~70% of adolescents and seem to operate in a dose-dependent manner in improving cognition and behavior.^{89,90} The beneficial effects of stimulants are of similar quality and magnitude for adolescents of both genders and for younger and older children.⁹¹ Immediate-release preparations of methylphenidate and amphetamine are available in generic form. The extended-release formulations provide longer durations of action, resulting in the need for fewer daily administrations, elimination of school administrations, and thus fewer adherence issues and less potential for diversion and abuse. The extended-release preparations of the stimulants have durations of action that start ~30 minutes after dosing and last 8 hours (Ritalin LA and Metadate CD) to 12 hours (Concerta and Adderall XR). Dosing starts at the lowest dose available. Doses exceeding those approved by the Food and Drug Administration have been used clinically. A recent multisite study of OROS methylphenidate with adolescents demonstrated that one third of the participants experienced the best efficacy with 72 mg daily, with good tolerability.⁹²

There seems to be a dose-response relationship for both behavioral and cognitive effects of the stimulants among youths with ADHD,^{89,93} as well as for the most commonly reported short-term adverse effects, such as appetite suppression, sleep disturbances, and abdominal pain.^{89,94,95} Long-term adverse effects remain controversial, with mixed literature findings indicating only a weak association with motor tic development and variable results regarding height/weight decrement among prepubertal youths with ADHD.^{88,94,96}

Survey studies suggest that diversion of stimulants, especially immediate-release preparations, continues to be noteworthy.^{97–99} Medications may be abused orally or by grinding them into powder and then administering them through nasal insufflation. Psychostimulant medications may also be diverted to peers, either as a “favor” to friends or for financial profit. For example, in a survey of junior and senior high students who were prescribed stimulants,¹⁰⁰ 7% had sold (diverted) their medications. Similarly, diversion of stimulants to young adults presumably without ADHD seems problematic.¹⁰¹ Survey studies with college students indicated that ~11% of students without ADHD reported using methyl-

phenidate or amphetamine recreationally (including intranasally).¹⁰² Recently Wilens⁹⁷ presented data indicating that 11% of older adolescents and college-aged students were diverting their stimulants. Interestingly, diversion was exclusively with immediate-release but not extended-release stimulants and was confined largely to those with concurrent substance abuse or conduct disorder. More disturbingly, Low and Gendaszek⁹⁸ reported that, in a survey study of 150 undergraduate students (ADHD status not assessed) at Bates College, 4% had misused amphetamine compounds, 7% methylphenidate, and 24% both (total of 36%). As a comparison with another abused substance, one third of subjects in that sample also admitted using cocaine. However, as noted above, recently published evidence indicates that pharmacotherapy of ADHD does not increase the risk for substance abuse among individuals with ADHD but seems to reduce the risk for substance abuse by one half.⁹⁹

Atomoxetine (Strattera) is a recently approved, nonstimulant agent that has been approved for adolescents with ADHD. Atomoxetine is a highly specific, noradrenergic reuptake inhibitor with efficacy for ADHD.^{100,101} Moreover, atomoxetine seems to have efficacy for ADHD plus co-occurring disorders such as anxiety, tics, and depression. Atomoxetine has been shown to have similar efficacy and tolerability (side-effect profile) among adolescents, relative to more prototypic school-aged children with ADHD. In addition, long-term data indicate continued effectiveness with normal growth in height and weight and no unexpected adverse events occurring over 2 years.¹⁰¹

Atomoxetine demonstrates no abuse liability and is unscheduled by the Drug Enforcement Administration. Atomoxetine can be dosed once or twice daily; it should be initiated at a dose no higher than 0.5 mg/kg per day and increased to 1.2 mg/kg per day in 2 weeks. The peak efficacy of the medication seems to develop over 2 to 6 weeks. If adolescents continue to manifest symptoms, then the dose of atomoxetine can be increased to 1.4 mg/kg per day (100 mg per day) (Food and Drug Administration-approved dosing) to 1.8 mg/kg per day (maximal dose evaluated in clinical studies).^{100,101} The effects of atomoxetine are more gradual than those experienced primarily with stimulant medications.

Adverse effects of atomoxetine among adolescents (as among younger children) include sedation (usually noted during initial titration), appetite suppression, nausea, vomiting, and headaches. Most short-term adverse effects can be managed by changing the time of administration of the medication. Most recently, rare occurrences of hepatotoxicity that resolves when the medication is stopped have been reported (Lilly, personal communication). Data on the long-term adverse effects of atomoxetine are limited. There do not seem to be drug interactions with the stimulants, a combination that might be very helpful in refractory cases of ADHD. Case reports of this combination have been published,¹⁰² but there have been no formal studies of the effects of combined therapy. Atomoxetine doses should be re-

duced if the drug is administered with agents that inhibit the cytochrome P450 microsomal enzyme system, such as paroxetine (Paxil). Until additional evidence defines its safety and efficacy, the drug should be considered for adolescents with conditions unresponsive to stimulants, those with a preference for a nonstimulant, and those for whom there is concern about abuse by the patient or family members.

The antidepressants are off-label and are considered second-line medications for ADHD. The tricyclic antidepressants, eg, imipramine (Tofranil), desipramine (Norpramine), and nortriptyline (Pamelor), block the reuptake of neurotransmitters including norepinephrine. Tricyclic antidepressants are effective in controlling behavioral problems and improving cognitive impairments associated with ADHD but are less effective than the majority of stimulants, particularly for cognitive impairments.⁸⁸ Desipramine and nortriptyline were shown in published reports to have both short-term and long-term effects among adolescents.^{103,104} The tricyclic antidepressants should be considered only when adequate trials with both stimulant medications (amphetamine compounds and methylphenidate) have failed, atomoxetine is ineffective, and behavioral interventions have been tried. Dosing of the tricyclic antidepressants starts with 25 mg daily and is titrated upward slowly to a maximum of 5 mg/kg per day (2 mg/kg per day for nortriptyline).¹⁰⁴ Common adverse effects among adolescents include sedation, weight gain, dry mouth, constipation, and headache. Four deaths among children with ADHD (including 1 adolescent) who were treated with desipramine were reported.¹⁰⁵ However, independent evaluation of those cases failed to support a causal link.¹⁰⁶ Because minor increases in heart rate and the electrocardiographic intervals are predictable with tricyclic antidepressants, electrocardiographic monitoring at baseline and at the therapeutic dose is suggested (although not mandatory).¹⁰⁷

The novel dopaminergic antidepressant bupropion (Wellbutrin) has been reported to be effective and well tolerated in the treatment of ADHD,¹⁰⁸ although it remains untested among adolescents with ADHD under controlled conditions and therefore is a second-line treatment. One open-label study among depressed adolescents showed improvement in both ADHD and depression.¹⁰⁹ Bupropion should be started at 100 mg and slowly titrated upward, with beneficial effects for ADHD being noted generally at 300 to 400 mg daily.

The antihypertensive agent clonidine (Catapres) has been used increasingly as a second-line medication for the treatment of ADHD, particularly among adolescents with hyperactivity and aggressiveness.¹¹⁰ Although the effect of clonidine on ADHD is not as robust as that of stimulants, a meta-analysis suggested a moderate effect size (0.58) for this agent on symptoms of ADHD co-occurring with tics, aggression, or conduct disorder.¹¹⁰ Clonidine is a short-acting agent, with daily doses ranging from 0.05 mg to 0.6 mg, given in divided doses up to 4 times daily. Clonidine is commonly used clinically in addition to

stimulants and antidepressants. Short-term adverse effects include sedation (which tends to subside with continued treatment), dry mouth, depression, confusion, electrocardiographic changes, and hypertension with abrupt withdrawal. A recent multisite study demonstrated the usefulness of clonidine alone and in combination for the treatment of ADHD among children with tics.¹¹¹ Abrupt withdrawal of clonidine has been associated with rebound; therefore, slow tapering is advised. Guanfacine (Tenex) has also been used to treat ADHD, alone or in combination with tic disorders, among preadolescent children.¹¹² Dosing of guanfacine generally starts at 0.5 mg per day and is increased as necessary to a maximum of 4 mg per day, in 2 or 3 divided doses.

Although the serotonin reuptake inhibitors (for example, Prozac) are not useful for treatment of ADHD, venlafaxine (Effexor), because of its noradrenergic reuptake inhibition, may have mild efficacy for ADHD.¹¹³ Monoamine oxidase inhibitors (Nardil and Parnate) have been shown to be effective among adolescents with ADHD.¹¹⁴ However, the potential for hypertensive crises associated with tyramine-containing foods (such as most cheeses) and interactions with prescribed, illicit, and over-the-counter drugs (pressor amines, most cold medicines, and amphetamines) limit its usefulness. Provigil and cholinergic agents remain untested among adolescents.

Psychosocial Interventions

Types of Treatments

Psychosocial treatments encompass a broad set of interventions, including behavior therapy, academic interventions, family therapy, and care coordination. Relatively little research has been conducted on psychosocial treatments for adolescents with ADHD,⁵³ compared with the vast amount of treatment outcome research completed for children with the disorder.¹¹⁵ Nevertheless, there are important practice implications for adolescents that can be surmised from this work.

School Problems

Problems at school tend to be the most common complaints of parents of adolescents with ADHD.¹¹⁶ These usually include poor performance on tests and quizzes, missing assignments, careless work, and poor writing. Psychosocial interventions targeting these areas include behavioral techniques addressing organization and academic interventions, including training in note-taking and study skills, that focus on underachievement.^{60,117,118} These interventions tend to be labor intensive and are provided frequently by teachers and other school personnel. School districts' willingness to provide these interventions to adolescents varies. Some schools prioritize these services and provide them when the problems are recognized. Receiving these services in other districts can be enhanced by having a child identified as eligible to receive services under Section 504 of the Rehabilitation Act or in the "Other Health Impaired" category of the Individuals with Disabilities Education Act.⁵⁰ Although a diagnosis of ADHD does not by

itself qualify a student for these services, an adolescent with ADHD is likely to be found eligible if the ADHD is accompanied by significant academic impairment. Physicians may facilitate this process by educating parents about these services (www.ideapractices.org/index) and providing documentation of the diagnosis and impairment.

Substance Use

Because substance abuse becomes a prominent issue among adolescents, educating parents and patients about the risks and informing them about appropriate local prevention and intervention resources may be very helpful. The data suggest that this should be performed at a relatively young age (<11 years), because youths with ADHD begin their experimentation earlier than do children without the disorder.^{35,119} Some parents may request that their physician conduct random drug screens. Although parents may want to know the truth about their child's experimentation and use of illegal drugs, conducting these screens against the wishes of the adolescent can affect family relationships seriously. For example, parents who request a drug screen communicate to their child that they no longer trust him or her. Although this may be obviously true in some families, in others this message may disrupt family functioning seriously. Furthermore, it can lead to power struggles and defiance by adolescents who refuse to comply with these screens. Adolescents also may find ways to defeat the validity of the screens, by drinking excessive amounts of water or using products that are readily available via the Internet. Depending on the age of the adolescent and the consent laws in the state, the child's consent may be needed to conduct the screens, and the American Academy of Pediatrics recommends that drug screening not be performed without a child's knowledge and consent except in cases of medical necessity.¹²⁰ In addition, parents need to know what to do if the test results are positive. Parents wonder frequently how to respond to this news, and counterproductive responses are not uncommon. Pediatricians conducting drug screens should consult with a toxicologist or addiction professional at the time the test is ordered, to avoid false-positive and false-negative tests.

Family Stress

In addition to concerns about substance use, the cumulative effect of the chronic stress of raising a child with moderate to severe ADHD can take a serious toll on parents.¹²¹ Parents respond to this stress in many different ways, and some of these reactions may affect the adolescent, the parents, and the siblings negatively. Simple recognition and assessment of parents' stress and coping can be a useful psychosocial intervention for many parents. Parents may need supportive services, and physician encouragement and appropriate referrals can facilitate this need being met. Although early reports indicate that parent training and family therapy are not as effective for adolescents with ADHD and their families as they have been for children with

ADHD,¹²² these interventions can be helpful for some parents and should be considered for families exhibiting significant distress. Furthermore, some forms of family therapy that have not been assessed directly with families of adolescents with ADHD have been found to be effective with families of adolescents with problems such as substance abuse and should be evaluated with this population.¹²³

Social Impairment

The social impairment reported frequently to accompany ADHD among children continues into adolescence.¹²⁴ The consequences of these problems may be even greater for adolescents than for children, because the cruelty of peer rejection and bullying can be greatest in the young adolescent years. In addition, social impairment with ADHD increases the risk for substance use and other problems.¹²⁵ Effective psychosocial treatments for adolescents with social impairment have not been reported, although modest results were observed in initial studies of comprehensive and intensive psychosocial treatment programs.¹¹⁷ These interventions incorporated novel techniques, including videotape reviews of naturally occurring social behavior, and emphasized strategies to facilitate generalization. Many traditional social skills interventions fail to generalize to natural settings and have minimal impact on social functioning^{126,127} or have not been evaluated with adolescents.¹²⁸

Driving

The data describing automobile accidents and traffic violations involving adolescents with ADHD are likely to lead many parents of these young drivers to ask their physicians for guidance.⁶¹ Unfortunately, there are no reports of effective psychosocial interventions for this problem and only preliminary information on the potential benefits of medication.¹²⁹ Parent management strategies related to the use of an automobile have implications for this difficult area. Parents may restrict the peers who can ride with their adolescent driver, limit the time of day the car can be used, and provide close monitoring. The risks associated with driving problems are increased significantly if the adolescent is experimenting with drugs or alcohol.¹²⁹ Parents should be encouraged to discuss this topic regularly with their teenager and to follow up aggressively on any suspicions. In some situations, maintaining driving privileges may be contingent on demonstrating responsible behavior in other settings, such as home and school, and possibly participating in laboratory testing for drugs. For some adolescents with ADHD, it may be important to plan medication dosing so that the adolescents have coverage during periods in which they are likely to be driving.

Primary care physicians are being incorporated increasingly into important roles in the delivery of universal and selective psychosocial mental health services.^{130,131} Implementing these basic psychosocial interventions in a busy pediatric practice is likely to be a challenge. Because of the wide range of impairment among adolescents with ADHD, care is

often provided by a variety of professionals. As other providers become involved, the coordination of care becomes a central issue and can be facilitated by the sharing of information about the services and measures of progress. This system is part of the medical home concept.¹³² Collaborating with a qualified psychologist or mental health counselor with expertise working with adolescents and behavioral techniques can be a practical solution; however, there are many communities without providers with expertise in these areas. Counselors and teachers at secondary schools may provide many of these services and may be very interested in collaborating with a physician practice.

TRANSITION TO ADULTHOOD

Insurance Coverage

The peer-reviewed medical literature about the transition from secondary education for young people with ADHD is sparse. It is clear, however, that the move to increasing independence and postsecondary training is fraught with difficulties for all adolescents with chronic medical conditions.¹³³ Before they can begin to consider training and other issues, they would benefit from finding ways to continue medical care and maintain at least the semblance of a medical home.

Even in childhood, health insurance for individuals with ADHD is limited. A survey of Children and Adults with Attention-Deficit/Hyperactivity Disorder members¹³⁴ found that 82% of health insurance policies held by a sample of members contained assessment of ADHD limitations and 24% of health policies did not cover the treatment of ADHD; of the 76% of policies that covered the treatment of ADHD, 83% contained treatment limits. In addition, the out-of-pocket obligations were higher than for other health conditions and were similar to those for other psychiatric conditions.

The insurance coverage issues are magnified when a child becomes an adult. At a time when many of the family structures that have supported them through their school careers begin to change and become more tenuous, adolescents' ability to obtain and fund medical care decreases precipitously. Young adults, 18 to 24 years of age, are more likely than any other age group to be uninsured.¹³⁵ Of Americans between the ages of 18 and 24 years, 31.6% are without medical insurance, compared with 12.0% for those ≤ 18 years of age.¹³⁶ Many commercial policies no longer cover young people under their parents' policies, particularly if the young people are not enrolled full-time in college or other advanced training.¹³⁶ Because the median costs of health care for individuals with ADHD are twice those for individuals without ADHD,¹³⁷ obtaining private health insurance on their own before they are employed full-time is likely to be difficult for individuals with ADHD. Government health care programs also cease after age 18 for unmarried people without children.¹³⁸ The ability to pay for continuing medical care and medication therefore becomes a critical issue for young adults with ADHD, which is

complicated by preexisting-condition exclusions present in many policies.

Access to Care

After reaching the age of majority, fewer young people are cared for by pediatricians, and family and adult physicians may be less comfortable dealing with young people with ADHD. Although some patients continue care for ADHD through the services of the psychiatric community, the inability of these physicians to provide comprehensive medical services would preclude their replacing a medical home model for their patients,^{139,140} which would be provided ideally by the patient's pediatrician. College health services may provide support for individuals who are enrolled in college, but such services cannot be expected to offer comprehensive care when the student is home or outside the school calendar. Whenever possible, it is important to have a plan on how to transition these individuals into the adult health care system.

Anticipatory Guidance

The need for pediatricians and other health professionals to provide anticipatory guidance to their graduating patients with ADHD is important. Adolescents with ADHD who are leaving home for what may be the first time are particularly vulnerable to the consequences of sudden diminution of parental supervision. In preparing students with ADHD for being away at school, physicians need to caution them about the increased risk of their becoming smokers¹⁴¹ and their increased risk of driving-related morbidities.⁵⁶ In addition to a general warning to college-bound students to avoid binge drinking, students with ADHD need to know that they have an increased long-term risk of alcohol and illicit drug use if they are not receiving appropriate treatment.¹⁴² Individuals preparing for college need to become aware of how to navigate the complexities of dealing with college scheduling and course planning, acquiring study skills, and learning to access any special services for students with ADHD that their college may offer. They also need to deal with the more basic problems of following a schedule on their own and taking their medication reliably. There are several educational materials that may be useful for them to read.¹⁴³⁻¹⁴⁵ They should be reminded of the potential for theft in keeping a controlled substance in their dormitory rooms and the hazards of sharing or selling controlled substances to their peers.¹⁴⁶

Testing Accommodations

Both the SAT¹⁴⁷ and ACT¹⁴⁸ have processes in place to allow students with ADHD to apply for special accommodations, including extended testing time. However, there are strict requirements for the type and timing of documentation required. Details are available at the Educational Testing Service Web site (www.ets.org/disability/adhdplcy.html). Both testing services have subscribed to the basic tenets established by the Consortium on ADHD Documentation¹⁴⁹ and have ceased flagging tests taken with

special accommodations.¹⁵⁰ For consideration for military service, each enlistee must take and pass the Armed Services Vocational Aptitude Battery, a timed test for which no accommodations are permitted.¹⁴³

Military Enlistment

Enlistment in the military is uncertain for those with ADHD. The reasons for rejection for appointment, enlistment, or induction include a history of immaturity and impulsiveness, a chronic history of academic skill deficits that interfere with work or school after age 12, and the current use of medication to improve or to maintain academic skills. Under certain circumstances, individual military services may grant waivers to individuals who do not meet the basic eligibility criteria. Demonstrating success in either school or work for a certain period of time without the use of medication is basic in whether a waiver will be granted.¹⁴³

PLANNING FOR THE FUTURE

Planning for the future is complicated for all graduating high school students but offers special challenges for those with ADHD. Educational attainment is less for patients with ADHD, and their future occupational outcomes are of lower ranking than those of their cohorts.¹⁵¹ Young people who have ADHD, predominantly inattentive type, or ADHD, combined type, have fewer years of school and are less likely to graduate from college, compared with young people without ADHD. Furthermore, youths with the combined type of ADHD have higher rates of oppositional defiant disorder, suicide attempts, and arrests than do those with the inattentive type.¹⁵²

High school, college, and other counselors have made themselves available to help such students, and vocational tests are available to help assess likely job satisfaction, but the usefulness of such assistance for this population is not well documented in the medical literature. Anecdotally, special services programs provided by colleges seem to fulfill real needs for students with ADHD, including providing late course-dropping dates, special registration assistance, adaptive equipment such as computers, and note-takers for qualifying students.¹⁵³ Some communities offer support for students with ADHD through state vocational rehabilitation services or through ADHD coaching services.¹⁵⁴ Although there is little research in this area, there are a number of organizations, publications, and websites offering information, encouragement, and support to adolescents making the transition from secondary school to work or postsecondary education.¹⁵⁵⁻¹⁶²

FUTURE RESEARCH

Although much progress has been made in our understanding of the diagnosis and treatment of ADHD, much has yet to be researched, particularly for adolescents. It is clear that the current diagnostic criteria, although valid for children, may need to be modified for adolescents and adults, to reflect the developmental changes that take place as children approach adulthood. How the subtypes change in the transition from childhood to adolescence and

how the patterns of comorbidities change need to be identified more clearly. The recent pressure and incentives that the government has placed on the pharmaceutical industry have increased the number of pharmaceutical company-sponsored studies among adolescents. However, additional studies are required to clarify how medication needs, types, dosages, and frequencies of administration differ among adolescents and adults, compared with children. Given the developmental significance of social functioning, additional studies of the development and evaluations of psychosocial interventions targeting these behaviors are greatly needed. The unique aspects of obtaining adolescents' adherence to treatment are important factors requiring clarification. Lastly, longitudinal studies examining the outcomes for adolescents and adults are required to identify more clearly the course of the disorder and the impact of treatment.

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Diagnosis, Treatment, and Clinical Implications**

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