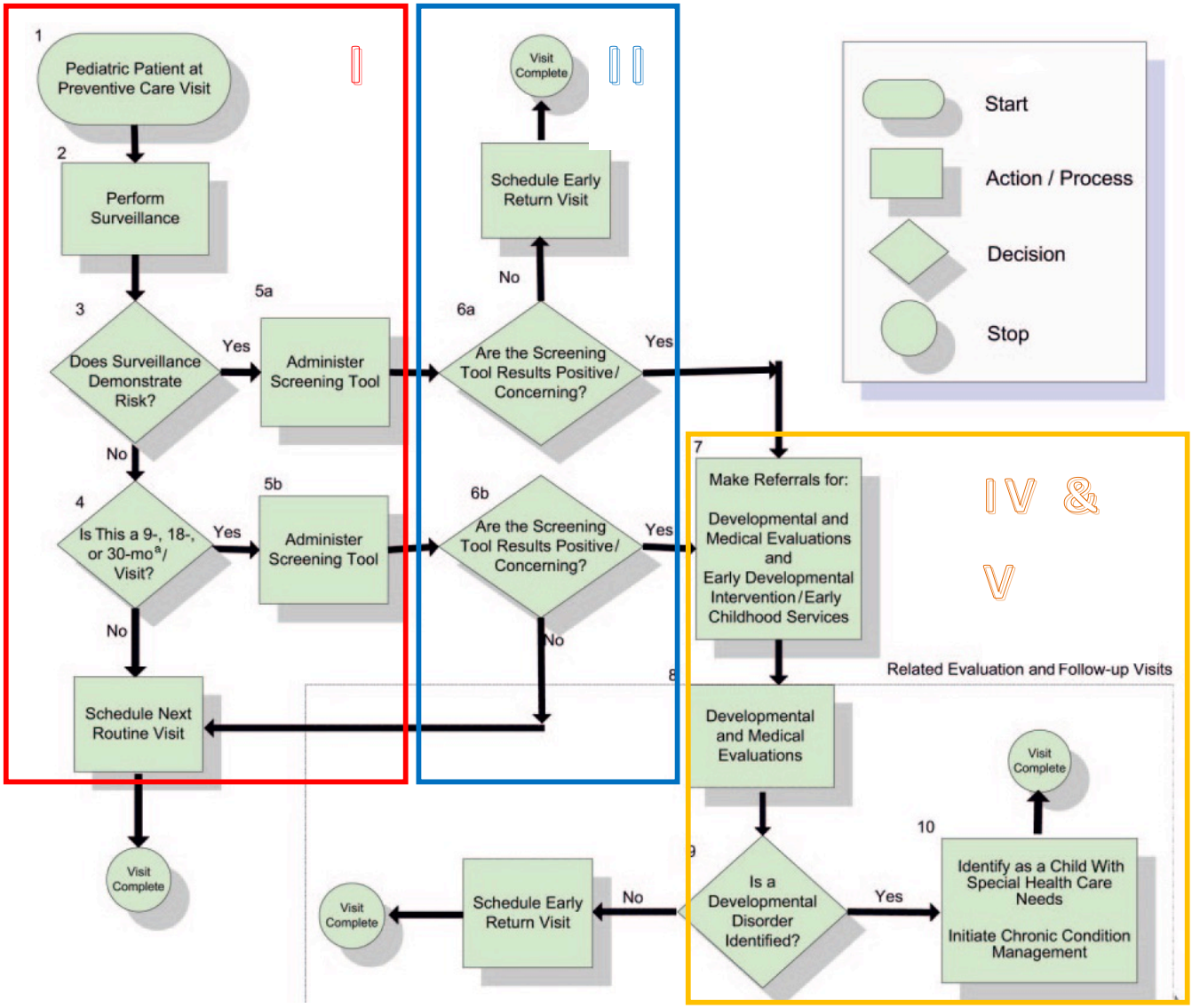
NCC Pediatrics Continuity Clinic Curriculum: **Development I-V** *Faculty Guide*

Overall Goal:

Understand the proper use of developmental surveillance in the pediatric office, to include developmental screening, school readiness, & use of community resources. *(Graphic from AAP Policy Statement on Developmental Screening & Surveillance— See Extra Credit).*

Overall Objectives:

- Devo I: Typical Development
- Devo II: Atypical Development
- Devo III: "K.I.D.S. Game"
- **Devo IV: Psycho-educational Testing**
- Devo V: Developmental Interventions & Services



NCC Pediatrics Continuity Clinic Curriculum: **Development IV: Psychometric Testing** ***Faculty Guide***

Goals & Objectives: *To understand the appropriate use of psychometric testing in the pediatric office to better promote school readiness and inform patient advocacy:*
- Learn the early warning signs and how to diagnose Specific Learning Disabilities, such as RD.
- Explain how IQ and Achievement tests can be used in conjunction to diagnose LDs.
- Review the diagnostic criteria and rating scales for ADHD
- Model how to use psychometric testing results to designate specific school-based interventions.

Pre-Meeting Preparation:

Please read/review the following enclosures:

- "Learning Disabilities and School Failure" *(PIR, 2011)*
- "Attention-Deficit/Hyperactivity Disorder" *(PIR, 2010) (article predated DSMV)*
- "Pediatricians Integral to ADHD Diagnostic Practices" *(AAP News, 2015)*
- Review of Psychometric Tests:
  - Wechsler Intelligence Scale for Children (WISC) V E-brochure
  - Woodcock Johnson IV Pamphlet Update

Conference Agenda:

- *Review* Development IV Quiz *(<5min)*
- Complete Development IV Case *(based on patient P.M.)*
- **Round table:** Review provided copies of WISC-V and WJ-IV as examples of IQ and Achievement Tests. Encourage residents to share examples of psychometric testing from their own patient panels.

Post-Conference: *Board Review Q&A*

Extra-Credit:

- "School Performance: The Pediatrician's Role" (Clinical Pediatrics, 2008)
- "Discovering Gifted Children in Pediatric Practice" (Journal of DBP, 2005)
- **NICHQ ADHD Toolkit** *(on NCCPeds Website)*
- CAM for LD; CAM for ADHD (PIR, 2001; 2009)

Learning Disabilities and School Failure

Sheryl L. Rimrodt, MD,*
Paul H. Lipkin, MD†

Author Disclosure
Drs Rimrodt and Lipkin have disclosed no financial relationships relevant to this article. This commentary does not contain a discussion of an unapproved/investigative use of a commercial product/device.

Objectives After completing this article, readers should be able to:

1. Articulate a systematic medical approach to the child who has school failure or suspected learning disability.
2. Compare and contrast learning disability from other related conditions that may affect a child's school function.
3. Identify key historic factors recognized during developmental surveillance for children who have learning disabilities.
4. List key school and community resources for advising parents about the evaluation, treatment, and prognosis of a child who has a learning disability.
5. Outline a medical home management plan for children who have learning disabilities.

Case Study

During a health supervision visit for a 7-year-old boy, the pediatrician asks the boy's mother if she has any concerns about his development and school progress this year. She reports, with a deep sigh, that he is doing well with friends and at home, but he is doing poorly with his school performance. He is having difficulty in his reading and cannot complete many of the school assignments. While at home, he avoids his homework, often arguing with her about completing it and leaving to go play video games. She has not yet discussed her concerns with his teacher. She expresses relief about being asked about this and welcomes the pediatrician's advice about what to do next.

Introduction

Close to 3 million children from the ages of 6 to 11 years are affected by learning disabilities (LDs). (1) The category of specific LD includes disabilities in mathematics and written expression, but the most common form of specific LD is reading disability (RD) or dyslexia, which is the primary focus of research and of this review. RD accounts for 80% of cases of LD and occurs in an estimated 5% to 10% of the general pediatric population, with the most recent population surveys placing the figure at 6.5%. (1)(2) Males who have RD outnumber similarly affected females. Within specific medical populations, such as in children who have neurofibromatosis type 1, the frequency of RD can be 50% or more.

These estimated frequencies are much greater than those of other well-known developmental disorders, such as intellectual disability and autism, which occur in about 1% of children. In fact, RD rivals other common pediatric disorders in frequency, such as asthma, which is estimated to occur in about 10% of the general pediatric population.

As with most medical disorders, different children may experience different degrees of impairment. Functioning is modulated by the presence or absence of environmental supports. For example, a child who has RD in early elementary school may be able to compensate adequately with a strong memory for individual words, but if the disorder remains unrecognized, as the school curriculum shifts from "learning to read" to "using reading to learn," the student may begin to experience early symptoms of academic impairment, such as an unexpected drop in grades. If the disorder is not addressed at an early stage, the student is at increased risk of resorting to protective mechanisms to

*Division of Developmental Medicine and the Center for Child Development, Assistant Professor of Pediatrics, Vanderbilt University School of Medicine, Nashville, TN.
†Director, Center for Development and Learning, Kennedy Krieger Institute; Associate Professor of Pediatrics, Johns Hopkins University School of Medicine, Baltimore, MD.

minimize the damage to self-esteem caused by repeated failures and humiliations, such as dropping out of school.

In a recent survey in United States public schools, school failure, defined as grade retention (repeat of grade), occurred in 10% of kindergarten through eighth-grade students at least once. (3) The provision of special education services in United States public schools has grown from 3.7 million (5% of students) in the 1976 to 1977 school year, shortly after the Individuals with Disabilities Education Act (IDEA) was first passed, to 6.7 million (9% of students) in the 2006 to 2007 school year. The most common disability qualifying a student for services was RD, with the percentage of students receiving services under this diagnosis increasing from 2% in 1975 to 5% in 2007. Grade retention continues to be employed by some schools, even in the face of growing consensus that it does not improve and, in fact, may harm a student's outcome.

Another presentation of school failure is expulsion, which occurred for only 0.2% of children in 2006, but with marked disparities along racial, socioeconomic status, and sex-based divisions. (3) Dropping out of school is a third sign of school failure. The United States Department of Education defines the dropout rate as the percent of 16 to 24 year olds who are not enrolled in school and do not yet have a high school diploma or a General Equivalency Diploma (GED). The GED is a set of subject tests that, when passed, certify that the taker has American or Canadian high-school level skills. The status dropout rate has decreased from 14% in 1980 to 9% in 2007, but this decline still likely represents a net increase in total number of dropouts, based on the overall increase in student enrollment since 1970 (up 12% to 19% for the 18- to 24-year-old age range). (3)

In this article, we present a model for conceptualizing learning problems, using a framework to guide the clinician in deciding how to identify, assess, and manage an undetected LD in a child who is at risk for increasing school problems that could eventually result in school failure.

Definition

LD represents a disability based on a discrepancy between a person's overall intellectual ability and actual academic performance. It is currently defined formally in the IDEA as "a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations" and "includes such conditions as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia." (4) The definition specifically excludes children who have learning problems resulting from primary visual, hearing, or motor disabilities; intellectual disability; and environmental, cultural, or economic disadvantage. The American Psychiatric Association (APA) created a working definition for LD in *The Diagnostic and Statistical Manual of Mental Disorders* Fourth Edition Text Revision as "when the individual's achievement on individually administered, standardized tests in reading, mathematics, or written expression is substantially below that expected for age, schooling, and level of intelligence. The learning problems significantly interfere with academic achievement or activities of daily living that require reading, mathematical, or writing skills." (5) The APA subdivides LD into RD, mathematics disorder, disorder of written expression, and learning disorders not otherwise specified. Although a research definition does not exist for LD, the definition for RD, often referred to as dyslexia, is "difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities" that "typically result from a deficit in the phonological component of language." (6) The core concept of the definition of dyslexia is that it is unexpected because "it occurs in spite of the individual having received appropriate reading instruction and having otherwise average to above-average overall cognitive abilities." (7)

With the reauthorization in 2004 of IDEA, there was a conceptual and regulatory shift away from policies that resulted in waiting until a child had received testing to document a discrepancy between achievement and overall intelligence before providing special services. The new regulations encourage school districts to provide additional support for struggling students, even before a diagnosis is established, through a process called Response to Intervention (RTI).

An important distinction for a clinician to understand is that, in the United States, LD is not the same as intellectual disability (formerly mental retardation), a diagnosis defined by deficient performance (at or below two standard deviations from the mean) on measures of both intellectual skill and functional skills in self-help and adaptive behavior. In contrast, children who have LD perform overall within the normal range of intelligence and adaptive functioning but show isolated specific academic skills deficits. It should be noted that in the United Kingdom, the term LD is used in place of intellectual disability, without a clear distinction between these disabilities.

School failure sometimes is defined as retention in a

Table 1. Signs and Symptoms of Learning Disability and School Failure

Increased Learning Effort	School Distress	School Failure
"School is boring"	Frequent failing grades	Retention
School anxiety	Frequent absences	Expulsion
Class clown behavior	Social disengagement	Dropping out
Spending a much longer time completing homework than classmates	Frequent detention	
	Suspensions	
	Aggression and bullying behaviors	

grade, but it may be even a more severe failure when a student is expelled or drops out. These two situations may not typically be considered as being closely related to LD, but within populations that have other behavioral problems, there is a significantly increased risk of concurrent academically impairing learning difficulties. We propose an approach for earlier detection of school problems, with recognition before a child progresses to school failure.

Pathogenesis

Significant evidence points toward both genetic and neuroanatomic bases for both LD and RD. Family and twin studies suggest that 50% of the problems in performance can be accounted for by heritable factors, with environmental influences greater in children who have lower IQ scores. Genetic linkage analyses suggest loci on chromosomes 2, 3, 6, 15, and 18, with four candidate susceptibility genes (*DYX1C1, KIAA0319, DCDC2, ROBO1*) identified. (8) These genes are involved in neuronal migration and axon growth. Identified anatomic abnormalities include ectopias in cortical layer 1, focal microgyria, and defects in the thalamus and cerebellum. Differences have also been described in the temporal, parietal, and occipital brain regions. Abnormal circuitry may account for the sensory, motor, perceptual, and cognitive problems seen in LD, including the phonologic deficits, motor deficits, and problems in auditory discrimination, borne out in recent functional magnetic resonance imaging studies. (9)

Clinical Aspects

LD is considered to cause relatively low morbidity because the presentation is often more subtle than in other developmental disorders, such as intellectual disability or autism, leaving the problem undetected until school entry or later. For example, a child who has RD may compensate for a limited ability to use the alphabetic principle to decode words by rote memorization of a large number of sight words. A child who has strong general cognitive ability, as can be the case in RD, may be able to employ this strategy successfully well into upper elementary school or even later. Symptoms of academic distress (Table 1) might not be apparent until the coping strategies begin to be outstripped by increasing school demands for reading and writing in middle school and beyond, often manifesting as academic underachievement, school failure, or classroom behavior problems.

Earlier signs of LD may assist in earlier identification. Through the use of developmental surveillance at routine health supervision visits, the pediatrician may recognize significant risk factors, such as a prior medical history of prematurity or family history of LD and educational difficulties. (10) A history of preschool developmental problems can also indicate that the child is at increased risk for LD. The child who has a preschool speech and language disorder may later experience educational difficulties in areas such as comprehension of language-based instruction or the phonemic processes used in the development of early word reading or decoding. Difficulty with recognition and drawing of shapes in the preschool period may portend problems in letter recognition or writing. Such language and visual motor difficulties may also be associated with problems with the sound/symbol associations needed for reading. Performance of formal developmental screening at the 30-month visit may identify these related preschool problems; performance at the 48-month visit may identify specific problems in early decoding, writing, and sound/symbol association.

Using the Medical Model for Approaching School Difficulties

As a starting point for outlining a medical model to approach school failure in children, we can use the analogy of a medical approach to respiratory distress or failure. Presented with a child already in respiratory arrest, a practitioner may not immediately know the cause but he or she does know two facts:

- Respiratory failure is a final common physiologic pathway for a large number of conditions, but the differen-

tial diagnosis can be narrowed by taking a focused history.
- Any interventions initiated at this point have a much higher chance of success if warning signs of respiratory distress are identified and treated before progressing to failure.

Similarly, a medical practitioner presented with a child already in school failure does not immediately know the cause but he or she does know two facts:

- School failure is a final common pathway for a large number of conditions, but the differential diagnosis can be narrowed by taking a focused history.
- Any interventions initiated at this point have a much higher chance of success if warning signs of "school distress" are identified and treated before progressing to failure.

Thus, the proposed framework includes recognizing signs and symptoms that can improve the early identification of "increased effort of learning" and "school distress" before it progresses to failure.

Early Recognition

It has been observed that successful intervention is much more difficult once a student has progressed to one of the signs of school failure. However, earlier detection of "increased effort of learning" and "school distress" may be more amenable to treatment and are noted frequently in any pediatric practice if the clinician purposely elicits the information from patients and families. For example, in 2006, 7% of children (1 in 14) had been suspended from school at least once during the year. (11) In some students, signs of school distress can present as internalizing behaviors resulting in frequent absences or social disengagement; other students may present with externalizing symptoms such as "acting out" (ie, negative attention seeking at school) leading to frequent detentions or aggressive behavior that may eventually result in suspension or expulsion. Aggressive behavior toward vulnerable students (bullying) is particularly in the spotlight due to increased awareness of recent acts of homicide and suicide occurring in schools. In the 2005 to 2006 school year, 78% of public schools experienced one or more violent incidents; 17% of these were reported as serious violent incidents. (11)

Other, more subtle and perhaps earlier signs of school distress may indicate increased effort of learning. The most straightforward example of this distress is the student who diligently puts in several hours each night on homework and still underperforms in school. This is a common history obtained from children found to have RD. Another strategy that students may use to divert attention from academic underachievement is playing the class clown, which results in interruptions of instruction, especially when that student feels put on the spot. Some children present a cavalier or disdainful attitude toward school, describing it as "boring." Children using any of these strategies may, in fact, be experiencing significant anxiety that can further impair cognitive function (eg, memory deficits) and executive functioning (eg, inability to plan ahead to organize one's time). Pediatricians alert to the various presentations of school distress are more likely to identify children at risk in the early school years.

History

The next step in the evaluation of the child who has school failure or suspected LD is to obtain a focused history that includes the following elements: past school history and current school day routines, developmental milestones, social history, pregnancy-to-birth history, past medical history, and family history of similar concerns.

SCHOOL HISTORY. A detailed chronologic school history should include whether the child attended child care, preschool, or prekindergarten as well as a chronologic summary of schools attended from kindergarten forward. Was the child ever asked to leave (expelled) from one or more of these settings and for what behaviors? Was school entry postponed because of immaturity? How successful was each school year, ie, was there a change in performance across years? Was the child retained in any grade? A large number of different schools attended may simply reflect family circumstances but can sometimes be a hint of problems that resulted in the child being placed in a different setting. Have teachers (past or present) expressed concerns about the student's school performance? How is the child performing this year compared with previous years? How easy or difficult is it to complete homework? How many hours are spent on homework each night? Is homework a source of family conflict? Is homework interfering with the child's opportunities to participate in favorite extracurricular activities? What are the child's interests, extracurricular activities, and areas of strength? Does the child enjoy reading for pleasure? Are there sleep problems affecting learning or resulting from school problems?

Details about the current classroom setting are relevant, including how many students are in the child's classroom and how many teachers or aides are routinely

in the classroom. Does the student have a one-to-one aide and a 504 plan or an Individualized Education Program (IEP) (12)(13) in place? The 504 plan is part of a United States federal law passed in 1973 (the Rehabilitation Act) that extended civil rights to individuals who have disabilities. The Act allows for reasonable accommodations such as a special study area, as necessary, for students who have disabilities. The IEP process is mandated by the recently reauthorized (2004) IDEA, which is enacted to provide every United States child with a free and appropriate education that meets the unique needs across the lifespan (birth to 21 years) of the individual who has a qualifying disability and prepares that person for future educational, employment, and independence opportunities.

HISTORY OF PREVIOUS EVALUATIONS. Knowledge of previous evaluations may provide important insights. For example, has the child been seen previously by a professional specifically for an assessment of development or a learning-related evaluation (eg, IQ testing, academic testing)? Was the child ever evaluated in the state Early Intervention or Special Educational Preschool programs? If the child ever had a 504 plan or an IEP in school, what services were received and for how long? When was the most recent re-evaluation? Has the child ever been treated for speech, language, or learning difficulties with special therapy or classroom placement? Has the child received tutoring? Reviewing copies of relevant past evaluations can often offer an additional perspective on the child's past development that may not be elicited in discussions with the family.

CHILD'S SCHOOL DAY SCHEDULE. It also is important to obtain a history of the child's schedule for a school day, including what time the child wakes up, any medications taken, how easy it is for the child to get out of bed, whether he or she requires excessive supervision while dressing and getting ready for school, and how efficient this process is. For example, are mornings always "down to the wire" on getting out the door on time? Other questions to consider are: What time does the school day start? How many hours are spent in school? Where does the child go after school and what are his or her activities? Are they structured activities or free play? When does homework get started? How many hours and how much supervision is necessary on a routine basis? What time does he or she go to bed? Does the child generally fall asleep easily and stay asleep through the night? Is the child's diet or appetite affected by school problems? Is it easy or difficult to get the child to eat a balanced diet? Such information should provide important insight as to the time and location of difficulties that are occurring.

DEVELOPMENTAL MILESTONES. The pediatrician should ask about several milestones for each developmental area: gross motor, fine motor (including dressing and feeding), language, and toilet training. The goal is to learn whether milestones occurred on time and whether there was isolated difficulty in one area compared with others.

SOCIAL HISTORY. Other important elements in the history include how difficult it is for this child to make and keep a friend, to hold a conversation, or to ask to join a group of children at play. How does the child do in social settings that are not at home or at school, such as at religious services or in restaurants? How does the child get along with siblings, parents, and other adults? What does the child like to do when playing?

PREGNANCY-TO-BIRTH HISTORY. A history of prior pregnancy losses can suggest a possible genetic disorder that may be related to the school distress. Problems during the gestation or delivery may suggest possible environmental impacts that may be related to the school distress.

PAST MEDICAL HISTORY. It is important to rule out a past history of seizures, tics, or sensory deficits such as impairment of hearing or vision. Sometimes a poorly controlled chronic disease (eg, asthma, diabetes, cardiac, or kidney disease) can affect attendance as well as the child's ability to concentrate. The medication list is important to obtain because some medications can have a negative impact on cognition (eg, phenobarbital).

FAMILY HISTORY. The clinician should inquire about parents, grandparents, uncles, aunts, cousins, and siblings. Is there a history of anyone on either side of the family having difficulties similar to the patient? Did anyone in the family have difficulty learning to read, or spell, or learn a foreign language?

Physical Examination

Although no physical examination finding is pathognomonic for LD, some findings can help to corroborate the diagnostic decision or give information about cause. Part of the focused physical examination should include close scrutiny of the skin for any stigmata associated with neurocutaneous disorders. In particular, children who

have neurofibromatosis type 1 and numerous café-au-lait macules have approximately a 50% prevalence of LD or attention-deficit/hyperactivity disorder (ADHD). The neurologic system should be carefully examined for any evidence of asymmetry of strength or tone and for intactness of cranial nerve function.

Subtle motor signs (often called neurologic "soft signs") may help the clinician understand the school concerns within the context of other neurologic or developmental impairments. Neurologic soft signs alone are a low-yield examination item, but marked findings may be a clue to immaturity of motor control that could significantly impair handwriting. Marked findings can also be a useful biomarker for ADHD because motor control circuitry is closely associated with circuitry controlling emotional, cognitive, and attentional responses.

Subtle motor findings that are visible by direct observation are the inability of the individual to isolate movements to one part of the body. For example, stressed gaits can be used to discern the ability to isolate the feet from the hands. In this maneuver, the clinician asks the child to walk on the outside edges of his or her feet for 10 steps and observes whether the child isolates the movement to the feet or if the motor movement "overflows" that boundary, resulting in unusual posturing of the hands or mouth. Children older than 9 years of age generally can accomplish the isolation.

Similarly, the ability to isolate one side of the body from the other can be evaluated with patterned finger tapping (successive finger apposition to the thumb) or patterned hand patting (alternating pronating/supinating hand position) on one hand and then the other. Children older than 13 years of age can typically isolate patterned finger apposition to one side without noticeable "overflow." Children older than 9 years of age are typically able to isolate patterned hand patting to the left or right hand without noticeable "overflow" of the movement to the opposite hand.

Diagnostic Testing

Blood, urine, and imaging studies generally are not indicated or diagnostically useful in the evaluation of school distress and LDs. Notable exceptions include neurologic findings suggesting a focal lesion, skin findings suggesting a neurocutaneous syndrome, and physical findings or past medical history suggestive of disorders such as syndromes or nutritional disorders that have a genetic or metabolic cause. Hearing and vision screening should be documented or performed.

Diagnosis

Confirming the diagnosis of an LD in a child presenting with school distress generally necessitates collaborative work between the physician and a team of related nonmedical professionals, which may include psychologists, educators, audiologists, and speech-language and occupational therapists. The physician's role in this process includes ruling out hearing and vision impairments and establishing that the learning lags are not due to limited access to appropriate instruction (assessed using the school history). In addition, the pediatrician can assist in the diagnosis and management of related developmental or behavioral disorders, including ADHD and autism spectrum disorders, as well as identify psychosocial contributions to the child's difficulties. The Centers for Disease Control and Prevention have estimated that 4% of children ages 6 to 12 years have LD, and another 4% are affected by both LD and ADHD. (1) If further specialty medical assistance is required, the pediatrician can consult specialists in neurodevelopmental disabilities or developmental and behavioral pediatrics.

Domain-specific academic and cognitive testing is the formal diagnostic process used to determine the presence and extent of an LD. In some situations, it is appropriate for this testing to take place through the school district as part of the IEP process. In other situations, parents may prefer to seek private psychological services for this testing. Such an evaluation tests a child's cognitive abilities, including the areas of language processing, memory, attention, and nonverbal reasoning, as well as specific academic achievement in core areas, including reading, mathematics, and written expression. Table 2 lists commonly used evaluation tests.

In general, this type of psychoeducational testing is beyond the scope of a general pediatric practice, although some clinicians who have additional experience in this area (eg, pediatricians who may be board certified in neurodevelopmental disabilities or developmental and behavioral pediatrics) may feel comfortable administering and interpreting some measures in the office. In either case, it is helpful for primary care physicians to become familiar with local resources in the schools and in the community where this testing can be obtained. When LD is suspected, the clinician should guide the family to these resources and assist in the referral process.

The usual criteria for diagnosing RD are poor word recognition and decoding skills demonstrated through specific testing. Some evaluations also assess spelling, reading fluency, and reading comprehension; others directly test the deficits in phonologic processing that underlie RD, which are found in children who have

Table 2. **Commonly Used Tests for Evaluation of Suspected Learning Disabilities**

Area of Learning Measurement	Skill Tested
Academic Achievement	
Woodcock-Johnson-III	Academic fluency
Wide Range Achievement Test	Word reading
	Sentence comprehension
	Spelling
	Math computation
Adaptive Behavior	
Adaptive Behavior Assessment System-II	Global assessment of competence
Vineland Adaptive Behavior Scale-II	Global adaptive behavior
Attention	
Conners Rating Scales, Third Edition	ADHD Index
	Inattention
	Hyperactivity/impulsivity
	Learning problems/executive functioning
	Aggression
	Peer relations
ADHD Rating Scale-IV (formerly DuPaul scale)	Inattention
	Hyperactivity/impulsivity
NICHQ Vanderbilt Parent and Teacher Assessment Scales	Inattention
	Hyperactivity
	Oppositional defiant disorder
	Conduct disorder
	Anxiety/depression
	Performance (academic, relationships)
General Cognition	
Wechsler Intelligence Scales for Children—Fourth Edition (WISC-IV)	Full-scale intelligence
	Verbal comprehension
	Perceptual reasoning
	Working memory
	Processing speed
General Behavior	
Achenbach Child Behavior Checklist (CBCL)	Total problems
	Externalizing
	Internalizing
	Attention problems
Language	
Clinical Evaluation of Language Fundamentals (4th Ed.) (CELF)	Expressive language
	Receptive language
Visual Motor	
Beery Test of Visual Motor Integration (5th Ed)	Visual motor total score

ADHD=Attention-deficit/hyperactivity disorder, NICHCQ=National Initiative for Children's Health Care Quality

difficulty learning the correspondence between oral sounds and the written symbols (letters and letter combinations) on a page of text.

In the past, academic testing was compared with the student's estimated potential, as measured by an IQ test, with LD diagnosed when significant discrepancy was demonstrated between IQ and reading scores. This approach was problematic because children whose IQ scores were below average would not meet such discrepancy criteria and children who had extraordinarily high IQ scores could be considered to have LD in spite of reading scores solidly within the range of age expected norms.

More recently, the RTI has been adopted as a valid standard approach to diagnosis of LD. (14)(15) RTI is a process of assessment followed by remedial instruction in the child's area of deficits for a period of time before reassessing. The assessment-instruction-assessment process comprises three tiers of increasingly intensive educational supports and instruction. RTI can help distinguish a lack of adequate instruction from an LD by showing whether improvement occurs with minimally increased intensity of instruction or requires repeated cycles of RTI, resulting in a highly specific and individualized instructional program for the child.

Management

The pediatric clinician can play a critical role not only in identifying the child who has LD but also in ongoing management. (16) Such help may take the form of advocacy through assurance of proper services received both after the initial evaluation as well as on an ongoing basis throughout the school years. When a child has been confirmed as having LD, the clinician should implement the medical home model for chronic condition management, providing accessible, continuous, comprehensive, family-centered, coordinated, compassionate, and culturally effective care. The medical and neurodevelopmental underpinnings of LD, its effects on functional and mental health outcomes, and its chronic lifelong nature suggest a critical role for the primary care

clinician. Upon diagnosis, the physician should review the child's initial psychoeducational evaluation with the family to assure that he or she is receiving appropriate educational remediation, accommodations, modifications, and therapies.

As with other neurodevelopmental conditions, ongoing developmental surveillance during the annual school-age health supervision visit is important for the child who has LD. The pediatrician or pediatric nurse practitioner should inquire about every child's academic performance and school behavior. For those who have LD, the family should be encouraged to bring the child's report card as well as the IEP for review by the clinician. When a child's progress or behaviors are of concern to the parent or the pediatric clinician, further contact with the school or teacher is indicated. For those children in whom associated behavior problems may be observed, investigation for related disorders, such as ADHD, adjustment disorder, or anxiety disorder, should be considered.

Education of families is also critically important to help them access appropriate treatment. At a minimum, families should leave the physician's office understanding that RD is not due to a primary visual deficit and that letter reversals, a common finding in typically developing 7 year olds, is not diagnostic of RD. (17) Although optometric training is commonly used in children who have LD, it is considered an alternative treatment, with ongoing controversy of its efficacy existing between the fields of optometry and medicine. Other myths and the use of alternative treatments also may require discussion. Common misconceptions include regarding the child as lazy or as not trying hard enough. Another misconception is perpetuated when a family is told that repeating a grade could help the student "catch up." In these situations, families can be redirected to more accurate sources of information, including the American Academy of Pediatrics pamphlet "Learning Disabilities: What Parents Need to Know." (18) Further information and support can be offered through referral to parent and LD advocacy organizations, such as the National Center for Learning Disabilities (www.ncld.org), the Learning Disabilities Association of America (www.ldanatl.org), LDOnline (www.ldonline.org), the International Dyslexia Association (www.interdys.org), the National Dissemination Center for Children with Disabilities (www.nichcy.org), and the Parent Advocacy Coalition for Educational Rights Center (www.pacer.org).

Prognosis

The prognosis for children who have LD can range from academic and social success to ongoing vocational and personal-social problems in adulthood. Affected children are at increased risk for poor academic performance, not completing high school, and exhibiting behaviors that, in some cases, may escalate and lead to expulsion. For a clinician presented with a child in the midst of school failure, the long-term effects on the student's self-esteem and behavior may overwhelm concerns about academic failure.

Longitudinal tracking of children who have RD reveals persistent reading problems into young adulthood. (19)(20) However, with proper parent, school, and community support, children who have LD can reach high levels of achievement. University support services and accommodations are available in the United States for those who have LD, as required under Section 504 of the Rehabilitation Act and the Americans with Disabilities Act. (13) The adolescent beginning a college education should seek such assistance.

The child who has LD can be gifted at other cognitive and creative talents that can be nurtured and developed, with self-esteem and a sense of accomplishment maintained in spite of an academically impairing LD. On the other hand, long-term adult outcomes also include fre-

Summary

- Based on strong research evidence, LD is a highly prevalent, biologically based disorder in children. (2)(8)
- Based on some research evidence as well as consensus, children manifesting school problems and suspected of having LD should undergo a comprehensive medical evaluation, including history review and physical examination, for identification of relevant risk factors for LD. (7)
- Based primarily on consensus due to lack of relevant clinical studies, a child showing increased effort of learning, school distress, or school failure should be suspected of having LD.
- Based primarily on consensus due to lack of relevant clinical studies, the child who has school problems and is suspected of having LD should be referred by the pediatrician for a comprehensive psychoeducational evaluation. (17)
- Based on some research evidence as well as consensus, all children should have annual developmental surveillance as well as formal developmental screening at ages 30 and 48 months for early identification of risk factors for LD. (10)
- Based primarily on consensus due to lack of relevant clinical studies, the pediatric clinician should play an advocacy role for children who have LD and their families from initial diagnosis into young adulthood. (21)

quent unemployment or employment at less than a living wage, restricted educational and work opportunities, and poverty. It is estimated that lifelong wage earnings for a person without a high school diploma or GED can be $1 million less than for a college graduate. (3) It is incumbent, therefore, on the pediatric clinician to perform annual developmental surveillance of the child who has LD. Monitoring of his or her progress better assures that the child receives proper educational services, treatment of associated developmental or behavior problems, and family and community support.

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Attention-Deficit/Hyperactivity Disorder

Anna Maria Wilms Floet, MD,* Cathy Scheiner, MD,† Linda Grossman, MD§

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Introduction

Attention-deficit/hyperactivity disorder (ADHD) is a common neurobiologic disorder characterized by developmentally inappropriate levels of inattention, hyperactivity, and impulsivity. ADHD also is one of the most prevalent chronic health conditions affecting school-age children. Consequently, physicians frequently are asked to evaluate children for a possible diagnosis of ADHD. The importance of an appropriate and timely diagnosis is based on the knowledge that children who have ADHD may experience difficulty in social, emotional, and academic domains and that treatment can improve outcomes for these children.

Prevalence

ADHD is a behavioral disorder, making it difficult to quantify. Epidemiologic studies indicate that at least 3% of children in the United States are affected by ADHD, with usual quoted rates of 5% and 8%. (1) Prevalence rates for ADHD vary, depending on the patient sample, geography, and diagnostic criteria (Table 1). The diagnosis is reported 2.5 times more frequently in boys than in girls, with 9.2% of males and 2.9% of females found to have behaviors that are consistent with ADHD. ADHD is considered a lifelong condition. Among adolescents who receive ADHD diagnoses as children, 60% to 80% continue to meet criteria for ADHD during their teenage years and adulthood.

Prevalence rates for ADHD vary by age. Studies indicate that school-age children are more likely to be diagnosed compared with preschool-age children and adolescents. Approximately 50% of children who receive the diagnosis are treated with medication. According to a 2003 National Survey of Children's Health, 56.3% of children who had reported ADHD were being treated with medication at the time of the survey, and school-age children were most likely to be receiving medication for ADHD. (2)

Studies have not demonstrated a consistent association among ADHD prevalence and race, ethnicity, or socioeconomic status. However, environmental and biologic factors may increase the risk of ADHD. Environmental factors include early lead exposure and prenatal exposure to cigarette smoking and alcohol. Biologic factors such as low birthweight, prematurity, and intrauterine growth restriction also increase the risk for ADHD.

Causes

Research in the fields of neurobiology, genetics, and neuropsychology support a biologic basis for ADHD. Many studies show an association between ADHD and biologic systems that are believed to control attention and regulate inhibition. However, no single cause of ADHD has been identified

Neuroimaging studies have shown structural and functional differences in areas of the brains in patients who have ADHD compared with patients who have no ADHD. Certain regions of the brain, rich in dopaminergic and noradrenergic pathways and associated with executive function, seem to be particularly affected, including the prefrontal cortex, striatum, and cerebellum. Functional magnetic resonance imaging (MRI) studies suggest that these particular regions of the brain are less activated in children who have ADHD compared with those of age-matched controls during activities that measure executive function, a cognitive process of the frontal lobe that is used to solve problems or achieve a goal. Other studies, using brain MRI, have found reductions in prefrontal, frontal, and hemispheric volumes in individuals who have ADHD compared with controls. The clinical significance of these differences is not clear.

*Kennedy Krieger Institute, Center for Development and Learning, Center for Autism and Related Disorders, Baltimore, Md.
†Children's National Medical Center, Washington, DC.
§Baltimore County Department of Health, Baltimore, Md.

Table 1. Diagnostic Criteria for Attention-Deficit/Hyperactivity Disorder

A. Either 1 or 2

1. Six or more of the following symptoms of inattention have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level

Inattention

1. Often fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities
2. Often has difficulty sustaining attention in tasks or play activities
3. Often does not seem to listen when spoken to directly
4. Often does not follow through on instructions and fails to finish school work, chores, or duties in the workplace (not due to oppositional behavior or failure to understand instructions)
5. Often has difficulty organizing tasks and activities
6. Often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework)
7. Often loses things necessary for tasks or activities (eg, toys, school assignments, pencils, books, tools)
8. Often is easily distracted by extraneous stimuli
9. Often is forgetful in daily activities

2. Six or more of the following symptoms of hyperactivity-impulsivity have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level

Hyperactivity

1. Often fidgets with hands or feet or squirms in seat
2. Often leaves seat in classroom or in other situations in which remaining seated is expected
3. Often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness)
4. Often has difficulty quietly playing or engaging in leisure activities
5. Often is "on the go" or acts as if "driven by a motor"
6. Often talks excessively

Impulsivity

7. Often blurts out answers before the questions have been completed
8. Often has difficulty awaiting turn
9. Often interrupts or intrudes on others (eg, butts into conversations or games)

B. Some hyperactive-impulsive symptoms or inattentive symptoms that caused impairment were present before 7 years of age

C. Some impairment from the symptoms is present in two or more settings (eg, at school or at home)

D. There must be clear evidence of clinically significant impairment in social, academic, or occupational functioning

E. The symptoms do not occur exclusively during the course of a pervasive developmental disorder, schizophrenia, or other psychotic disorder and are not better accounted for by another mental disorder (eg, mood disorder, anxiety disorder, dissociative disorder, or personality disorder)

Several studies support the hypothesis that ADHD is associated with deficits in executive functioning. Studies based on results from neuropsychological tests of executive function in children who have ADHD showed that these children performed poorly compared with age-matched controls on specific tasks. Although these results improve understanding of the cognitive problems that some children who have ADHD may face, the results do not provide adequate evidence to conclude that problems with executive function are specific to ADHD. However, executive function deficits may be a comorbid problem among children who have ADHD. Tests of executive function, such as set shifting, working memory, or processing speed, and other neuropsychological tests, such as continuous performance testing, should not be used alone to diagnose ADHD. (3)

Genetic studies suggest that ADHD is an inherited disorder. ADHD is more likely if a parent or sibling has been diagnosed with the disorder. This conclusion is supported by the high concordance for ADHD in identical twins as well as by family studies. Multiple genes contribute to the ADHD phenotype, including those related to monoaminergic (dopaminergic, serotonergic, and noradrenergic) neurotransmission. These genes include dopamine receptor genes (*DRD4* and *DRD5*) and a dopamine transporter gene (*DAT1*). The basis for these studies emerged from evidence indicating that these neurotransmitters are involved in the modulation of at-

tention and behavioral regulation in the frontal cortex. Despite the increased prevalence in male children, no study has shown that ADHD is attributable to an X-linked effect.

Defining ADHD

ADHD is defined as a mental health disorder in the *Diagnostic and Statistical Manual 4th Edition* (DSM IV). (4) Over the years, the diagnostic criteria have been revised as clinical impressions of what constitutes this disorder have shifted. The most current definition of ADHD is listed under DSM IV criteria as "a persistent pattern of inattention and/or hyperactivity-impulsivity that is more frequent and severe than is typically observed in individuals of comparable levels of development." The DSM IV criteria were developed by a committee and were based on a review of the literature and an analysis of field trials to determine whether the symptoms of ADHD had diagnostic utility. This effort led to the development of the two broad categories of symptoms (inattention and hyperactivity/impulsivity) and the distinction of three subtypes of ADHD (predominantly inattentive, predominantly hyperactive/impulsive, and combined type) (Table 1). To meet criteria for the predominantly inattentive subtype, the child must exhibit six of nine symptoms from A1. To meet criteria for the predominantly hyperactive subtype, the child must exhibit six of nine symptoms from category A2. To meet criteria for the combined type, the child must exhibit six of nine symptoms from both categories.

Diagnosing ADHD

Overview

ADHD is a behavioral disorder. Diagnosis requires a comprehensive clinical evaluation based on identifying children who have the core symptoms of inattention, hyperactivity, and impulsivity and whose behavior is sufficiently severe and persistent to cause functional impairment. No single test is available to establish the diagnosis. Although many children may be inattentive, hyperactive, or impulsive, the level of severity and degree of functional impairment, as well as considerations of what else might be causing the symptoms, determine which children meet the diagnosis and are treated for ADHD.

To assist clinicians with the accurate identification of children who have ADHD, the American Academy of Pediatrics (AAP) published a clinical practice guideline in 2000. (5) This guideline specifically urges primary care physicians to initiate an evaluation for ADHD in "any child, ages 6 to 12, who presents with the core symptoms of ADHD, behavior problems or academic difficulties." In addition, the guideline specifies that:

1. The child's symptoms meet the DSM IV criteria for ADHD.
2. Information be collected from the parents or caregivers regarding the core symptoms of ADHD, the age of onset, the duration of symptoms, and the degree of functional impairment.
3. Information be obtained from another source such as the classroom teacher regarding the core symptoms of ADHD, the duration of symptoms, and the degree of impairment.
4. An assessment of potential coexisting conditions, such as mood disorders or learning disabilities, be performed.

Initiating an Evaluation

The initial evaluation for suspected ADHD may be prompted by a variety of clinical circumstances. A clinician may become concerned about ADHD during a routine health supervision visit after screening for behavior and emotional problems. More frequently, parents, teachers, caregivers, or other professionals may raise concerns independent of any health-care screening effort. For example, parents may be concerned about their child's declining academic performance, relationship difficulties with peers or family members, or symptoms of emotional problems.

Once a concern is identified, an initial screening begins by obtaining a description of the child's behavior and its impact on his or her ability to function in school, at home, and with peers. During the screening process, it should be determined if evidence is sufficient to proceed with an additional evaluation for ADHD. Useful questions at this point should address the child's academic performance, homework completion, behavioral or mood problems, and peer relationships.

While gathering information, the clinician should be aware that the presenting symptoms of ADHD vary with the age and developmental level of the child. For example, during the preschool years, many children are inattentive, hyperactive, or impulsive. It may be difficult to distinguish age-appropriate levels of physical activity and short attention span from those activity levels and attention spans in children who have ADHD. Although the AAP guideline does not include specific recommendations regarding the diagnosis of ADHD in this population, studies show that preschool-age children may have significant attention or behavioral problems consistent with a diagnosis of ADHD. However, among preschool-age children who receive the diagnosis of ADHD, fewer

than 50% continue to have the diagnosis during childhood. The degree, duration, and pervasiveness of ADHD symptoms help to distinguish those children who are most likely to develop a persistent pattern of behavior that is consistent with ADHD.

As children enter elementary school, activity levels decline and children are expected to sustain attention for longer periods of time, to complete tasks independently, and to work cooperatively with their peers. At this age, children typically are able to focus for longer periods of time but may be impulsive at times. Teachers and parents of children who have underlying ADHD may express concerns about the child's safety or his or her ability to remain focused in class or to follow school routines.

During adolescence, demands are greater for organizational skills, time management, and the mastering of large amounts of material. Some adolescents who have ADHD, especially the predominately inattentive type, may not receive a diagnosis until middle school or high school. If there are not signs of significant impairment in functioning, a diagnosis of ADHD cannot be made. However, a diagnosis of ADHD still should be considered if an undiagnosed adolescent manifesting previous symptoms becomes more disruptive in class, exhibits increased academic problems, engages in increased risk-taking behavior, or becomes oppositional as the academic and maturational challenges increase.

Confirming the Symptoms

If the history indicates that a child's behavior is contributing to significant impairment in more than one setting, the clinician may proceed with the diagnostic process. Specific information about the child's symptoms to determine if they meet DSM IV criteria for ADHD must be obtained and whether another cause might better explain the symptoms must be determined. Both the parent and child should be interviewed to determine information about the child's behavior as well as the onset, duration, and severity of symptoms and the context in which the symptoms occur. For example, the clinician may inquire about the child's behavior in various situations: completing homework assignments and long-term school projects, getting ready for school in the morning, relating to peers, sitting in class, or following instructions. In cases where the presenting symptoms of inattention, hyperactivity, or impulsivity do not meet criteria for ADHD but warrant additional behavioral interventions or parent education, the clinician can use the *Diagnostic and Statistical Manual for Primary Care* (DSM-PC) (6) to document the child's behavior in the medical record and to develop an intervention plan.

The medical record should contain specific descriptions of the child's symptoms and not simply state that the child is inattentive, hyperactive, or impulsive. For example, the description of a hyperactive middle school child may indicate that the child leaves his seat during class, runs out of the classroom, fidgets endlessly, or has difficulty sitting still during any activity that requires concentration.

Because the DSM-IV symptoms were not selected scientifically and because there is substantial overlap among the symptoms, it is harder to establish a rating scale or a scientific scoring to determine whether a specific child has ADHD. Therefore, ADHD-specific rating scales are not diagnostic. However, they may be used to gather information about the child's behaviors from the parent, teacher, or both. In general, these rating scales assess the core symptoms of ADHD, as specified in the DSM IV, and they are relatively easy to administer (Table 2). The strength of the rating scales lies in their link to DSM IV symptoms. Rating scales probably are most useful in documenting whether the rater sees the core symptoms as being present for a specific child compared with his or her same-age peers. Broad-band rating scales that are not ADHD-specific have not been shown to provide sufficient evidence to support their use in the assessment of ADHD. (5)(16)

When choosing a rating scale, it is important to realize their limitations. Two different clinical situations illustrate this problem. First, although most of the ADHD-specific rating scales demonstrate good concurrent validity with other established instruments that are used to measure similar behaviors, they may not be good measures of developmental variations in the expression of ADHD. Second, when a child's behaviors do not conform to DSM IV criteria, such as ADHD complicated by oppositional behaviors, the diagnosis may be missed if the clinician only uses the DSM IV criteria to establish a diagnosis of ADHD.

The clinician also should recognize that ADHD-specific rating scales differ in their normative data. For example, normative data for the Connors Scales and the Attention Deficit Disorder Evaluation Scale (ADDES-3) were formulated based on discrete age ranges (eg, comparing ages 3 to 5, 6 to 8); other scales, such as the ADHD-Symptoms Rating Scale (ADHD-SRS), established normative data based on broader age ranges (eg, 5 to 12 years, 13 to 18 years). Only the Connors Scales have normative data for preschool-age children. Norma-

tive data also may differ by race, sex, and geographic area. Therefore, when using a rating scale, it may be difficult to interpret the results if the clinician's particular patient sample is not represented in the scale's normative data.

Rating scales also may be used to measure behavioral changes that occur over time or in response to treatment. However, few studies have been published that describe their diagnostic utility in this context. When using a rating scale for these purposes, it is best to select one that has sufficient test-retest reliability and good sensitivity to treatment effects.

Many of the ADHD rating scales also provide screening questions for comorbid conditions. In many cases, the validity and psychometric properties of these subscales have not been determined.

In summary, ADHD-specific rating scales are useful but must be interpreted within the clinical context of the child being evaluated. Rating scales should be used to supplement information obtained from a clinical history as well as to assess the functional consequences of the behaviors. Despite the benefits of using rating scales, their scores alone do not establish a diagnosis. Clinical judgment is needed to integrate the results of these scales into the clinical assessment.

Differential Diagnosis and Coexisting Conditions

The evaluation of a child for ADHD should include careful consideration of other possible explanations for the symptoms as well as an assessment of possible coexisting conditions and disorders (Table 3). It is important to consider whether family stressors (including domestic violence), lack of sleep (from organic disorders such as sleep apnea or nonorganic conditions such as poor sleep hygiene), sensory impairments, a seizure disorder, inappropriate school placement, or unrealistic expectations is the cause of the symptoms. In addition, psychiatric disorders such as autism, anxiety problems, mood disorders, specific learning disabilities, or intellectual disability may present with symptoms that mimic ADHD. Skillful interviewing may help determine whether another disorder is the sole explanation for the symptoms or represents a coexisting disorder.

Studies show that as many as 67% of children who have ADHD may have a coexisting condition such as a psychiatric problem, learning disorder, or social immaturity. The more common comorbid psychiatric conditions that have been described include oppositional defiant disorder (prevalence of 35%), conduct disorder (preva-

Table 2. Attention-Deficit/Hyperactivity Disorder-specific Rating Scales

Scale	Normative Data (ages)	Benefits	Limitations
Conners-3 Conners-EC (Early Childhood) Conners (7,8)	6 to 18 years 2 to 6 years	Adolescent self-report available	Multiple versions available; may be confusing
Swanson, Nolan, and Pelham IV Questionnaire (SNAP IV) Swanson 1992 (9)	5 to 11 years	Scoring available on the Internet	Limited normative data
ADHD Rating Scale IV (ADHD RS IV) DuPaul et al 1998 (10)	5 to 18 years		Only asks about DSM-IV ADHD symptoms
Vanderbilt ADHD Rating Scale (VARS) Wolraich 2003 (11)	Elementary school	Includes rating of impairment; asks about comorbid symptoms	No normative data on adolescents
ADHD Symptoms Rating Scale (ADHD-SRS) Holland et al 2001 (12)	5 to 18 years		Lengthy
Attention Deficit Disorder Evaluation Scale-3rd Edition (ADDES-3) McCarney 2004 (13)(14)	4 to 18 years		Lengthy
ACTeRS-2nd Edition Ullman et al 2000 (15)	Kindergarten to 8th grade for teacher version	Adolescent self-report available	Normative data on parent and adolescent version not published

Each scale has a parent and teacher version except the SNAP IV.

Table 3. Coexisting Disorders and Differential Diagnosis of Attention-Deficit/Hyperactivity Disorder

Developmental Disorders
Language disorder
Learning disability
Intellectual disability
Autism spectrum disorders
Developmental coordination disorder
Medical Disorders
Lead intoxication
Anemia
Medication adverse effects
Seizure disorder
Substance abuse
Sensory deficits
Prematurity
Fetal alcohol syndrome
Tourette syndrome
Sleep apnea
Genetic Disorders
Klinefelter syndrome
Fragile X syndrome
Turner syndrome
22q11.2 deletion syndrome
Williams syndrome
Neurofibromatosis I
Inborn errors of metabolism
Psychiatric Disorders
Adjustment disorder
Anxiety disorder
Attachment disorder
Mood disorder
Oppositional defiant disorder
Posttraumatic stress disorder

Adapted from Lock TM, Worley KA, Wolraich ML. Attention deficit/hyperactivity disorder. In: Wolraich ML, Drotar DD, Dworkin PH, Perrin EC, eds. *Developmental-Behavioral Pediatrics: Evidence and Practice*. Philadelphia, Pa: Mosby, Inc; 2008: 579–601.

lence of 30%), anxiety disorder (prevalence of 25%), and mood disorder (prevalence of ~18%). (4) These coexisting conditions also need to be addressed. Although some of these coexisting conditions may improve as the ADHD is treated, most require separate intervention.

Depending on the specific definition and treatment setting, 12% to 60% of children who have ADHD may have a coexisting learning or language problem. The most common learning disorder is a written language disorder. Because most children who have ADHD experience academic underachievement, it is important to distinguish whether a learning disability also is present. The patient's history may provide clues to the underlying reasons for academic problems. For example, if a child's ADHD symptoms are more likely to occur during a particular activity or setting, a learning disorder may be present. Psychological testing combined with achievement testing may help to identify a learning disorder. Learning problems are more likely to occur in children who have the predominantly inattentive or combined subtypes of ADHD.

The differential diagnosis of ADHD also includes medical conditions, genetic disorders, neurologic disorders, and developmental disorders that may contribute to a child's symptoms of inattention, impulsivity, or hyperactivity. Although the DSM IV criteria for ADHD specifically exclude developmental disorders such as intellectual disability and pervasive developmental disorders such as autism, children who have these disorders may present with symptoms of inattention, hyperactivity, or impulsivity that are consistent with ADHD and treatable according to accepted standards for ADHD treatment.

Treatment

In 2001, after extensive review of the scientific literature, the AAP published an evidence-based clinical practice guideline for the treatment of the school-age child who has ADHD. (17) A key study considered in developing this guideline was the National Institute of Mental Health Collaborative multi-site multimodal treatment study of children with attention deficit/hyperactivity disorder (MTA study). (18) In the MTA study, children were randomized to four groups: medication treatment alone (these children also had monthly 30-minute follow-up appointments, during which some brief counseling was included), intensive behavioral treatment alone, a combination of medication management and behavioral treatment, and community treatment as the control group.

The MTA study showed that pharmacologic intervention for ADHD was more effective than behavioral treatment alone. Combination treatment was no better than medication alone, except when the children studied also had a comorbid anxiety or oppositional defiant disorder. When those comorbid conditions were present, combination treatment was more effective than medication alone. Satisfaction with treatment reported by teachers and parents was highest in the combination treatment group.

The AAP guideline includes five recommendations

regarding treatment of ADHD: 1) Approach and treat ADHD as a chronic health condition, 2) Collaborate with partners in designing and evaluating treatment plans and outcomes, 3) Provide medication management, 4) Provide periodic systematic follow-up, and 5) Evaluate treatment failure as needed.

Treat ADHD as a Chronic Health Condition

The 2001 AAP practice guideline emphasizes that ADHD is a chronic health condition. This chronic care model, originally designed for adults, was adapted for use in children by the National Initiative for Children's Healthcare Quality. This model emphasizes ongoing parental and child education about ADHD and its treatments. The treatment of ADHD as a chronic care condition involves engaging the family, the child, and professionals in the schools (teachers, nurses, psychologists, counselors) in the assessment and long-term treatment of this disorder.

Collaborate With Partners Regarding Treatment Goals

The primary goal of ADHD treatment is to maximize the child's functioning in the home and school. The clinician's role is to design and implement an individual treatment plan for the child in partnership with the family that sets treatment goals and priorities. The clinician also collaborates with the educational system to address the child's symptoms and monitor the response to medication within the school. The process of developing target outcomes requires input from the parents, teachers, and other professionals involved with the child.

Although some children who have ADHD respond to medication intervention and no longer need special accommodations at school, others may need significant support to participate fully in their educational programs. Thus, school-based interventions become an integral aspect of behavioral treatment and educational support for children who have ADHD.

The Rehabilitation Act of 1973 provides the legal basis for school-based accommodations once a disability such as ADHD is identified. According to Section 504 of the Rehabilitation Act, parents may request accommodations within the regular classroom based on the child's individual needs. Examples of accommodations include preferential seating, modified assignments and homework load (such as dividing longer assignments into shorter manageable parts), use of visual cues and reminders to help children stay on task, and frequent motor breaks from the classroom routine. The clinician may help parents understand the value of these educational accommodations, explain the process of requesting and implementing a 504 plan, and make suggestions regarding the specific accommodations

When children diagnosed as having ADHD need special education services for a comorbid learning disability or because of the functional impact of their ADHD symptoms, parents may request an Individualized Education Plan (IEP) according to the provisions of the Individuals with Disabilities Education Act (IDEA). An IEP also may include counseling and a behavior management program. A yearly review of treatment goals and the child's progress is mandatory under IDEA. A clinician may participate in this process by making recommendations regarding these goals and treatments (Table 4).

The use of a daily report card provides parents and teachers with a communication tool that records a child's progress in achieving treatment goals and provides opportunities for rewards and consequences.

Medication Management

For most children, stimulant medication is highly effective in treating the core symptoms of ADHD. Therefore, initiation of medication often is recommended in the treatment for school-age children who have ADHD. General guidelines for medication management include:

1. Initiate treatment with a stimulant medication from the amphetamine or methylphenidate group. If one stimulant group does not work, switch to the other.

2. Dosing of stimulant medication is not weight-dependent. Start with a low dose and titrate until ADHD symptoms are manageable, maximum dose is reached, or adverse effects prevent additional titration. Generally, the relationship between dose and clinical response is

Table 4. Examples of Treatment Goals

- Improve academic performance: work completion, accuracy, efficiency
- Improve independence in self-care and school work
- Improve relationships with parents, siblings, peers, and teachers
- Decrease frequency of disruptive behavior
- Improve self-control
- Improve self-esteem
- Improve safety in the community; reduce inappropriate risk-taking behavior

Adapted from AAP Clinical Practice Guideline. Treatment of the school-aged child with ADHD. *Pediatrics.* 2001;108:1033–1044.

linear, with a greater reduction in symptoms achieved at higher doses of stimulant medication.

3. Initiation of treatment with an extended-release preparation of medication often is preferred, especially for older children who need medication coverage for extended periods of time (there is no need to start with short-acting medications).

4. Use of parent and teacher ADHD rating scales is helpful during the titration phase and periodically thereafter to determine response to medication and to monitor adverse effects.

5. At each visit, monitor for growth impairment by measuring height and weight; monitor for potential cardiac effects of the medication (such as elevated blood pressure or tachycardia) by measuring blood pressure and pulse.

6. A 1-month follow-up visit is recommended after starting the medication. Additional follow-up visits are based on treatment response but should occur at least twice a year. Treatment of ADHD should continue as long as symptoms remain present and cause impairment.

7. If a child who has ADHD shows full remission of symptoms and normative functioning, behavior therapy may not need to be added to the regimen.

8. Additional laboratory investigation or electrocardiography is not recommended unless clinically indicated. (19)

First-line Agents: Stimulant Medications

Stimulant medications are considered the first line of treatment for ADHD because they are highly efficacious in reducing symptoms. More than 80% of children who have ADHD respond to stimulants (although a few medication trials may be needed before finding the agent that elicits the best response). Two categories of stimulants are available: methylphenidate and amphetamine compounds. Studies indicate that each of these groups of stimulants has equal efficacy. Their primary mode of action is to enhance central nervous system catecholamine action, probably by increasing the availability of dopamine and norepinephrine at the synaptic cleft level in the frontal cortical-striatal circuits that regulate attention, arousal, and impulse control. When converting between dextroamphetamine and methylphenidate products, the equivalent dose of a dextroamphetamine product generally is half that of a methylphenidate product (except for dexmethylphenidate, which has the same dose).

Both categories of stimulant medications are available as short-, intermediate-, and long-acting formulations. The onset of action usually is within 30 minutes but may be longer, especially with methylphenidate hydrochloride or with methylphenidate transdermal. Stimulant medications are classified as category II controlled substances because they have the potential for abuse or dependence. However, multiple studies indicate that children taking stimulants to treat ADHD do not develop dependence or signs of addiction, they do not need escalating doses beyond that expected from their growth, and they do not suffer withdrawal symptoms when they stop taking their stimulant medications. Multiple studies of children taking stimulants to treat their ADHD also suggest that taking such medications decreases, rather than increases, the child's risk for addiction to illicit drugs.

Children who have ADHD and are treated with stimulants show improvement in attention to task and decrease in impulsivity and hyperactivity. Stimulants also may improve parent-child interactions, reduce aggressive behavior, and improve a child's academic productivity and accuracy. The effect on academic performance is less strong.

Stimulants generally are well tolerated. However, appropriate medication management requires interviewing both the parent and child regarding possible adverse effects. The most common adverse effects of stimulants are decreased appetite, abdominal pain, headaches, irritability, and sleep problems. Gastrointestinal effects and headaches may be lessened if the medication is taken with food. Less common adverse effects include weight loss, "rebound" effects, tics, social withdrawal, and affective changes. Rebound refers to temporary worsening of symptoms (irritability, increased activity, or mood swings) when the medication wears off. Administering a low dose of an immediate-release (short-acting) stimulant at this time may be helpful. Social withdrawal, lethargy, or restricted affect may be a result of overdosing. Rare adverse effects include psychotic behavior that may present as hallucinations or mania.

Tics are reported with varying frequency after the start of stimulant medication. Stimulant medication may lower the threshold for the development of tics, but such medications are not believed to "cause" tics. The presence of tics is not a contraindication to stimulant use. The decision to modify drug treatment based on the presence or development of tics should be individualized for each patient. The clinician and the family may consider factors such as the improvement in symptoms versus the impairment caused by the tics when trying to make such a decision.

The effect of stimulants on long-term growth continues to be studied. Short-term use of stimulants (studies

evaluating up to 3 years of treatment) can cause a transient lag in growth, with most growth deficits occurring in the first year. Fewer data are available concerning long-term treatment and its impact on final adult height with long-term stimulant use. (20)

Recent attention has focused on the risk of sudden cardiac death in pediatric patients who are treated with stimulant drugs. After careful consideration of the available data, the AAP published a policy statement in 2008 regarding cardiovascular monitoring and stimulant drugs for ADHD. (19) The statement recommends assessing all children, including those in whom stimulant medication is being considered, using a targeted cardiac history (patient history of previously detected cardiovascular disease, palpitations, syncope, or seizures; family history of sudden death in children or young adults; hypertrophic cardiomyopathy, long QT syndrome) and a physical examination (including a cardiac examination). Routine electrocardiography is not indicated before starting a child on stimulant medication. Special caution is recommended before using stimulant medications in children or adolescents who have pre-existing cardiovascular disease or symptoms suggesting cardiovascular disease. In these cases, consultation with a pediatric cardiologist is recommended.

All children who are prescribed stimulant medications require regular monitoring of pulse and blood pressure. Small elevations in pulse or blood pressure may not be clinically significant. If significant elevations occur, evaluation for an underlying medical problem should be initiated.

Second-line Agents: Nonstimulant Medications

Atomoxetine is considered a second-line drug for the treatment of ADHD because it has been shown to be less effective in treating ADHD symptoms when compared with stimulants. Atomoxetine is a selective inhibitor of the presynaptic norepinephrine transporter in the central nervous system. It increases norepinephrine and dopamine concentrations, especially in the prefrontal cortex. This medication has been approved by the United States Food and Drug Administration (FDA) for treatment of children ages 6 years and older who have ADHD.

Atomoxetine has a longer half-life compared with that of stimulants. Therefore, treatment effects may not be noted for several days and a steady state not be reached for up to 6 weeks. Some data show efficacy in treatment of ADHD with comorbid anxiety disorder. Atomoxetine also may be used in situations where substance abuse is a concern because this medication is not a class II drug.

Most common adverse effects of atomoxetine include decreased appetite, abdominal pain, nausea, and somnolence. Among the less common adverse effects are headaches, fatigue, dyspepsia, vomiting, and diarrhea. Rare cases of hepatitis (reversible) have been related to this medication. Some studies show that tics are less likely to develop with atomoxetine treatment. In 2005, a "black box" warning was added regarding an increased risk for suicidal ideation or suicidal behavior, similar to that found with selective serotonin reuptake inhibitors.

FDA-approved medications for treating ADHD are listed in Table 5. Contraindications to medications for treating ADHD are listed in Table 6. Patient medication guidelines, required by the FDA in 2006 and published by the individual drug manufacturers, can be accessed on the FDA Center for Drug Evaluation and Research web page. (21) These guides inform parents about possible cardiovascular risks, psychiatric effects, and contraindications of the medications.

Second-line agents not approved by the FDA may be used to treat ADHD. These medications include antidepressants (tricyclic antidepressants, bupropion) and alpha-2-adrenergic agonists (clonidine, guanfacine). A review of these medications is beyond the scope of this article.

Nonpharmacologic Interventions

Behavioral Therapy

Behavioral interventions (Table 7) are directed at manipulating the physical and social environment to modify behavior. These interventions can be used in the home and school. Behavior therapy may be recommended as an initial treatment when ADHD symptoms are mild and cause minimal impairment, when the diagnosis is uncertain, when the family chooses not to use medication for the child, or as an adjunct to medication treatment.

Behavior management in the home is most effective when parents understand the principles of the approach. The clinician may help the parent better understand behavior management, and parent training programs are available in many communities. These programs help parents understand their child's behavior and provide tools to deal with behavioral difficulties. Behavioral therapies have proven effective when consistently implemented and maintained. Additional forms of therapy, such as cognitive-behavioral therapy or family therapy, although not proven to be effective in the management of core ADHD symptoms, may be appropriate in the treatment of comorbid problems or family interaction difficulties.

Table 5. Approved Medications for the Treatment of Attention-Deficit/Hyperactivity Disorder in Children 6 Years of Age and Older

Brand/Generic	Form/Units Available	Starting Dose	MRD	Comment
Methylphenidate (MPH)				
Ritalin®*/MPH (Novartis, East Hanover, NJ)	5-, 10-, 20-mg tab (scored)	5 mg bid to tid	60 mg	Rapid onset (within 15 to 20 min), rapid termination of action. Lasts 3.5 to 4 h**
Ritalin SR®*/MPH (Novartis, East Hanover, NJ)	20-mg tab (sustained release: half released immediately, half released 4 h later)	20 mg q AM	60 mg	Effect usually lasts about 8 h.** Must be swallowed whole; cannot be crushed or chewed.
Ritalin LA®/MPH (Novartis, East Hanover, NJ)	10-, 20-, 30-, 40-mg caps, extended-release (50% immediate release beads; 50% modified release beads; bimodal release profile)	10 mg q am; increase by 10 mg each week until good control is achieved	60 mg	May sprinkle contents on applesauce and swallow without chewing beads (contents should not be crushed, chewed, or divided). Lasts 8 to 10 h.**
Concerta®/MPH (ALZA, Mountain View, CA [marketed by Mc Neil])	18-, 27-, 36-, 54-mg tabs (immediate-release outer coating; osmotic pressure system delivers drug gradually)	18 mg q AM; increase weekly by 18 mg each week until good control is achieved.	72 mg	Noncrushable; must be swallowed whole. Lasts 12 h.** Note: nonabsorbable outer shell may be seen in stool; avoid with gastrointestinal narrowing.
Metadate CD®/MPH (UCB, Rochester, NY)	10-, 20-, 30-, 40-, 50-, 60-mg cap extended-release (30% immediate release, 70% gradually; bimodal peaks at 1½ and 4½ h)	20 mg q AM and increase by 10 mg each week	60 mg	Note: may sprinkle contents on applesauce.
Methylin®/MPH (AlliantPhr, Alpharetta, GA)	2.5-, 5-, 10-mg tab (chewable); 5 mg/5 mL,10 mg/5 mL (oral solution)	5 mg bid with increments of 5 to 10 mg weekly	60 mg	
Focalin®/dexMPH (Novartis, East Hanover, NJ)	2.5-, 5-, 10-mg tabs	2.5 mg bid; increase in 2.5- to 5-mg increments	20 mg	
Focalin XR®/dexMPH (Novartis, East Hanover, NJ)	5-, 10-, 15-, 20-mg caps extended-release (bimodal peaks 4 h apart)	5 mg q AM; increase weekly by 5 mg	20 mg	May sprinkle contents on applesauce and swallow without chewing beads.
Daytrana®/MPH (Shire US, Wayne, PA)	10-, 15-, 20-, 30-mg transdermal patch	Apply 2 h before desired effect; remove after 9 h (may remove earlier)	30 mg	Hypersensitivity to methylphenidate, especially when patch not removed after 9 h. MRD 30 mg/day.

(Continued)

Complementary and Alternative Therapies

Numerous complementary and alternative treatments exist for ADHD, but a comprehensive review is beyond the scope of this article. Common dietary interventions include elimination of foods (such as sugar) or food additives (such as dyes) or addition of dietary supple-

Table 5. Approved Medications for the Treatment of Attention-Deficit/Hyperactivity Disorder in Children 6 Years of Age and Older—continued

Brand/Generic	Form/Units Available	Starting Dose	MRD	Comment
Amphetamines (AMP)				
Dexedrine®*†/dextroAMP (GlaxoSmithKline, Research Triangle Park, NC)	5-mgtab	5 mg q day or bid and increase of 5 mg weekly	40 mg	For 3 to 5 year olds, 2.5 mg daily and weekly increases of 2.5 mg.
Dexedrine Spansules®/ dextroAMP sulfate (GlaxoSmithKline, Research Triangle Park, NC)	5-, 10-, 15-mg spansule sustained-release caps	5 mg q AM and increase by 5 mg weekly	40 mg	May sprinkle contents on applesauce and swallow without chewing beads.
Adderall®*/mixed AMP salts (DSM Pharm, Greenville, NC)	5-, 7.5-, 10-, 12.5-, 15-, 20-, 30-mg all scored	5 mg 1 to 2 times/ day and increase by 2.5 mg weekly	40 mg	
Adderall XR®*/mixed dextroAMP/AMP salts (Shire US, Wayne, PA)	5-, 10-, 15-, 20-, 25-, 30-mg caps extended-release (50% immediate release bead; 50% beads release 4 h later; biphasic model)	10 mg q AM and increase by 10 mg weekly	40 mg	May sprinkle contents on applesauce and swallow without chewing beads.
Desoxyn®/Met AMP HCl (Abbott Pharmaceuticals, Deerfield, IL)	5-mg tab	5 mg 1 to 2 times per day, increase by 5 mg weekly	20 to 25 mg	
Vyvanse® Lisdex AMP dimesylate (Shire US, Wayne, PA)	20-, 30-, 40-, 50-, 60-, 70-mg caps	20 mg q AM	70 mg	May sprinkle contents in a glass of water; needs to be consumed immediately.
Nonstimulant				
Strattera®/Atomoxetine (Eli Lilly, Indianapolis, IN)	10-, 18-, 25-, 40-, 60-, 80-, 100-mg caps (cannot be opened)	<70 kg: Start 0.50 mg/kg q AM×4 days; increase to 1 mg/kg po q AM×4 days, then to 1.2 mg/kg per day in single or bid dose; assess response in 2 wk. >70 kg: Start 40 mg po q AM×4 days; increase to 80 mg po q AM (or 40 mg po bid); assess response in 2 wk.	1.4 mg/kg per day or 100 mg	

MRD: maximum recommended daily dose
*Generic forms available.
**Note: durations of action are estimates; duration may vary with individual child.
†Dexedrine is approved in children 3 to 5 years of age.
Note: drugs listed do not appear in order of importance. *Pediatrics in Review* does not imply endorsement of any product. Recommendation does not serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.
Resource: Accessed October 2009 at: http://www.fda.gov/Drugs/DrugSafety/PostmarketDrugSafetyInformationforPatientsandProviders/ucm107918.htm

ments (egs, vitamins, minerals, herbs). Elimination of sugar has not proven to have an observable effect. Although new treatments for ADHD would be a welcome addition to pharmacologic and behavioral intervention, more evidence-based research needs to be conducted before complementary and alternative therapies can be recommended for the daily management of children who have ADHD.

Table 6. Contraindications to Medications Used for Treatment of Attention-Deficit/Hyperactive Disorder

Active Ingredient	Contraindication
Mixed salts of amphetamine	Monoamine oxidase (MAO) inhibitors within 14 days, glaucoma, symptomatic cardiovascular disease, hyperthyroidism, moderate-to-severe hypertension
Dextroamphetamine	MAO inhibitors within 14 days, glaucoma, symptomatic cardiovascular disease, hyperthyroidism, moderate-to-severe hypertension
Methylphenidate	MAO inhibitors within 14 days, glaucoma, symptomatic cardiovascular disease, hyperthyroidism, moderate-to-severe hypertension, pre-existing severe gastrointestinal narrowing; use caution when prescribing concomitantly with anticoagulants, anticonvulsants, phenylbutazone, and tricyclic antidepressants
Atomoxetine	MAO inhibitors within 14 days, glaucoma; may interfere with selective serotonin reuptake inhibitor metabolism (uses CYP2D6 system); drug interaction with albuterol; jaundice or laboratory evidence of liver injury

Adapted from *Caring for Children with ADHD: A Resource Toolkit for Clinicians*. 2002.

Follow-up and Long-term Management

Children who receive ADHD diagnoses require long-term follow-up because evidence is increasing that ADHD does not resolve as children get older. Long-term management includes adhering to the principles of treatment discussed previously.

The clinician, family, and school professionals are responsible for joint assessment and treatment of the comorbid conditions associated with ADHD. For example, if academic performance is an ongoing concern despite treatment for ADHD, the clinician may want to empower the family to request that the school evaluate the child for a possible learning disorder. Screening for comorbid mental health conditions may prompt the primary care clinician to refer the child to clinicians specially trained in assessing and managing such conditions.

In general, stimulants are effective for treating ADHD symptoms in children who present with comorbid anxiety or depressive disorder, although additional treatments (psychotherapy or medication treatment) often are needed. Children who have intellectual disability receive the diagnosis of ADHD if their symptoms are inconsistent with their developmental level and cause additional functional impairments.

The evaluation of a lack of response to treatment should include determining whether the set target goals are realistic and target behaviors clearly defined, re-evaluating the original diagnosis of ADHD, and screening for and treating any comorbid conditions. Lack of

Table 7. Effective Behavioral Techniques for Attention-Deficit/Hyperactivity Disorder

Technique	Description	Example
Positive reinforcement	Providing rewards or privileges contingent on the child's performance	Child completes assignment and is allowed to play on the computer
Time out	Removing access to enjoyable activities because of unwanted or problem behavior	Child hits sibling impulsively and is required to sit for 5 minutes in time out
Response cost	Withdrawing rewards or privileges contingent on performance of unwanted or problem behavior	Child loses free time privileges for not completing homework
Token economy	Combining positive reinforcement and response cost	Child earns stars for completing assignments and loses stars for getting out of seat. The child cashes in the sum of stars at the end of the week for a prize

Adapted from AAP Clinical Practice Guideline. Treatment of the school-aged child with ADHD. *Pediatrics*. 2001;108:1033–1044.

adherence to treatment also may be a factor or a change in medication may be warranted. Medication failure may prompt use of a second-line medication or referral to specialists for consultation and treatment when adequate trials of both groups of stimulants have failed.

Prognosis/Long-term Outcome

As children age, their hyperactive and impulsive symptoms tend to decrease. Despite these changes in symptoms, most children continue to meet criteria for ADHD as adolescents and adults. However, the treatment goals and objectives need to be modified over time. Academic problems may become more obvious and require additional interventions as children grow older. Children whose ADHD is untreated also are at increased risk for developing substance abuse problems and other high-risk behaviors. Comorbid conditions remain present and require ongoing monitoring.

To view References, a Suggested Reading list, and books and resources for families for this article, visit http://pedsinreview.aappublications.org and click on the article title.

Summary

- Based on strong research evidence, school-age children who present with behavior problems or academic underachievement should receive an evaluation for ADHD. (2)(5)
- Based on consensus and strong research evidence, ADHD-specific rating scales may be used to evaluate a child for symptoms of ADHD, but they are not diagnostic of ADHD. (5)(16)
- Based on strong research evidence, approximately 67% of patients diagnosed as having ADHD have comorbid mood disorder or learning disorder. (5)(22)(23)
- Based on strong research evidence, the primary care clinician should establish a treatment program that recognizes ADHD as a chronic condition that requires ongoing management and monitoring. (17)
- Based on strong research evidence, the clinician initially should recommend stimulant medication for the treatment of ADHD, with stimulant drugs from either class (amphetamines, methylphenidate) being equally effective. (17)

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Report finds pediatricians now integral to ADHD diagnostic practices

by **Trisha Korioth** • Staff Writer

Just under 40% of children with attention-deficit/hyperactivity disorder (ADHD) are first diagnosed by a pediatrician, and almost all are using valid diagnostic tools as recommended by AAP guidelines, according to a new report from the Centers for Disease Control and Prevention (CDC).

Pediatricians diagnosed 39% of all children with ADHD, while 23% of children under age 6 were diagnosed by a psychiatrist.

This is evidence that pediatricians are using accurate procedures to diagnose the condition, said Mark Wolraich, M.D., FAAP, chair of the AAP Subcommittee on ADHD, Steering Committee on Quality Improvement and Management.

The report "Diagnostic Experiences of Children With ADHD" was published today and is available at http://1.usa.gov/1PNeOtM.

Researchers collected data from a sample of children diagnosed with ADHD as of 2011-'12, including the child's median age at diagnosis, type of provider who first diagnosed the child and who first raised concern about the child's behavior. Data were drawn from the 2014 National Survey of the Diagnosis and Treatment of ADHD and Tourette Syndrome, a follow-up to the 2011-'12 National Survey of Children's Health.

"A greater number of children who have ADHD are being identified, rather than the concern that clinicians are over-diagnosing the condition," Dr. Wolraich said. "I think it reflects well on our AAP efforts."

The median age at which children were first diagnosed with the disorder was 7 years. About one-third were diagnosed before age 6, an age at which few valid tools support diagnosis, the report noted.

While most families reported information having been gathered from parents and teachers, consistent with the AAP guideline, one in five children received a diagnosis based only on information collected from family members, noted the report.

A majority of clinicians used rating scales, which mostly are based on the *Diagnostic and Statistical Manual of Mental Disorders (DSM-5)* criteria, said Dr. Wolraich. Most clinicians also are contacting teachers and obtaining neurological testing, he added.

"These are all recommendations that we had included in the first and revised (AAP ADHD) guidelines," Dr. Wolraich said.

In addition to the clinical guidelines released in 2001 and revised in 2011, the Academy has developed and encouraged training efforts, including an ADHD toolkit to assist pediatricians in using evidence-based diagnostic practices (see resources).

RESOURCE

- AAP clinical practice guideline on ADHD, http://pediatrics.aappublications.org/content/128/5/1007.full
- Caring for Children with ADHD: A Resource Toolkit for Clinicians, http://bit.ly/1hWRDD8

Development IV Quiz

1. What is the definition of Learning Disability (LD)?
   - A disability based on a *significant discrepancy* between a person's overall **intellectual ability** (measured by an IQ test) and actual **academic performance (**e.g. reading scores).
     - School psychologists use >1.5 SD difference in the "discrepancy model"
   - DSM-IVR: "when the individual's **achievement** on individually administered, standardized tests in reading, mathematics, or written expression is substantially below that expected for age, schooling, and **level of intelligence**"

2. How has this traditional definition been challenged?
   After the Individuals with Disabilities Education Act (IDEA) of 2004, there was a shift away from waiting until a child had received testing before providing services, and instead providing additional support for struggling students, *even before a diagnosis is established*, This process, called **Response to Intervention (RTI)**, can help distinguish a lack of adequate instruction from an LD by showing whether improvement occurs with minimally increased intensity of instruction or requires repeated cycles of RTI.

3. What is the prevalence of LD? How about of Reading Disability (RD)?
   5-10% of a Gen Peds practice. RD is most common and accounts for 80% of LD cases.

4. What is the definition of Attention-Deficit Hyperactivity Disorder (ADHD)?
   DSM-V: (1) 6 of 9 hyperactive/impulsive behaviors AND/OR inattentive behaviors; (2) occurs in ≥2 settings for at least 6mo; (3) present prior to age 7; (4) significant impairment in learning and/or social interactions.

5. What percentage of ADHD diagnoses is made by pediatricians?
   39%. Of note, the prevalence of ADHD is 4-12% in primary care or community samples.

PSYCHOLOGICAL ASSESSMENT

(Based on evaluation by Dr. Louis Essers, Division of Neurodevelopmental Pediatrics)

BACKGROUND INFORMATION

Child's name: **P. M.**
Age: **9 years**
Grade: **4th**

REASON FOR VISIT: P. does not finish her work on time; she interrupts class and is still learning to raise her hand before speaking; she does not complete her assignments and does not complete tests in time. She needs reminders to stay on task; has difficulty staying organized; has difficulty finding things in her backpack; she forgets books she needs for homework. At times P. does not write her assignments down; has difficulty completing work from her previous assignment; has difficulty keeping track of an assignment.

HISTORY

Gestation: P. was born to a 34 year old, gravida 1 mother, and 34 year old father, after a 40 week pregnancy that was normal.

Birth occurred at NNMC. Labor lasted a total of 10 hours. Delivery was spontaneous, vaginal. Presentation was vertex. There was no fetal distress. Forceps were not needed. Apgars were normal. The initial exam by the pediatrician was normal.

Neonatal: Birth weight was 7 pounds 1 ounces. They went home two days later.

Infancy: During the first few months of life the baby was described as normal. She was neither excessively quiet nor hyperactive. Feedings were breastmilk for 6 months.

Past Medical: Hospitalizations: Age 3 years ITP & Mono. Allergies: none. Immunizations: current. Diet now consists of all food groups. No known food allergies; takes no medications at present.

Previous Evaluations: none

Developmental: Her mother reports P.'s milestones as follows:

Auditory-Linguistic	**expected**	**attained**
3 word sentences	(30 mo)	30 mo
Fine Motor/Adaptive	**expected**	**attained**
Toilet trained	(36 mo)	42 mo
Tied shoelaces (bow)	(60 mo)	7 years
Gross Motor	**expected**	**attained**
Walked (independently)	(12 mo)	12 mo
Rode two wheeler	(72 mo)	72 mo

IEP / Educational: P. is now in a regular classroom in the 4th grade at a private school. Additional assistance: none. There is an au pair living with the family. Her teacher reports that P. has problems of behavior, staying focused, and being tired (lying on the desk).
Reading is average. Math is average.

School history is as follows:

Pre-school: no problems
KG: Problems included sitting in the bathroom/"hiding-out"
Gr 1: Problems included completing her work
Grs 2/3/4: Problems included same

Home Behavior: P.'s disposition is described as cheerful, trying to be "the helpful eldest child." Interpersonal relations are said to be good. In a group of other children P. does fine. She gets along well with members of the family. Emotions seen in P. include a broad range of emotions.

P. has no problem understanding and remembering. She can sit and watch a TV program with good concentration. She does not complete her homework in a timely fashion. She has some mild difficulty remaining seated at meals; she tends to fidget. She likes to read and loves to draw.

Hobbies include reading, ballet, piano, and violin. Violin teacher said P. hides in the library or bathroom.

Behavioral concerns at home: none
P. has had no symptoms of depression or symptoms of anxiety.
P. has had no visual or auditory hallucinations.
P. has never had any unusual repetitive movements such as tics, or any unusual vocalizations which could not be controlled. She does hum at times when she is doing her work.

Family: Mother is healthy and completed an advanced degree in medicine with no academic problems. She is married to P.'s father. Father is healthy. He completed an advanced degree in medicine with no academic problems. Siblings include: Girl (age 8 years), doing well; Girl (age 5 years), doing well. Extended family members with behavioral or developmental concerns include:

Maternal: aunt with dyslexia
Paternal: none

Social: P. lives with her family and always has. The main caretaker is an au pair. There have been no recent stressful events in P.'s life. Social problems include: none.

BEHAVIORAL QUESTIONNAIRES:

Vanderbilt Rating Scale (number of features rated as "often" or "very often")

	Mother	Teacher	Teacher
Inattentive	7/9	5/9	7/9
Hyperactive/Impulsive:	2/9	5/9	6/9
Oppositionality	0/8	1/4	1/4
Conduct	0/13	0/6	0/6
Anxiety/depression	0/7	1/7	1/7

MENTAL STATUS EXAM and TEST BEHAVIOR TODAY

Appearance:
- Hygiene: clean
- Age: looks stated age
- Physical features: medium

Alertness:
- Alert: Yes
- Attention: attention not always sustained
- Concentration: WNL

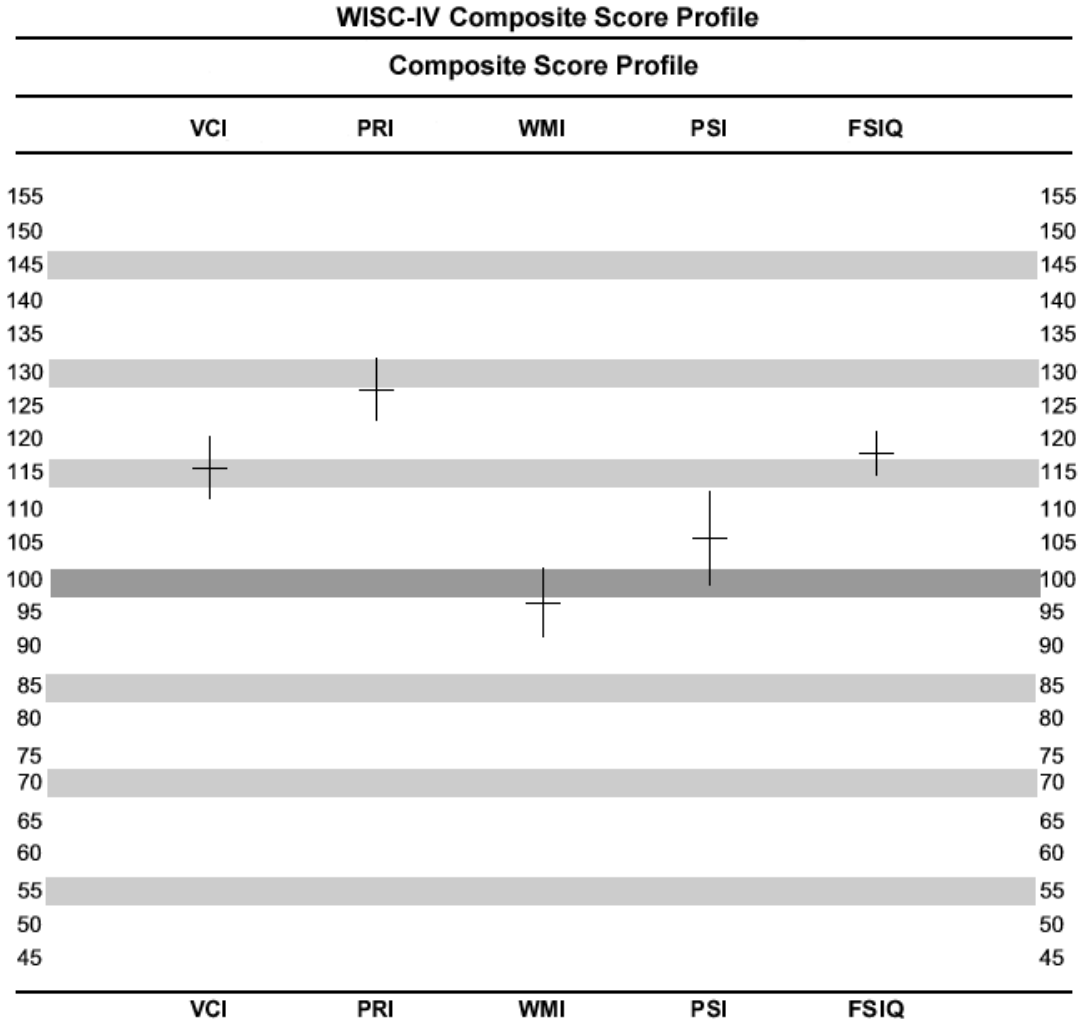
Behavior: No peculiarities noted; occasional hand tremor; atypical pencil grip noted
Speech: WNL

Attitude: Cooperative
Memory: intact
Mood and Affect: Mood: happy; Affect: broad range
Perceptual Disturbances: No Hallucinations/ illusions/ depersonalization/ derealization/ ideas of reference
Thought Processes}: logical; goal-oriented
Thought Content: WNL
Abstract thinking: WNL
Does the patient have thoughts of suicide? Not evident
Does the patient have thoughts of homicide? Not evident
Insight: good
Judgment: good

TEST RESULTS: P. completed aptitude testing (Wechsler Intelligence Scale for Children - IV) and achievement testing (Woodcock Johnson III: WJ III). **SS = Standard Score; PR = Percentile Rank; Mean= 100; SD= 15**

WISC-IV Composite Scores Summary

Scale	Sum of Scaled Scores	Composite Standard Score	Percentile Rank	95% Confidence Interval	Qualitative Description
Verbal Comprehension (VCI)	39	116	86	108-122	High Average
Perceptual Reasoning (PRI)	43	127	96	117-132	Superior
Working Memory (WMI)	19	97	42	90-105	Average
Processing Speed (PSI)	22	106	66	96-114	Average
Full Scale (FSIQ)	123	118	88	113-122	High Average



Vertical bar represents the Standard Error of Measurement.

Composite	SS	SEM	Composite	SS	SEM
VCI	116	4.24	PSI	106	6.54
PRI	127	4.24	FSIQ	118	3
WMI	97	4.74			

Composite Score Differences

Discrepancy Comparisons	Scaled Score 1	Scaled Score 2	Diff.	Critical Value	Sig. Diff. Y/N	Base Rate
VCI - PRI	116	127	-11	11.75	N	22.3%
VCI - WMI	116	97	19	12.46	Y	9.2%
VCI - PSI	116	106	10	15.28	N	25.8%
PRI - WMI	127	97	30	12.46	Y	2.6%
PRI - PSI	127	106	21	15.28	Y	8%
WMI - PSI	97	106	-9	15.83	N	32.2%

Verbal Comprehension Subtest Score Summary (Total Raw Score to Scaled Score Conversions)

Subtest	Raw Score	Scaled Score Mean=10 SD =3	Percentile Rank
Similarities	15	12	75
Vocabulary	32	14	91
Comprehension	20	13	84

Perceptual Reasoning Subtest Score Summary (Total Raw Score to Scaled Score Conversions)

Subtests	Raw Score	Scaled Score Mean=10 SD =3	Percentile Rank
Block Design	34	15	95
Picture Concepts	17	13	84
Matrix Reasoning	22	15	95

Working Memory Subtest Score Summary (Total Raw Score to Scaled Score Conversions)

Subtests	Raw Score	Scaled Score Mean=10 SD =3	Percentile Rank
Digit Span	11	8	25
Letter-Number Sequencing	14	11	63

Processing Speed Subtest Scores Summary (Total Raw Score to Scaled Score Conversions)

Subtests	Raw Score	Scaled Score Mean=10 SD =3	Percentile Rank
Coding (CD)	51	11	63
Symbol Search (SS)	28	11	63

P. was administered ten subtests of the **Wechsler Intelligence Scale for Children – Fourth Edition (WISC-IV)** from which her composite scores are derived.

The **Full Scale IQ (FSIQ)** is derived from a combination of ten subtest scores and is considered the most representative estimate of global intellectual functioning. P.'s general cognitive ability is within the High

Average range of intellectual functioning, as measured by the FSIQ. Her overall thinking and reasoning abilities exceed those of approximately 88% of children her age (FSIQ = 118; 95% confidence interval = 113-122).

The **Verbal Comprehension Index** is designed to measure verbal reasoning and concept formation. P.'s verbal reasoning abilities as measured by the Verbal Comprehension Index are in the High Average range and above those of approximately 86% of her peers (VCI = 116; 95% confidence interval = 108-122).

The **Perceptual Reasoning Index** is designed to measure fluid reasoning in the perceptual domain with tasks that assess nonverbal concept formation, visual perception and organization, simultaneous processing, visual-motor coordination, learning, and the ability to separate figure and ground in visual stimuli. P.'s nonverbal reasoning abilities as measured by the Perceptual Reasoning Index are in the Superior range and above those of approximately 96% of her peers (PRI = 127; 95% confidence interval = 117-132).

The **Working Memory Index** measures the ability to sustain attention, concentrate, and exert mental control. P.'s abilities are in the Average range. She performed better than approximately 42% of her age-mates in this area (Working Memory Index = 97; 95% confidence interval 90-105).

The **Processing Speed Index** is an indication of the rapidity with which an individual can mentally process simple or routine information without making errors. Students with superior reasoning ability often tend to perform less well, although still adequately, on processing speed tasks. P.'s ability in processing simple or routine visual material without making errors is in the Average range when compared to her peers. She performed better than approximately 66% of her peers on the processing speed tasks (Processing Speed Index = 106; 95% confidence interval 96-114).

TABLE OF SCORES: ***Woodcock-Johnson III Tests of Achievement***

CLUSTER/Test	PR	SS(68% BAND)
TOTAL ACHIEVEMENT	*13*	***83*** *(81-86)*
BROAD READING	***9***	***80 (78-83)***
Letter-Word Identification	*22*	*89 (86-91)*
Reading Fluency	*11*	*82 (78-86)*
Passage Comprehension	*12*	*82 (79-86)*
BROAD MATH	***84***	***115 (111-119)***
Applied Problems	*95*	*124 (119-130)*
Calculation	*77*	*111 (104-118)*
Math Fluency	*22*	*88 (84-93)*
WRITTEN LANGUAGE	***10***	***81 (75-86)***
Spelling	*22*	*88 (84-92)*
Writing Fluency	*12*	*82 (70-94)*
Writing Samples	*47*	*99 (92-106)*
MATH CALC SKILLS	*59*	*103 (98-109)*
WRITTEN EXPRESSION	*13*	*83 (74-93)*
ACADEMIC SKILLS	*26*	*90 (88-93)*
ACADEMIC FLUENCY	*8*	*79 (73-85)*
ACADEMIC APPS	*47*	*99 (96-101)*
Picture Vocabulary	*97*	*128 (122-134)*

Interpretation of WISC-IV Results
She performed slightly better on nonverbal than on verbal reasoning tasks, but there is no significant meaningful difference between P.'s ability to reason with and without the use of words. P. performed comparably on the verbal subtests, suggesting that these verbal cognitive abilities are similarly developed. P. performed comparably on the perceptual reasoning subtests contributing to the PRI, suggesting that her visual-spatial reasoning and perceptual-organizational skills are similarly developed. P.'s *abilities to sustain attention, concentrate, and exert mental control are a weakness* relative to her nonverbal and verbal reasoning abilities. A relative weakness in mental control may make the processing of complex information more time-consuming for P., draining her mental energies more quickly as compared to other children her age, and perhaps result in more frequent errors on a variety of learning tasks. Although clearly weaker than her verbal and nonverbal reasoning abilities, P.'s ability to exert mental control is still comparable to her peers. Processing visual material quickly is an ability that P. performs less well than her nonverbal reasoning ability.

Interpretation of Woodcock-Johnson III Achievement Results
When compared to others at her age level, P.'s academic skills and her ability to apply those skills are both within the low average range. P.'s performance is high average in mathematics; average in math calculation skills; low average in reading, written language, and written expression. Her fluency (speed) with academic tasks is weak.

IMPRESSION:
P. is a confident, energetic, optimistic, fine, considerate, alert, socially interactive and assertive 9 year old in 4th grade who has superior perceptual reasoning aptitude and high average verbal comprehension. Her superior Perceptual Reasoning Index (PRI) is the best estimate of her intelligence.

P. completed aptitude testing (Wechsler Intelligence Scale for Children - IV) and achievement testing (Woodcock Johnson III: WJ III). Her general cognitive ability, as estimated by the WISC-IV, is in the High Average range. P.'s general verbal comprehension abilities were in the High Average range (VCI = 116), and general perceptual reasoning abilities were in the Superior range (PRI = 127). P.'s general working memory abilities are in the Average range (WMI = 97), and general processing speed abilities in the Average range (PSI = 106). P.'s abilities to sustain attention, concentrate, and exert mental control are a weakness relative to her nonverbal and verbal reasoning abilities. P.'s ability to process visual material quickly is also a weakness relative to her verbal and nonverbal reasoning ability.

P.'s reading is improving. Her math fluency is weak and she has symptoms which we are consistent with attention deficit hyperactivity disorder. She evidences an atypical pencil grip which affects her writing; she still reverses letters. A mild hand tremor was observed. Reversals in her written work are evident, for example "b" & "d." Her verbal responses tended to be speedy.

Teacher checklists were significant for "high energy" and inattention.

DIAGNOSES:
Axis 1:
Axis 2:
Axis 3:
Axis 4:
Axis 5:

RECOMMENDATIONS:

Development IV Case

Please refer to Psychological Assessment of Patient P.M. The following questions will serve as a guide to reviewing and interpreting both the qualitative and quantitative elements.

1a. What elements of the "**reason for visit**" and "**history**" (pgs. 1-2) suggest a possible developmental or behavioral disorder? Are there any early signs of "increased learning effort" or "school distress" or "school failure"?

- Interrupts class, doesn't complete her assignments, doesn't finish tests in time, needs reminders to stay on task, difficulty staying organized, difficulty finding things.
- Developmental delay in Fine/Motor Adaptive Skills (see **1b**)
- Reading and Math performance are reported as "average"
- "Hiding out", in kindergarten and at violin. "Lying on desk" at school.
- At home, difficulty remaining seated at meals, tends to fidget
- Maternal aunt with dyslexia (see **1c**)

1b. Calculate a DQ for Patient PM's communication, fine-motor, and gross motor domains.

DQ = devo age/ chrono age x 100

Communication & Gross Motor are 100

Fine Motor is 36/42 x 100 = 85 or 60/84 x 100 = 71

** A DQ > 85 is normal. A DQ <70 is abnormal. The gray zone warrants follow-up.*

1c. What is the significance, if any, of PM's family history?

Family and twin studies suggest that **50% of learning problems can be accounted for by heritable factors.** A family history of LD is considered a risk factor for having an LD.

2a. How do the "**behavioral questionnaires,**" "**mental status exam,**" and "**test behavior**" (pgs. 2-3) contribute to your concerns? **Score the Vanderbilt** as part of your answer.

- Cannot officially score Vanderbilt, based on absence of "performance questions" results; however, PM meets criteria for the inattentive domain with >6/9 positive items scored by Mother and Teacher #2. She does not meet criteria for the hyperactive domain, because only Teacher #2 scored >6/9 positive items.
- MSE is reassuring, but highlights inattention, as well as "occasional hand tremor" and an "atypical pencil grip" (see **2a**).

2b. What is the significance, if any, of PM's hand tremor?

This subtle motor sign, in addition to her "atypical pencil grip" and history of fine motor delay, may reflect the "soft neurologic signs" seen in children with both LD and ADHD. Please note, however, that these are non-specific findings. *(see p 320 of PIR for exam maneuvers).*

3. Before reviewing PM's test results, what is your **differential diagnosis**?

- **Specific Learning Disorder** (cannot determine yet if reading, mathematics, written expression, or NOS based on history)
- **ADHD** (remember that ADHD & LD can coexist— *30-40% kids with LD have ADHD*)
- Also consider ASDs, MR, ODD, CD, anxiety disorder, depressive disorder, impaired vision or hearing, epilepsy, and chronic medical conditions, but much less likely.

4. The test results include a Weschler Intelligence Scale for Children-IV (**WISC-IV**) and a Woodcock Johnson Test of Achievement (**WJIII**) assessment (pgs. 3-6). How do these tools differ? Why do we need both?

- The WISC-IV is an **IQ test**, which helps to illustrate a patient's potential or aptitude. The WJIII is an **Achievement Test**, which approximates school performance (e.g. you will often see a "grade equivalent" or GE as one of the standard scores).
- Doing both assessments allows us to estimate a patient's potential vs. actual performance, which is the definition of LD (specifically, a difference ≥1.5 SD)

5a. What is the relationship between the **FSIQ** and the other WISC-IV **Composite Scores**?
The FSIQ is the **consensus score** which takes into account *all* the other composite scores and represents global intellectual functioning. This patient's FSIQ is in the *high-average* range, as is her verbal comprehension (VCI). Her perceptual reasoning (PRI) is *superior*; however, her working memory (WMI) and her processing speed (PSI) are both *average*.

5b. Were there any statistically significant differences between PM's **WISC-IV composite scores**? If so, what does this suggest?
Yes—between VCI & WMI; PRI & WMI; and PRI & PSI. Interpreted, this patient's **abilities to sustain attention and exert mental control** are a *relative weakness* compared to her non-verbal reasoning and verbal reasoning skills. This reinforces the results of the Vanderbilts.

5c. Does this patient show a difference between **verbal** and **nonverbal** (i.e. **performance**) abilities on the WISC-IV? If so, what does this suggest?
Not really. PM performed slightly better on non-verbal (PRI) than verbal (VCI) reasoning tasks, but this was not statistically significant. A **statistically significant difference between verbal and nonverbal scores *may* indicate a verbal or non-verbal LD**; however, it is the difference between aptitiude (e.g. the WISC) and achievement (e.g the WJIII) that defines an LD.

6. On the **WJIII**, are there differences in the **achievement tests**? If so, what does this suggest?
Yes—Her performance in math is high-average (84th %ile); whereas low-average in reading (9th %ile) and written language (10th %ile). This uneven profile is suggestive of a specific LD.

7a. Plot on the Normal Curve ***(see next page)*** this patient's **standard scores (SS)** for FSIQ, Broad Reading, Broad Math, & Written Language. Use a mean of 100 and SD of 15.
Residents should note the following:

- Her FSIQ and Math scores plot out relatively near each other (SS = 118 vs. 115)
- Her Broad Reading and Writing scores also plot out near each other (SS = 80 vs. 81)

7b. How does the annotated Normal Curve help to illustrate the discrepancies in this patient's test results? Do these discrepancies suggest a diagnosis for PM?

- Her **FSIQ is > 2 standard deviations higher than her Reading and Writing scores**. This means that there is a significant difference between her *actual performance* in reading and writing and her *potential performance.*
- If one uses the "Discrepancy Model" (versus the newer "Response to Intervention" model), this >1.5SD difference between achievement and ability defines a **Reading Disability and Writing Expression Disability**.

8. What is your **final diagnosis**? Please use the Axis model illustrated at the end of the report.

Axis 1 *(Clinical disorders, including major mental disorders, learning disorders, substance abuse):*
Attention-Deficit/Hyperactivity Disorder, predominantly inattentive type (314.00)
Reading Disorder (315.00)
Disorder of Written Language (315.2)
Axis 2 *(Personality disorder):* X
Axis 3 *(Acute medical conditions and physical disorders)*: Mild tremor
Axis 4 *(Psychosocial and environmental factors contributing):* X
Axis 5 *(Global Assessment of Functioning/Children's Global Assessment Scale):* 75

9. What **interventions** would you recommend to address PM's diagnoses and improve her academic performance? (*N.B. We will discuss IEP's in further detail in the Devo V module*).

➔ **IEP** to address school-based academic needs and interventions.

Learning Disorders

- **Tutoring** in reading and written language. Please be sure to use a **reading specialist**.
- "Bypass strategies" such as **recorded books** (be sure she has the text when she listens).
- **Extended time** (150%) for all tests and classroom projects.
- When instructions are written, read them to PM so she can also hear them.
- Provide **verbal cues** for key points in material.
- Stress paraphrasing and **self-verbalization** techniques.
- Make a **laptop** available to PM whenever feasible.
- Consider formal **speech and language evaluation** to further clarify learning needs.
- Encourage **extra-curricular activities** to enhance peer acceptance and self-esteem.

ADHD: *Target 3-6 outcomes associated with key symptoms . . .*

- Teach **organization skills**; consider color codes for notebooks, folders, binders.
- Encourage and coach in the use of a **planner**; use auditory cues when feasible.
- Whenever feasible, **small-group** for test-taking.
- Allow PM to have the option to write in the test booklet rather than Scan-tron.
- Encourage PM to regularly and frequently **review information** that must be remembered. Family & teachers could review this information with her and provide positive reinforcement for improvement.
- Consider **stimulant medication** and/or **cognitive-behavioral therapy**.

10. You are Patient P.M.'s PCM. When do you want to **follow up** with her?

This is up for discussion. First, follow-up after psychometric testing is completed to discuss results with family. After that, the frequency of monitoring through office visits and phone calls depends on the degree of dysfunction, the ease of implementing school-based interventions, and the family's adherence to the treatment plan.

Development IV Board Review

1. A 10-year-old girl is having difficulty completing her schoolwork in class without making errors. She is capable of doing the work with extended time but not within time limits. She is trying very hard to keep up with her classmates, but she works very slowly. Her parents report that she is able to do her homework but requires a lot of time. Her parents bring you a copy of her school testing results, including both the 10 subtest scores and the 4 index scores of the Wechsler Intelligence Scale for Children-Fourth Edition.

Of the following, the score that is MOST likely to be affected for this girl is the
A. full-scale intelligence quotient
B. perceptual reasoning factor
C. processing speed factor
D. verbal comprehension factor
E. working memory factor

The Wechsler Intelligence Scale for Children (WISC-IV) is used to assess a child's mental ability in comparison with the abilities of other children of the same age via a numerical score referred to as the full-scale intelligence quotient (IQ). The scores on a cognitive test are used to predict how a person will function academically.

The WISC-IV consists of 15 subtests: 10 core subtests and 5 additional optional subtests. The subtests are grouped into four composite scales known as factor scores. The individual factor scores provide more detailed information regarding the child's mental ability than does the full-scale IQ score. The verbal comprehension factor assesses skills such as verbal knowledge and how a person uses verbal skills in novel situations. The perceptual reasoning factor evaluates the ability to reason and organize material that is seen without the use of words. The working memory factor is based on the ability to remember information and either to manipulate it or use it to perform calculations. The processing speed factor assesses the speed of processing information.

The girl described in the vignette is unable to complete tasks within time limits, indicating that she has difficulty with the speed of processing simple visual information without making a mistake. Therefore, the score that is most likely to be affected for her is the processing speed factor.

Factor scores on the WISC-IV should be fairly similar. A substantial difference between scores suggests a greater likelihood of a learning or cognitive disability.

2. A mother of a 6-year-old boy in your practice is concerned that her son may have dyslexia. She has brought a sample of his printing to the visit in which the boy wrote "ded" instead of "bed" and "dad" instead of "bad." She wants your advice on what she should do to help her son learn how to write properly.

Of the following, the MOST appropriate response is to
A. reassure the mother that letter reversal can be normal through 7 years of age
B. recommend a comprehensive psychoeducational evaluation for a learning disability
C. recommend neurologic evaluation
D. refer the child for an occupational therapy evaluation and services to improve his writing skill
E. refer the child for vision therapy

Letter reversal in writing can be normal in children through 7 years of age. Dyslexia, a word recognition defect, is a specific learning disability that is neurobiologically based. It is characterized by problems with the ability to recognize words accurately and poor spelling and decoding skills. Its prevalence is as high as 17.4% of the school-age population. Affected children have problems attaching the correct labels or names to letters and words. They may call a "b" a "d" or read "saw" as "was." Because the problem is linguistic, not visual, affected children do not have problems copying letters.

Backward writing and letter reversal occur commonly in early development for all children whether or not they have learning disabilities. All children should receive routine vision screening, but a visual acuity problem would not be the cause of the letter reversal for the boy described in the vignette. There is no scientific evidence that vision therapy (eye exercise) is effective in the remediation of language-based learning disorders. Because letter reversal still can be considered in the normal range of development at 6 years of age, psycho-educational evaluation, neurologic evaluation, and occupational therapy are not indicated for this child.

3. A 9-year-old girl has been evaluated by a learning consultant and found to have a slow reading rate, weakness in short-term memory, and problems with reading comprehension. Her parents ask you what subjects other than reading will be most challenging for her due to these learning difficulties.

Of the following, the subject that this child should find MOST challenging is
A. art
B. creative writing
C. mathematics
D. music
E. social studies

A student who has a slow reading rate, reduced reading comprehension, and impaired short-term memory, such as the girl described in the vignette, will encounter problems in "content" classes, which include subjects such as science, history, and social studies. When children read texts in these subjects, they need to read factual information and use the material in the text to obtain knowledge about the subject. This requires comprehension of the text, which involves identifying and understanding the words.

To determine the meaning of a word, a reader first must decode and identify the word on the page. A slow reader takes much longer to complete assignments and test questions. Further, individuals who have weakness in understanding and remembering the text will have much more difficulty with homework assignments and on examinations. The girl in the vignette will not have the same difficulty with art, music, creative writing, or mathematics because these subjects do not demand the same emphasis on reading a text and recalling facts.

4. A 12-year-old boy recently took a standardized achievement test at school. His score dropped from 105 on last year's achievement test to 95 on the most recent test. Last season the boy played hockey and fell down, hitting his head, although he did not lose consciousness. He had no previous head injury. He was evaluated in the emergency department and had normal findings on computed tomography scan. The mother asks whether the boy suffered brain injury due to his fall that caused him to lose academic skills.

Of the following, the MOST appropriate response is to
A. explain that it is normal to have a small variation between scores
B. recommend neurorehabilitation due to loss of his academic skills
C. restrict the child's contact sports activity for the next season
D. send the child for comprehensive neuropsychological testing
E. send the child for head magnetic resonance imaging

The small difference in scores on standardized achievement tests described for the boy in the vignette is normal. To be significant, the change would need to be greater than 1 standard deviation (15 points). Because the values reported for the boy are within that expected for test-retest variation, brain magnetic resonance imaging, contact sports restriction, neuropsychological testing, and neuro-rehabilitation are not needed.

Standardized scores measure performance for a group of students, such as all the students in one school, at a certain grade, or in a single school district. Standardized scores employ a procedure in which scores are reported in terms of standard deviation units from the mean.

When scores are standardized to the normal bell curve, two thirds of the students in the sample fall between -1 and +1 standard deviations from the mean. Scores also may be expressed as percentiles or, in some cases, grade equivalents. Standardized scores are less useful for evaluating change in an individual student. A single student may be learning more every day and growing in ability or skill, but still be at the same relative rank compared with his or her peers.

Achievement tests measure what a child has learned in specific subject areas such as reading or mathematics. Criterion-based testing evaluates how much a student knows or can do using a specific set of standards, not by comparison with other students, which probably makes it more useful for identifying whether a student is improving or meeting objectives. A child who has a significant discrepancy (determined by each state) between an expected achievement score based on an IQ test and the actual score may have a specific learning disability and be eligible for specialized educational services.

5. The mother of a 9 year-old boy brings him to the pediatrician because her son is exhibiting hyperactivity and inattention in school. Before this year, the boy has performed well in school and has shown no signs of hyperactivity or inattention. His teacher reports that the boy is restless in the classroom and frequently leaves his seat. His mind seems to wander during the teacher's lectures. On questionnaires, the teacher confirms the inattention and hyperactivity. The boy shows no symptoms at home, and he does well as church, school, and at camp.

The most appropriate first step in managing this patient would be:
A. Explaining to the parents that he meets criteria for ADHD and what the diagnosis means.
B. Looking for other causes of the hyperactivity and inattention in the differential diagnosis.
C. Beginning an empiric trial of stimulant medication to see whether his symptoms improve with pharmacologic intervention.
D. Working with the school to modify the boy's assignments and classroom setting.
E. Referring to a counselor for self-esteem enhancement and social skills training, and behavior modification.

It is important to establish the correct diagnosis before beginning therapeutic interventions. This child does not meet the criteria for the diagnosis of ADHD because his symptoms appeared after 7 years of age and are present only in one setting (school). It would be important to assess whether factors such as the teacher's expectations, classroom dynamics, or peer issues are impacting his classroom behavior and performance. If a child meets criteria for ADHD, all of the other management options become reasonable parts of the therapeutic plan.