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# Autism Spectrum Disorder

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## Autism Spectrum Disorder

Diagnostic Criteria

**299.00 (F84.0)**

- A. Persistent deficits in social communication and social interaction across multiple contexts, as manifested by the following, currently or by history (examples are illustrative, not exhaustive; see text):
1. Deficits in social-emotional reciprocity, ranging, for example, from abnormal social approach and failure of normal back-and-forth conversation; to reduced sharing of interests, emotions, or affect; to failure to initiate or respond to social interactions.
  2. Deficits in nonverbal communicative behaviors used for social interaction, ranging, for example, from poorly integrated verbal and nonverbal communication; to abnormalities in eye contact and body language or deficits in understanding and use of gestures; to a total lack of facial expressions and nonverbal communication.
  3. Deficits in developing, maintaining, and understanding relationships, ranging, for example, from difficulties adjusting behavior to suit various social contexts; to difficulties in sharing imaginative play or in making friends; to absence of interest in peers.

*Specify current severity:*

**Severity is based on social communication impairments and restricted, repetitive patterns of behavior** (see Table 2).

- B. Restricted, repetitive patterns of behavior, interests, or activities, as manifested by at least two of the following, currently or by history (examples are illustrative, not exhaustive; see text):
1. Stereotyped or repetitive motor movements, use of objects, or speech (e.g., simple motor stereotypies, lining up toys or flipping objects, echolalia, idiosyncratic phrases).
  2. Insistence on sameness, inflexible adherence to routines, or ritualized patterns of verbal or nonverbal behavior (e.g., extreme distress at small changes, difficulties with transitions, rigid thinking patterns, greeting rituals, need to take same route or eat same food every day).
  3. Highly restricted, fixated interests that are abnormal in intensity or focus (e.g., strong attachment to or preoccupation with unusual objects, excessively circumscribed or perseverative interests).
  4. Hyper- or hyporeactivity to sensory input or unusual interest in sensory aspects of the environment (e.g., apparent indifference to pain/temperature, adverse response to specific sounds or textures, excessive smelling or touching of objects, visual fascination with lights or movement).

*Specify current severity:*

**Severity is based on social communication impairments and restricted, repetitive patterns of behavior** (see Table 2).

- C. Symptoms must be present in the early developmental period (but may not become fully manifest until social demands exceed limited capacities, or may be masked by learned strategies in later life).
- D. Symptoms cause clinically significant impairment in social, occupational, or other important areas of current functioning.

- E. These disturbances are not better explained by intellectual disability (intellectual developmental disorder) or global developmental delay. Intellectual disability and autism spectrum disorder frequently co-occur; to make comorbid diagnoses of autism spectrum disorder and intellectual disability, social communication should be below that expected for general developmental level.

**Note:** Individuals with a well-established DSM-IV diagnosis of autistic disorder, Asperger's disorder, or pervasive developmental disorder not otherwise specified should be given the diagnosis of autism spectrum disorder. Individuals who have marked deficits in social communication, but whose symptoms do not otherwise meet criteria for autism spectrum disorder, should be evaluated for social (pragmatic) communication disorder.

Specify if:

**With or without accompanying intellectual impairment**

**With or without accompanying language impairment**

**Associated with a known medical or genetic condition or environmental factor**

(**Coding note:** Use additional code to identify the associated medical or genetic condition.)

**Associated with another neurodevelopmental, mental, or behavioral disorder**

(**Coding note:** Use additional code[s] to identify the associated neurodevelopmental, mental, or behavioral disorder[s].)

**With catatonia** (refer to the criteria for catatonia associated with another mental disorder, pp. 119–120, for definition) (**Coding note:** Use additional code 293.89 [F06.1] catatonia associated with autism spectrum disorder to indicate the presence of the comorbid catatonia.)

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## Recording Procedures

For autism spectrum disorder that is associated with a known medical or genetic condition or environmental factor, or with another neurodevelopmental, mental, or behavioral disorder, record autism spectrum disorder associated with (name of condition, disorder, or factor) (e.g., autism spectrum disorder associated with Rett syndrome). Severity should be recorded as level of support needed for each of the two psychopathological domains in Table 2 (e.g., “requiring very substantial support for deficits in social communication and requiring substantial support for restricted, repetitive behaviors”). Specification of “with accompanying intellectual impairment” or “without accompanying intellectual impairment” should be recorded next. Language impairment specification should be recorded thereafter. If there is accompanying language impairment, the current level of verbal functioning should be recorded (e.g., “with accompanying language impairment—no intelligible speech” or “with accompanying language impairment—phrase speech”). If catatonia is present, record separately “catatonia associated with autism spectrum disorder.”

## Specifiers

The severity specifiers (see Table 2) may be used to describe succinctly the current symptomatology (which might fall below level 1), with the recognition that severity may vary by context and fluctuate over time. Severity of social communication difficulties and restricted, repetitive behaviors should be separately rated. The descriptive severity categories should not be used to determine eligibility for and provision of services; these can only be developed at an individual level and through discussion of personal priorities and targets.

Regarding the specifier “with or without accompanying intellectual impairment,” understanding the (often uneven) intellectual profile of a child or adult with autism spectrum disorder is necessary for interpreting diagnostic features. Separate estimates of verbal and nonverbal skill are necessary (e.g., using untimed nonverbal tests to assess potential strengths in individuals with limited language).

**TABLE 2** Severity levels for autism spectrum disorder

Severity level	Social communication	Restricted, repetitive behaviors
Level 3 “Requiring very substantial support”	Severe deficits in verbal and nonverbal social communication skills cause severe impairments in functioning, very limited initiation of social interactions, and minimal response to social overtures from others. For example, a person with few words of intelligible speech who rarely initiates interaction and, when he or she does, makes unusual approaches to meet needs only and responds to only very direct social approaches.	Inflexibility of behavior, extreme difficulty coping with change, or other restricted/ repetitive behaviors markedly interfere with functioning in all spheres. Great distress/difficulty changing focus or action.
Level 2 “Requiring substantial support”	Marked deficits in verbal and nonverbal social communication skills; social impairments apparent even with supports in place; limited initiation of social interactions; and reduced or abnormal responses to social overtures from others. For example, a person who speaks simple sentences, whose interaction is limited to narrow special interests, and who has markedly odd nonverbal communication.	Inflexibility of behavior, difficulty coping with change, or other restricted/ repetitive behaviors appear frequently enough to be obvious to the casual observer and interfere with functioning in a variety of contexts. Distress and/or difficulty changing focus or action.
Level 1 “Requiring support”	Without supports in place, deficits in social communication cause noticeable impairments. Difficulty initiating social interactions, and clear examples of atypical or unsuccessful responses to social overtures of others. May appear to have decreased interest in social interactions. For example, a person who is able to speak in full sentences and engages in communication but whose to-and-fro conversation with others fails, and whose attempts to make friends are odd and typically unsuccessful.	Inflexibility of behavior causes significant interference with functioning in one or more contexts. Difficulty switching between activities. Problems of organization and planning hamper independence.

To use the specifier “with or without accompanying language impairment,” the current level of verbal functioning should be assessed and described. Examples of the specific descriptions for “with accompanying language impairment” might include no intelligible speech (nonverbal), single words only, or phrase speech. Language level in individuals “without accompanying language impairment” might be further described by speaks in full sentences or has fluent speech. Since receptive language may lag behind expressive language development in autism spectrum disorder, receptive and expressive language skills should be considered separately.

The specifier “associated with a known medical or genetic condition or environmental factor” should be used when the individual has a known genetic disorder (e.g., Rett syndrome, Fragile X syndrome, Down syndrome), a medical disorder (e.g. epilepsy), or a history of environmental exposure (e.g., valproate, fetal alcohol syndrome, very low birth weight).

Additional neurodevelopmental, mental or behavioral conditions should also be noted (e.g., attention-deficit/hyperactivity disorder; developmental coordination disorder; disruptive behavior, impulse-control, or conduct disorders; anxiety, depressive, or bipolar disorders; tics or Tourette’s disorder; self-injury; feeding, elimination, or sleep disorders).

## Diagnostic Features

The essential features of autism spectrum disorder are persistent impairment in reciprocal social communication and social interaction (Criterion A), and restricted, repetitive patterns of behavior, interests, or activities (Criterion B). These symptoms are present from early childhood and limit or impair everyday functioning (Criteria C and D). The stage at which functional impairment becomes obvious will vary according to characteristics of the individual and his or her environment. Core diagnostic features are evident in the developmental period, but intervention, compensation, and current supports may mask difficulties in at least some contexts. Manifestations of the disorder also vary greatly depending on the severity of the autistic condition, developmental level, and chronological age; hence, the term *spectrum*. Autism spectrum disorder encompasses disorders previously referred to as early infantile autism, childhood autism, Kanner’s autism, high-functioning autism, atypical autism, pervasive developmental disorder not otherwise specified, childhood disintegrative disorder, and Asperger’s disorder.

The impairments in communication and social interaction specified in Criterion A are pervasive and sustained. Diagnoses are most valid and reliable when based on multiple sources of information, including clinician’s observations, caregiver history, and, when possible, self-report. Verbal and nonverbal deficits in social communication have varying manifestations, depending on the individual’s age, intellectual level, and language ability, as well as other factors such as treatment history and current support. Many individuals have language deficits, ranging from complete lack of speech through language delays, poor comprehension of speech, echoed speech, or stilted and overly literal language. Even when formal language skills (e.g., vocabulary, grammar) are intact, the use of language for reciprocal social communication is impaired in autism spectrum disorder.

Deficits in social-emotional reciprocity (i.e., the ability to engage with others and share thoughts and feelings) are clearly evident in young children with the disorder, who may show little or no initiation of social interaction and no sharing of emotions, along with reduced or absent imitation of others’ behavior. What language exists is often one-sided, lacking in social reciprocity, and used to request or label rather than to comment, share feelings, or converse. In adults without intellectual disabilities or language delays, deficits in social-emotional reciprocity may be most apparent in difficulties processing and responding to complex social cues (e.g., when and how to join a conversation, what not to say). Adults who have developed compensation strategies for some social challenges still struggle in novel or unsupported situations and suffer from the effort and anxiety of consciously calculating what is socially intuitive for most individuals.

Deficits in nonverbal communicative behaviors used for social interaction are manifested by absent, reduced, or atypical use of eye contact (relative to cultural norms), gestures, facial expressions, body orientation, or speech intonation. An early feature of autism spectrum disorder is impaired joint attention as manifested by a lack of pointing, showing, or bringing objects to share interest with others, or failure to follow someone's pointing or eye gaze. Individuals may learn a few functional gestures, but their repertoire is smaller than that of others, and they often fail to use expressive gestures spontaneously in communication. Among adults with fluent language, the difficulty in coordinating nonverbal communication with speech may give the impression of odd, wooden, or exaggerated "body language" during interactions. Impairment may be relatively subtle within individual modes (e.g., someone may have relatively good eye contact when speaking) but noticeable in poor integration of eye contact, gesture, body posture, prosody, and facial expression for social communication.

Deficits in developing, maintaining, and understanding relationships should be judged against norms for age, gender, and culture. There may be absent, reduced, or atypical social interest, manifested by rejection of others, passivity, or inappropriate approaches that seem aggressive or disruptive. These difficulties are particularly evident in young children, in whom there is often a lack of shared social play and imagination (e.g., age-appropriate flexible pretend play) and, later, insistence on playing by very fixed rules. Older individuals may struggle to understand what behavior is considered appropriate in one situation but not another (e.g., casual behavior during a job interview), or the different ways that language may be used to communicate (e.g., irony, white lies). There may be an apparent preference for solitary activities or for interacting with much younger or older people. Frequently, there is a desire to establish friendships without a complete or realistic idea of what friendship entails (e.g., one-sided friendships or friendships based solely on shared special interests). Relationships with siblings, co-workers, and caregivers are also important to consider (in terms of reciprocity).

Autism spectrum disorder is also defined by restricted, repetitive patterns of behavior, interests, or activities (as specified in Criterion B), which show a range of manifestations according to age and ability, intervention, and current supports. Stereotyped or repetitive behaviors include simple motor stereotypies (e.g., hand flapping, finger flicking), repetitive use of objects (e.g., spinning coins, lining up toys), and repetitive speech (e.g., echolalia, the delayed or immediate parroting of heard words; use of "you" when referring to self; stereotyped use of words, phrases, or prosodic patterns). Excessive adherence to routines and restricted patterns of behavior may be manifest in resistance to change (e.g., distress at apparently small changes, such as in packaging of a favorite food; insistence on adherence to rules; rigidity of thinking) or ritualized patterns of verbal or nonverbal behavior (e.g., repetitive questioning, pacing a perimeter). Highly restricted, fixated interests in autism spectrum disorder tend to be abnormal in intensity or focus (e.g., a toddler strongly attached to a pan; a child preoccupied with vacuum cleaners; an adult spending hours writing out timetables). Some fascinations and routines may relate to apparent hyper- or hyporeactivity to sensory input, manifested through extreme responses to specific sounds or textures, excessive smelling or touching of objects, fascination with lights or spinning objects, and sometimes apparent indifference to pain, heat, or cold. Extreme reaction to or rituals involving taste, smell, texture, or appearance of food or excessive food restrictions are common and may be a presenting feature of autism spectrum disorder.

Many adults with autism spectrum disorder without intellectual or language disabilities learn to suppress repetitive behavior in public. Special interests may be a source of pleasure and motivation and provide avenues for education and employment later in life. Diagnostic criteria may be met when restricted, repetitive patterns of behavior, interests, or activities were clearly present during childhood or at some time in the past, even if symptoms are no longer present.

Criterion D requires that the features must cause clinically significant impairment in social, occupational, or other important areas of current functioning. Criterion E specifies that the social communication deficits, although sometimes accompanied by intellectual disability (intellectual developmental disorder), are not in line with the individual's developmental level; impairments exceed difficulties expected on the basis of developmental level.

Standardized behavioral diagnostic instruments with good psychometric properties, including caregiver interviews, questionnaires and clinician observation measures, are available and can improve reliability of diagnosis over time and across clinicians.

## **Associated Features Supporting Diagnosis**

Many individuals with autism spectrum disorder also have intellectual impairment and/or language impairment (e.g., slow to talk, language comprehension behind production). Even those with average or high intelligence have an uneven profile of abilities. The gap between intellectual and adaptive functional skills is often large. Motor deficits are often present, including odd gait, clumsiness, and other abnormal motor signs (e.g., walking on tiptoes). Self-injury (e.g., head banging, biting the wrist) may occur, and disruptive/challenging behaviors are more common in children and adolescents with autism spectrum disorder than other disorders, including intellectual disability. Adolescents and adults with autism spectrum disorder are prone to anxiety and depression. Some individuals develop catatonic-like motor behavior (slowing and "freezing" mid-action), but these are typically not of the magnitude of a catatonic episode. However, it is possible for individuals with autism spectrum disorder to experience a marked deterioration in motor symptoms and display a full catatonic episode with symptoms such as mutism, posturing, grimacing and waxy flexibility. The risk period for comorbid catatonia appears to be greatest in the adolescent years.

## **Prevalence**

In recent years, reported frequencies for autism spectrum disorder across U.S. and non-U.S. countries have approached 1% of the population, with similar estimates in child and adult samples. It remains unclear whether higher rates reflect an expansion of the diagnostic criteria of DSM-IV to include subthreshold cases, increased awareness, differences in study methodology, or a true increase in the frequency of autism spectrum disorder.

## **Development and Course**

The age and pattern of onset also should be noted for autism spectrum disorder. Symptoms are typically recognized during the second year of life (12–24 months of age) but may be seen earlier than 12 months if developmental delays are severe, or noted later than 24 months if symptoms are more subtle. The pattern of onset description might include information about early developmental delays or any losses of social or language skills. In cases where skills have been lost, parents or caregivers may give a history of a gradual or relatively rapid deterioration in social behaviors or language skills. Typically, this would occur between 12 and 24 months of age and is distinguished from the rare instances of developmental regression occurring after at least 2 years of normal development (previously described as childhood disintegrative disorder).

The behavioral features of autism spectrum disorder first become evident in early childhood, with some cases presenting a lack of interest in social interaction in the first year of life. Some children with autism spectrum disorder experience developmental plateaus or regression, with a gradual or relatively rapid deterioration in social behaviors or use of language, often during the first 2 years of life. Such losses are rare in other disorders and may be a useful "red flag" for autism spectrum disorder. Much more unusual and warranting more extensive medical investigation are losses of skills beyond social communication (e.g., loss of self-care, toileting, motor skills) or those occurring after the

second birthday (see also Rett syndrome in the section “Differential Diagnosis” for this disorder).

First symptoms of autism spectrum disorder frequently involve delayed language development, often accompanied by lack of social interest or unusual social interactions (e.g., pulling individuals by the hand without any attempt to look at them), odd play patterns (e.g., carrying toys around but never playing with them), and unusual communication patterns (e.g., knowing the alphabet but not responding to own name). Deafness may be suspected but is typically ruled out. During the second year, odd and repetitive behaviors and the absence of typical play become more apparent. Since many typically developing young children have strong preferences and enjoy repetition (e.g., eating the same foods, watching the same video multiple times), distinguishing restricted and repetitive behaviors that are diagnostic of autism spectrum disorder can be difficult in preschoolers. The clinical distinction is based on the type, frequency, and intensity of the behavior (e.g., a child who daily lines up objects for hours and is very distressed if any item is moved).

Autism spectrum disorder is not a degenerative disorder, and it is typical for learning and compensation to continue throughout life. Symptoms are often most marked in early childhood and early school years, with developmental gains typical in later childhood in at least some areas (e.g., increased interest in social interaction). A small proportion of individuals deteriorate behaviorally during adolescence, whereas most others improve. Only a minority of individuals with autism spectrum disorder live and work independently in adulthood; those who do tend to have superior language and intellectual abilities and are able to find a niche that matches their special interests and skills. In general, individuals with lower levels of impairment may be better able to function independently. However, even these individuals may remain socially naive and vulnerable, have difficulties organizing practical demands without aid, and are prone to anxiety and depression. Many adults report using compensation strategies and coping mechanisms to mask their difficulties in public but suffer from the stress and effort of maintaining a socially acceptable facade. Scarcely anything is known about old age in autism spectrum disorder.

Some individuals come for first diagnosis in adulthood, perhaps prompted by the diagnosis of autism in a child in the family or a breakdown of relations at work or home. Obtaining detailed developmental history in such cases may be difficult, and it is important to consider self-reported difficulties. Where clinical observation suggests criteria are currently met, autism spectrum disorder may be diagnosed, provided there is no evidence of good social and communication skills in childhood. For example, the report (by parents or another relative) that the individual had ordinary and sustained reciprocal friendships and good nonverbal communication skills throughout childhood would rule out a diagnosis of autism spectrum disorder; however, the absence of developmental information in itself should not do so.

Manifestations of the social and communication impairments and restricted/repetitive behaviors that define autism spectrum disorder are clear in the developmental period. In later life, intervention or compensation, as well as current supports, may mask these difficulties in at least some contexts. However, symptoms remain sufficient to cause current impairment in social, occupational, or other important areas of functioning.

## Risk and Prognostic Factors

The best established prognostic factors for individual outcome within autism spectrum disorder are presence or absence of associated intellectual disability and language impairment (e.g., functional language by age 5 years is a good prognostic sign) and additional mental health problems. Epilepsy, as a comorbid diagnosis, is associated with greater intellectual disability and lower verbal ability.

**Environmental.** A variety of nonspecific risk factors, such as advanced parental age, low birth weight, or fetal exposure to valproate, may contribute to risk of autism spectrum disorder.

**Genetic and physiological.** Heritability estimates for autism spectrum disorder have ranged from 37% to higher than 90%, based on twin concordance rates. Currently, as many as 15% of cases of autism spectrum disorder appear to be associated with a known genetic mutation, with different de novo copy number variants or de novo mutations in specific genes associated with the disorder in different families. However, even when an autism spectrum disorder is associated with a known genetic mutation, it does not appear to be fully penetrant. Risk for the remainder of cases appears to be polygenic, with perhaps hundreds of genetic loci making relatively small contributions.

## Culture-Related Diagnostic Issues

Cultural differences will exist in norms for social interaction, nonverbal communication, and relationships, but individuals with autism spectrum disorder are markedly impaired against the norms for their cultural context. Cultural and socioeconomic factors may affect age at recognition or diagnosis; for example, in the United States, late or underdiagnosis of autism spectrum disorder among African American children may occur.

## Gender-Related Diagnostic Issues

Autism spectrum disorder is diagnosed four times more often in males than in females. In clinic samples, females tend to be more likely to show accompanying intellectual disability, suggesting that girls without accompanying intellectual impairments or language delays may go unrecognized, perhaps because of subtler manifestation of social and communication difficulties.

## Functional Consequences of Autism Spectrum Disorder

In young children with autism spectrum disorder, lack of social and communication abilities may hamper learning, especially learning through social interaction or in settings with peers. In the home, insistence on routines and aversion to change, as well as sensory sensitivities, may interfere with eating and sleeping and make routine care (e.g., haircuts, dental work) extremely difficult. Adaptive skills are typically below measured IQ. Extreme difficulties in planning, organization, and coping with change negatively impact academic achievement, even for students with above-average intelligence. During adulthood, these individuals may have difficulties establishing independence because of continued rigidity and difficulty with novelty.

Many individuals with autism spectrum disorder, even without intellectual disability, have poor adult psychosocial functioning as indexed by measures such as independent living and gainful employment. Functional consequences in old age are unknown, but social isolation and communication problems (e.g., reduced help-seeking) are likely to have consequences for health in older adulthood.

## Differential Diagnosis

**Rett syndrome.** Disruption of social interaction may be observed during the regressive phase of Rett syndrome (typically between 1–4 years of age); thus, a substantial proportion of affected young girls may have a presentation that meets diagnostic criteria for autism spectrum disorder. However, after this period, most individuals with Rett syndrome improve their social communication skills, and autistic features are no longer a major area of concern. Consequently, autism spectrum disorder should be considered only when all diagnostic criteria are met.

**Selective mutism.** In selective mutism, early development is not typically disturbed. The affected child usually exhibits appropriate communication skills in certain contexts and settings. Even in settings where the child is mute, social reciprocity is not impaired, nor are restricted or repetitive patterns of behavior present.

**Language disorders and social (pragmatic) communication disorder.** In some forms of language disorder, there may be problems of communication and some secondary social difficulties. However, specific language disorder is not usually associated with abnormal nonverbal communication, nor with the presence of restricted, repetitive patterns of behavior, interests, or activities.

When an individual shows impairment in social communication and social interactions but does not show restricted and repetitive behavior or interests, criteria for social (pragmatic) communication disorder, instead of autism spectrum disorder, may be met. The diagnosis of autism spectrum disorder supersedes that of social (pragmatic) communication disorder whenever the criteria for autism spectrum disorder are met, and care should be taken to enquire carefully regarding past or current restricted/repetitive behavior.

**Intellectual disability (intellectual developmental disorder) without autism spectrum disorder.** Intellectual disability without autism spectrum disorder may be difficult to differentiate from autism spectrum disorder in very young children. Individuals with intellectual disability who have not developed language or symbolic skills also present a challenge for differential diagnosis, since repetitive behavior often occurs in such individuals as well. A diagnosis of autism spectrum disorder in an individual with intellectual disability is appropriate when social communication and interaction are significantly impaired relative to the developmental level of the individual's nonverbal skills (e.g., fine motor skills, nonverbal problem solving). In contrast, intellectual disability is the appropriate diagnosis when there is no apparent discrepancy between the level of social-communicative skills and other intellectual skills.

**Stereotypic movement disorder.** Motor stereotypies are among the diagnostic characteristics of autism spectrum disorder, so an additional diagnosis of stereotypic movement disorder is not given when such repetitive behaviors are better explained by the presence of autism spectrum disorder. However, when stereotypies cause self-injury and become a focus of treatment, both diagnoses may be appropriate.

**Attention-deficit/hyperactivity disorder.** Abnormalities of attention (overly focused or easily distracted) are common in individuals with autism spectrum disorder, as is hyperactivity. A diagnosis of attention-deficit/hyperactivity disorder (ADHD) should be considered when attentional difficulties or hyperactivity exceeds that typically seen in individuals of comparable mental age.

**Schizophrenia.** Schizophrenia with childhood onset usually develops after a period of normal, or near normal, development. A prodromal state has been described in which social impairment and atypical interests and beliefs occur, which could be confused with the social deficits seen in autism spectrum disorder. Hallucinations and delusions, which are defining features of schizophrenia, are not features of autism spectrum disorder. However, clinicians must take into account the potential for individuals with autism spectrum disorder to be concrete in their interpretation of questions regarding the key features of schizophrenia (e.g., "Do you hear voices when no one is there?" "Yes [on the radio]").

## Comorbidity

Autism spectrum disorder is frequently associated with intellectual impairment and structural language disorder (i.e., an inability to comprehend and construct sentences with proper grammar), which should be noted under the relevant specifiers when applicable. Many individuals with autism spectrum disorder have psychiatric symptoms that do not form part of the diagnostic criteria for the disorder (about 70% of individuals with autism spectrum disorder may have one comorbid mental disorder, and 40% may have two or more comorbid mental disorders). When criteria for both ADHD and autism spectrum disorder are met, both diagnoses should be given. This same principle applies to concurrent diagnoses of autism spectrum disorder and developmental coordination disorder, anxiety disorders, depressive

disorders, and other comorbid diagnoses. Among individuals who are nonverbal or have language deficits, observable signs such as changes in sleep or eating and increases in challenging behavior should trigger an evaluation for anxiety or depression. Specific learning difficulties (literacy and numeracy) are common, as is developmental coordination disorder. Medical conditions commonly associated with autism spectrum disorder should be noted under the "associated with a known medical/genetic or environmental/acquired condition" specifier. Such medical conditions include epilepsy, sleep problems, and constipation. Avoidant-restrictive food intake disorder is a fairly frequent presenting feature of autism spectrum disorder, and extreme and narrow food preferences may persist.

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## Attention-Deficit/Hyperactivity Disorder

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### Attention-Deficit/Hyperactivity Disorder

#### Diagnostic Criteria

A. A persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development, as characterized by (1) and/or (2):

1. **Inattention:** Six (or more) of the following symptoms have persisted for at least 6 months to a degree that is inconsistent with developmental level and that negatively impacts directly on social and academic/occupational activities:

**Note:** The symptoms are not solely a manifestation of oppositional behavior, defiance, hostility, or failure to understand tasks or instructions. For older adolescents and adults (age 17 and older), at least five symptoms are required.

- a. Often fails to give close attention to details or makes careless mistakes in schoolwork, at work, or during other activities (e.g., overlooks or misses details, work is inaccurate).
- b. Often has difficulty sustaining attention in tasks or play activities (e.g., has difficulty remaining focused during lectures, conversations, or lengthy reading).
- c. Often does not seem to listen when spoken to directly (e.g., mind seems elsewhere, even in the absence of any obvious distraction).
- d. Often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (e.g., starts tasks but quickly loses focus and is easily sidetracked).
- e. Often has difficulty organizing tasks and activities (e.g., difficulty managing sequential tasks; difficulty keeping materials and belongings in order; messy, disorganized work; has poor time management; fails to meet deadlines).
- f. Often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (e.g., schoolwork or homework; for older adolescents and adults, preparing reports, completing forms, reviewing lengthy papers).
- g. Often loses things necessary for tasks or activities (e.g., school materials, pencils, books, tools, wallets, keys, paperwork, eyeglasses, mobile telephones).
- h. Is often easily distracted by extraneous stimuli (for older adolescents and adults, may include unrelated thoughts).
- i. Is often forgetful in daily activities (e.g., doing chores, running errands; for older adolescents and adults, returning calls, paying bills, keeping appointments).

2. **Hyperactivity and impulsivity:** Six (or more) of the following symptoms have persisted for at least 6 months to a degree that is inconsistent with developmental level and that negatively impacts directly on social and academic/occupational activities:
- Note:** The symptoms are not solely a manifestation of oppositional behavior, defiance, hostility, or a failure to understand tasks or instructions. For older adolescents and adults (age 17 and older), at least five symptoms are required.
- a. Often fidgets with or taps hands or feet or squirms in seat.
  - b. Often leaves seat in situations when remaining seated is expected (e.g., leaves his or her place in the classroom, in the office or other workplace, or in other situations that require remaining in place).
  - c. Often runs about or climbs in situations where it is inappropriate. (**Note:** In adolescents or adults, may be limited to feeling restless.)
  - d. Often unable to play or engage in leisure activities quietly.
  - e. Is often “on the go,” acting as if “driven by a motor” (e.g., is unable to be or uncomfortable being still for extended time, as in restaurants, meetings; may be experienced by others as being restless or difficult to keep up with).
  - f. Often talks excessively.
  - g. Often blurts out an answer before a question has been completed (e.g., completes people’s sentences; cannot wait for turn in conversation).
  - h. Often has difficulty waiting his or her turn (e.g., while waiting in line).
  - i. Often interrupts or intrudes on others (e.g., butts into conversations, games, or activities; may start using other people’s things without asking or receiving permission; for adolescents and adults, may intrude into or take over what others are doing).
- B. Several inattentive or hyperactive-impulsive symptoms were present prior to age 12 years.
- C. Several inattentive or hyperactive-impulsive symptoms are present in two or more settings (e.g., at home, school, or work; with friends or relatives; in other activities).
- D. There is clear evidence that the symptoms interfere with, or reduce the quality of, social, academic, or occupational functioning.
- E. The symptoms do not occur exclusively during the course of schizophrenia or another psychotic disorder and are not better explained by another mental disorder (e.g., mood disorder, anxiety disorder, dissociative disorder, personality disorder, substance intoxication or withdrawal).

Specify whether:

**314.01 (F90.2) Combined presentation:** If both Criterion A1 (inattention) and Criterion A2 (hyperactivity-impulsivity) are met for the past 6 months.

**314.00 (F90.0) Predominantly inattentive presentation:** If Criterion A1 (inattention) is met but Criterion A2 (hyperactivity-impulsivity) is not met for the past 6 months.

**314.01 (F90.1) Predominantly hyperactive/impulsive presentation:** If Criterion A2 (hyperactivity-impulsivity) is met and Criterion A1 (inattention) is not met for the past 6 months.

Specify if:

**In partial remission:** When full criteria were previously met, fewer than the full criteria have been met for the past 6 months, and the symptoms still result in impairment in social, academic, or occupational functioning.

Specify current severity:

**Mild:** Few, if any, symptoms in excess of those required to make the diagnosis are present, and symptoms result in no more than minor impairments in social or occupational functioning.

**Moderate:** Symptoms or functional impairment between “mild” and “severe” are present.

**Severe:** Many symptoms in excess of those required to make the diagnosis, or several symptoms that are particularly severe, are present, or the symptoms result in marked impairment in social or occupational functioning.

## Diagnostic Features

The essential feature of attention-deficit/hyperactivity disorder (ADHD) is a persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development. *Inattention* manifests behaviorally in ADHD as wandering off task, lacking persistence, having difficulty sustaining focus, and being disorganized and is not due to defiance or lack of comprehension. *Hyperactivity* refers to excessive motor activity (such as a child running about) when it is not appropriate, or excessive fidgeting, tapping, or talkativeness. In adults, hyperactivity may manifest as extreme restlessness or wearing others out with their activity. *Impulsivity* refers to hasty actions that occur in the moment without forethought and that have high potential for harm to the individual (e.g., darting into the street without looking). Impulsivity may reflect a desire for immediate rewards or an inability to delay gratification. Impulsive behaviors may manifest as social intrusiveness (e.g., interrupting others excessively) and/or as making important decisions without consideration of long-term consequences (e.g., taking a job without adequate information).

ADHD begins in childhood. The requirement that several symptoms be present before age 12 years conveys the importance of a substantial clinical presentation during childhood. At the same time, an earlier age at onset is not specified because of difficulties in establishing precise childhood onset retrospectively. Adult recall of childhood symptoms tends to be unreliable, and it is beneficial to obtain ancillary information.

Manifestations of the disorder must be present in more than one setting (e.g., home and school, work). Confirmation of substantial symptoms across settings typically cannot be done accurately without consulting informants who have seen the individual in those settings. Typically, symptoms vary depending on context within a given setting. Signs of the disorder may be minimal or absent when the individual is receiving frequent rewards for appropriate behavior, is under close supervision, is in a novel setting, is engaged in especially interesting activities, has consistent external stimulation (e.g., via electronic screens), or is interacting in one-on-one situations (e.g., the clinician's office).

## Associated Features Supporting Diagnosis

Mild delays in language, motor, or social development are not specific to ADHD but often co-occur. Associated features may include low frustration tolerance, irritability, or mood lability. Even in the absence of a specific learning disorder, academic or work performance is often impaired. Inattentive behavior is associated with various underlying cognitive processes, and individuals with ADHD may exhibit cognitive problems on tests of attention, executive function, or memory, although these tests are not sufficiently sensitive or specific to serve as diagnostic indices. By early adulthood, ADHD is associated with an increased risk of suicide attempt, primarily when comorbid with mood, conduct, or substance use disorders.

No biological marker is diagnostic for ADHD. As a group, compared with peers, children with ADHD display increased slow wave electroencephalograms, reduced total brain volume on magnetic resonance imaging, and possibly a delay in posterior to anterior cortical maturation, but these findings are not diagnostic. In the uncommon cases where there is a known genetic cause (e.g., Fragile X syndrome, 22q11 deletion syndrome), the ADHD presentation should still be diagnosed.

## Prevalence

Population surveys suggest that ADHD occurs in most cultures in about 5% of children and about 2.5% of adults.

## Development and Course

Many parents first observe excessive motor activity when the child is a toddler, but symptoms are difficult to distinguish from highly variable normative behaviors before age 4 years. ADHD is most often identified during elementary school years, and inattention becomes more prominent and impairing. The disorder is relatively stable through early adolescence, but some individuals have a worsened course with development of antisocial behaviors. In most individuals with ADHD, symptoms of motoric hyperactivity become less obvious in adolescence and adulthood, but difficulties with restlessness, inattention, poor planning, and impulsivity persist. A substantial proportion of children with ADHD remain relatively impaired into adulthood.

In preschool, the main manifestation is hyperactivity. Inattention becomes more prominent during elementary school. During adolescence, signs of hyperactivity (e.g., running and climbing) are less common and may be confined to fidgetiness or an inner feeling of jitteriness, restlessness, or impatience. In adulthood, along with inattention and restlessness, impulsivity may remain problematic even when hyperactivity has diminished.

## Risk and Prognostic Factors

**Temperamental.** ADHD is associated with reduced behavioral inhibition, effortful control, or constraint; negative emotionality; and/or elevated novelty seeking. These traits may predispose some children to ADHD but are not specific to the disorder.

**Environmental.** Very low birth weight (less than 1,500 grams) conveys a two- to three-fold risk for ADHD, but most children with low birth weight do not develop ADHD. Although ADHD is correlated with smoking during pregnancy, some of this association reflects common genetic risk. A minority of cases may be related to reactions to aspects of diet. There may be a history of child abuse, neglect, multiple foster placements, neurotoxin exposure (e.g., lead), infections (e.g., encephalitis), or alcohol exposure in utero. Exposure to environmental toxicants has been correlated with subsequent ADHD, but it is not known whether these associations are causal.

**Genetic and physiological.** ADHD is elevated in the first-degree biological relatives of individuals with ADHD. The heritability of ADHD is substantial. While specific genes have been correlated with ADHD, they are neither necessary nor sufficient causal factors. Visual and hearing impairments, metabolic abnormalities, sleep disorders, nutritional deficiencies, and epilepsy should be considered as possible influences on ADHD symptoms.

ADHD is not associated with specific physical features, although rates of minor physical anomalies (e.g., hypertelorism, highly arched palate, low-set ears) may be relatively elevated. Subtle motor delays and other neurological soft signs may occur. (Note that marked co-occurring clumsiness and motor delays should be coded separately [e.g., developmental coordination disorder].)

**Course modifiers.** Family interaction patterns in early childhood are unlikely to cause ADHD but may influence its course or contribute to secondary development of conduct problems.

## Culture-Related Diagnostic Issues

Differences in ADHD prevalence rates across regions appear attributable mainly to different diagnostic and methodological practices. However, there also may be cultural variation in attitudes toward or interpretations of children's behaviors. Clinical identification rates in the United States for African American and Latino populations tend to be lower than for Caucasian populations. Informant symptom ratings may be influenced by cultural group of the child and the informant, suggesting that culturally appropriate practices are relevant in assessing ADHD.

## Gender-Related Diagnostic Issues

ADHD is more frequent in males than in females in the general population, with a ratio of approximately 2:1 in children and 1.6:1 in adults. Females are more likely than males to present primarily with inattentive features.

## Functional Consequences of Attention-Deficit/Hyperactivity Disorder

ADHD is associated with reduced school performance and academic attainment, social rejection, and, in adults, poorer occupational performance, attainment, attendance, and higher probability of unemployment as well as elevated interpersonal conflict. Children with ADHD are significantly more likely than their peers without ADHD to develop conduct disorder in adolescence and antisocial personality disorder in adulthood, consequently increasing the likelihood for substance use disorders and incarceration. The risk of subsequent substance use disorders is elevated, especially when conduct disorder or antisocial personality disorder develops. Individuals with ADHD are more likely than peers to be injured. Traffic accidents and violations are more frequent in drivers with ADHD. There may be an elevated likelihood of obesity among individuals with ADHD.

Inadequate or variable self-application to tasks that require sustained effort is often interpreted by others as laziness, irresponsibility, or failure to cooperate. Family relationships may be characterized by discord and negative interactions. Peer relationships are often disrupted by peer rejection, neglect, or teasing of the individual with ADHD. On average, individuals with ADHD obtain less schooling, have poorer vocational achievement, and have reduced intellectual scores than their peers, although there is great variability. In its severe form, the disorder is markedly impairing, affecting social, familial, and scholastic/occupational adjustment.

Academic deficits, school-related problems, and peer neglect tend to be most associated with elevated symptoms of inattention, whereas peer rejection and, to a lesser extent, accidental injury are most salient with marked symptoms of hyperactivity or impulsivity.

## Differential Diagnosis

**Oppositional defiant disorder.** Individuals with oppositional defiant disorder may resist work or school tasks that require self-application because they resist conforming to others' demands. Their behavior is characterized by negativity, hostility, and defiance. These symptoms must be differentiated from aversion to school or mentally demanding tasks due to difficulty in sustaining mental effort, forgetting instructions, and impulsivity in individuals with ADHD. Complicating the differential diagnosis is the fact that some individuals with ADHD may develop secondary oppositional attitudes toward such tasks and devalue their importance.

**Intermittent explosive disorder.** ADHD and intermittent explosive disorder share high levels of impulsive behavior. However, individuals with intermittent explosive disorder show serious aggression toward others, which is not characteristic of ADHD, and they do not experience problems with sustaining attention as seen in ADHD. In addition, intermittent explosive disorder is rare in childhood. Intermittent explosive disorder may be diagnosed in the presence of ADHD.

**Other neurodevelopmental disorders.** The increased motoric activity that may occur in ADHD must be distinguished from the repetitive motor behavior that characterizes stereotypic movement disorder and some cases of autism spectrum disorder. In stereotypic movement disorder, the motoric behavior is generally fixed and repetitive (e.g., body rocking, self-biting), whereas the fidgetiness and restlessness in ADHD are typically generalized and not characterized by repetitive stereotypic movements. In Tourette's disorder,

frequent multiple tics can be mistaken for the generalized fidgetiness of ADHD. Prolonged observation may be needed to differentiate fidgetiness from bouts of multiple tics.

**Specific learning disorder.** Children with specific learning disorder may appear inattentive because of frustration, lack of interest, or limited ability. However, inattention in individuals with a specific learning disorder who do not have ADHD is not impairing outside of academic work.

**Intellectual disability (intellectual developmental disorder).** Symptoms of ADHD are common among children placed in academic settings that are inappropriate to their intellectual ability. In such cases, the symptoms are not evident during non-academic tasks. A diagnosis of ADHD in intellectual disability requires that inattention or hyperactivity be excessive for mental age.

**Autism spectrum disorder.** Individuals with ADHD and those with autism spectrum disorder exhibit inattention, social dysfunction, and difficult-to-manage behavior. The social dysfunction and peer rejection seen in individuals with ADHD must be distinguished from the social disengagement, isolation, and indifference to facial and tonal communication cues seen in individuals with autism spectrum disorder. Children with autism spectrum disorder may display tantrums because of an inability to tolerate a change from their expected course of events. In contrast, children with ADHD may misbehave or have a tantrum during a major transition because of impulsivity or poor self-control.

**Reactive attachment disorder.** Children with reactive attachment disorder may show social disinhibition, but not the full ADHD symptom cluster, and display other features such as a lack of enduring relationships that are not characteristic of ADHD.

**Anxiety disorders.** ADHD shares symptoms of inattention with anxiety disorders. Individuals with ADHD are inattentive because of their attraction to external stimuli, new activities, or preoccupation with enjoyable activities. This is distinguished from the inattention due to worry and rumination seen in anxiety disorders. Restlessness might be seen in anxiety disorders. However, in ADHD, the symptom is not associated with worry and rumination.

**Depressive disorders.** Individuals with depressive disorders may present with inability to concentrate. However, poor concentration in mood disorders becomes prominent only during a depressive episode.

**Bipolar disorder.** Individuals with bipolar disorder may have increased activity, poor concentration, and increased impulsivity, but these features are episodic, occurring several days at a time. In bipolar disorder, increased impulsivity or inattention is accompanied by elevated mood, grandiosity, and other specific bipolar features. Children with ADHD may show significant changes in mood within the same day; such lability is distinct from a manic episode, which must last 4 or more days to be a clinical indicator of bipolar disorder, even in children. Bipolar disorder is rare in preadolescents, even when severe irritability and anger are prominent, whereas ADHD is common among children and adolescents who display excessive anger and irritability.

**Disruptive mood dysregulation disorder.** Disruptive mood dysregulation disorder is characterized by pervasive irritability, and intolerance of frustration, but impulsiveness and disorganized attention are not essential features. However, most children and adolescents with the disorder have symptoms that also meet criteria for ADHD, which is diagnosed separately.

**Substance use disorders.** Differentiating ADHD from substance use disorders may be problematic if the first presentation of ADHD symptoms follows the onset of abuse or frequent use. Clear evidence of ADHD before substance misuse from informants or previous records may be essential for differential diagnosis.

**Personality disorders.** In adolescents and adults, it may be difficult to distinguish ADHD from borderline, narcissistic, and other personality disorders. All these disorders tend to share the features of disorganization, social intrusiveness, emotional dysregulation, and cognitive dysregulation. However, ADHD is not characterized by fear of abandonment, self-injury, extreme ambivalence, or other features of personality disorder. It may take extended clinical observation, informant interview, or detailed history to distinguish impulsive, socially intrusive, or inappropriate behavior from narcissistic, aggressive, or domineering behavior to make this differential diagnosis.

**Psychotic disorders.** ADHD is not diagnosed if the symptoms of inattention and hyperactivity occur exclusively during the course of a psychotic disorder.

**Medication-induced symptoms of ADHD.** Symptoms of inattention, hyperactivity, or impulsivity attributable to the use of medication (e.g., bronchodilators, isoniazid, neuroleptics [resulting in akathisia], thyroid replacement medication) are diagnosed as other specified or unspecified other (or unknown) substance-related disorders.

**Neurocognitive disorders.** Early major neurocognitive disorder (dementia) and/or mild neurocognitive disorder are not known to be associated with ADHD but may present with similar clinical features. These conditions are distinguished from ADHD by their late onset.

## Comorbidity

In clinical settings, comorbid disorders are frequent in individuals whose symptoms meet criteria for ADHD. In the general population, oppositional defiant disorder co-occurs with ADHD in approximately half of children with the combined presentation and about a quarter with the predominantly inattentive presentation. Conduct disorder co-occurs in about a quarter of children or adolescents with the combined presentation, depending on age and setting. Most children and adolescents with disruptive mood dysregulation disorder have symptoms that also meet criteria for ADHD; a lesser percentage of children with ADHD have symptoms that meet criteria for disruptive mood dysregulation disorder. Specific learning disorder commonly co-occurs with ADHD. Anxiety disorders and major depressive disorder occur in a minority of individuals with ADHD but more often than in the general population. Intermittent explosive disorder occurs in a minority of adults with ADHD, but at rates above population levels. Although substance use disorders are relatively more frequent among adults with ADHD in the general population, the disorders are present in only a minority of adults with ADHD. In adults, antisocial and other personality disorders may co-occur with ADHD. Other disorders that may co-occur with ADHD include obsessive-compulsive disorder, tic disorders, and autism spectrum disorder.

# Other Specified Attention-Deficit/ Hyperactivity Disorder

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**314.01 (F90.8)**

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This category applies to presentations in which symptoms characteristic of attention-deficit/hyperactivity disorder that cause clinically significant distress or impairment in social, occupational or other important areas of functioning predominate but do not meet the full criteria for attention-deficit/hyperactivity disorder or any of the disorders in the neurodevelopmental disorders diagnostic class. The other specified attention-deficit/hyperactivity disorder category is used in situations in which the clinician chooses to communicate

the specific reason that the presentation does not meet the criteria for attention-deficit/hyperactivity disorder or any specific neurodevelopmental disorder. This is done by recording “other specified attention-deficit/hyperactivity disorder” followed by the specific reason (e.g., “with insufficient inattention symptoms”).

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## Unspecified Attention-Deficit/Hyperactivity Disorder

**314.01 (F90.9)**

This category applies to presentations in which symptoms characteristic of attention-deficit/hyperactivity disorder that cause clinically significant distress or impairment in social, occupational, or other important areas of functioning predominate but do not meet the full criteria for attention-deficit/hyperactivity disorder or any of the disorders in the neurodevelopmental disorders diagnostic class. The unspecified attention-deficit/hyperactivity disorder category is used in situations in which the clinician chooses *not* to specify the reason that the criteria are not met for attention-deficit/hyperactivity disorder or for a specific neurodevelopmental disorder, and includes presentations in which there is insufficient information to make a more specific diagnosis.

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## Specific Learning Disorder

### Specific Learning Disorder

#### Diagnostic Criteria

- A. Difficulties learning and using academic skills, as indicated by the presence of at least one of the following symptoms that have persisted for at least 6 months, despite the provision of interventions that target those difficulties:
1. Inaccurate or slow and effortful word reading (e.g., reads single words aloud incorrectly or slowly and hesitantly, frequently guesses words, has difficulty sounding out words).
  2. Difficulty understanding the meaning of what is read (e.g., may read text accurately but not understand the sequence, relationships, inferences, or deeper meanings of what is read).
  3. Difficulties with spelling (e.g., may add, omit, or substitute vowels or consonants).
  4. Difficulties with written expression (e.g., makes multiple grammatical or punctuation errors within sentences; employs poor paragraph organization; written expression of ideas lacks clarity).
  5. Difficulties mastering number sense, number facts, or calculation (e.g., has poor understanding of numbers, their magnitude, and relationships; counts on fingers to add single-digit numbers instead of recalling the math fact as peers do; gets lost in the midst of arithmetic computation and may switch procedures).
  6. Difficulties with mathematical reasoning (e.g., has severe difficulty applying mathematical concepts, facts, or procedures to solve quantitative problems).

- B. The affected academic skills are substantially and quantifiably below those expected for the individual's chronological age, and cause significant interference with academic or occupational performance, or with activities of daily living, as confirmed by individually administered standardized achievement measures and comprehensive clinical assessment. For individuals age 17 years and older, a documented history of impairing learning difficulties may be substituted for the standardized assessment.
- C. The learning difficulties begin during school-age years but may not become fully manifest until the demands for those affected academic skills exceed the individual's limited capacities (e.g., as in timed tests, reading or writing lengthy complex reports for a tight deadline, excessively heavy academic loads).
- D. The learning difficulties are not better accounted for by intellectual disabilities, uncorrected visual or auditory acuity, other mental or neurological disorders, psychosocial adversity, lack of proficiency in the language of academic instruction, or inadequate educational instruction.

**Note:** The four diagnostic criteria are to be met based on a clinical synthesis of the individual's history (developmental, medical, family, educational), school reports, and psycho-educational assessment.

**Coding note:** Specify all academic domains and subskills that are impaired. When more than one domain is impaired, each one should be coded individually according to the following specifiers.

Specify if:

**315.00 (F81.0) With impairment in reading:**

- Word reading accuracy
- Reading rate or fluency
- Reading comprehension

**Note:** *Dyslexia* is an alternative term used to refer to a pattern of learning difficulties characterized by problems with accurate or fluent word recognition, poor decoding, and poor spelling abilities. If dyslexia is used to specify this particular pattern of difficulties, it is important also to specify any additional difficulties that are present, such as difficulties with reading comprehension or math reasoning.

**315.2 (F81.81) With impairment in written expression:**

- Spelling accuracy
- Grammar and punctuation accuracy
- Clarity or organization of written expression

**315.1 (F81.2) With impairment in mathematics:**

- Number sense
- Memorization of arithmetic facts
- Accurate or fluent calculation
- Accurate math reasoning

**Note:** *Dyscalculia* is an alternative term used to refer to a pattern of difficulties characterized by problems processing numerical information, learning arithmetic facts, and performing accurate or fluent calculations. If dyscalculia is used to specify this particular pattern of mathematic difficulties, it is important also to specify any additional difficulties that are present, such as difficulties with math reasoning or word reasoning accuracy.

Specify current severity:

**Mild:** Some difficulties learning skills in one or two academic domains, but of mild enough severity that the individual may be able to compensate or function well when provided with appropriate accommodations or support services, especially during the school years.

**Moderate:** Marked difficulties learning skills in one or more academic domains, so that the individual is unlikely to become proficient without some intervals of intensive and specialized teaching during the school years. Some accommodations or supportive services at least part of the day at school, in the workplace, or at home may be needed to complete activities accurately and efficiently.

**Severe:** Severe difficulties learning skills, affecting several academic domains, so that the individual is unlikely to learn those skills without ongoing intensive individualized and specialized teaching for most of the school years. Even with an array of appropriate accommodations or services at home, at school, or in the workplace, the individual may not be able to complete all activities efficiently.

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## Recording Procedures

Each impaired academic domain and subskill of specific learning disorder should be recorded. Because of ICD coding requirements, impairments in reading, impairments in written expression, and impairments in mathematics, with their corresponding impairments in subskills, must be coded separately. For example, impairments in reading and mathematics and impairments in the subskills of reading rate or fluency, reading comprehension, accurate or fluent calculation, and accurate math reasoning would be coded and recorded as 315.00 (F81.0) specific learning disorder with impairment in reading, with impairment in reading rate or fluency and impairment in reading comprehension; 315.1 (F81.2) specific learning disorder with impairment in mathematics, with impairment in accurate or fluent calculation and impairment in accurate math reasoning.

## Diagnostic Features

Specific learning disorder is a neurodevelopmental disorder with a biological origin that is the basis for abnormalities at a cognitive level that are associated with the behavioral signs of the disorder. The biological origin includes an interaction of genetic, epigenetic, and environmental factors, which affect the brain's ability to perceive or process verbal or non-verbal information efficiently and accurately.

One essential feature of specific learning disorder is persistent difficulties learning key-  
stone academic skills (Criterion A), with onset during the years of formal schooling (i.e., the developmental period). Key academic skills include reading of single words accurately and fluently, reading comprehension, written expression and spelling, arithmetic calculation, and mathematical reasoning (solving mathematical problems). In contrast to talking or walking, which are acquired developmental milestones that emerge with brain maturation, academic skills (e.g., reading, spelling, writing, mathematics) have to be taught and learned explicitly. Specific learning disorder disrupts the normal pattern of learning academic skills; it is not simply a consequence of lack of opportunity of learning or inadequate instruction. Difficulties mastering these key academic skills may also impede learning in other academic subjects (e.g., history, science, social studies), but those problems are attributable to difficulties learning the underlying academic skills. Difficulties learning to map letters with the sounds of one's language—to read printed words (often called *dyslexia*)—is one of the most common manifestations of specific learning disorder. The learning difficulties manifest as a range of observable, descriptive behaviors or symptoms (as listed in Criteria A1–A6). These clinical symptoms may be observed, probed by means of the clinical interview, or ascertained from school reports, rating scales, or descriptions in previous educational or psychological assessments. The learning difficulties are persistent, not transitory. In children and adolescents, *persistence* is defined as restricted progress in learning (i.e., no evidence that the individual is catching up with classmates) for at least 6 months despite the provision of extra help at home or school. For example, difficulties learning to read single words that do not fully or rapidly remit with the provision of instruction in phonological skills or word identification strategies may indicate a specific

learning disorder. Evidence of persistent learning difficulties may be derived from cumulative school reports, portfolios of the child's evaluated work, curriculum-based measures, or clinical interview. In adults, persistent difficulty refers to ongoing difficulties in literacy or numeracy skills that manifest during childhood or adolescence, as indicated by cumulative evidence from school reports, evaluated portfolios of work, or previous assessments.

A second key feature is that the individual's performance of the affected academic skills is well below average for age (Criterion B). One robust clinical indicator of difficulties learning academic skills is low academic achievement for age or average achievement that is sustainable only by extraordinarily high levels of effort or support. In children, the low academic skills cause significant interference in school performance (as indicated by school reports and teacher's grades or ratings). Another clinical indicator, particularly in adults, is avoidance of activities that require the academic skills. Also in adulthood, low academic skills interfere with occupational performance or everyday activities requiring those skills (as indicated by self-report or report by others). However, this criterion also requires psychometric evidence from an individually administered, psychometrically sound and culturally appropriate test of academic achievement that is norm-referenced or criterion-referenced. Academic skills are distributed along a continuum, so there is no natural cutpoint that can be used to differentiate individuals with and without specific learning disorder. Thus, any threshold used to specify what constitutes significantly low academic achievement (e.g., academic skills well below age expectation) is to a large extent arbitrary. Low achievement scores on one or more standardized tests or subtests within an academic domain (i.e., at least 1.5 standard deviations [SD] below the population mean for age, which translates to a standard score of 78 or less, which is below the 7th percentile) are needed for the greatest diagnostic certainty. However, precise scores will vary according to the particular standardized tests that are used. On the basis of clinical judgment, a more lenient threshold may be used (e.g., 1.0–2.5 SD below the population mean for age), when learning difficulties are supported by converging evidence from clinical assessment, academic history, school reports, or test scores. Moreover, since standardized tests are not available in all languages, the diagnosis may then be based in part on clinical judgment of scores on available test measures.

A third core feature is that the learning difficulties are readily apparent in the early school years in most individuals (Criterion C). However, in others, the learning difficulties may not manifest fully until later school years, by which time learning demands have increased and exceed the individual's limited capacities.

Another key diagnostic feature is that the learning difficulties are considered "specific," for four reasons. First, they are not attributable to intellectual disabilities (intellectual disability [intellectual developmental disorder]); global developmental delay; hearing or vision disorders, or neurological or motor disorders) (Criterion D). Specific learning disorder affects learning in individuals who otherwise demonstrate normal levels of intellectual functioning (generally estimated by an IQ score of greater than about 70 [ $\pm 5$  points allowing for measurement error]). The phrase "unexpected academic underachievement" is often cited as the defining characteristic of specific learning disorder in that the specific learning disabilities are not part of a more general learning difficulty as manifested in intellectual disability or global developmental delay. Specific learning disorder may also occur in individuals identified as intellectually "gifted." These individuals may be able to sustain apparently adequate academic functioning by using compensatory strategies, extraordinarily high effort, or support, until the learning demands or assessment procedures (e.g., timed tests) pose barriers to their demonstrating their learning or accomplishing required tasks. Second, the learning difficulty cannot be attributed to more general external factors, such as economic or environmental disadvantage, chronic absenteeism, or lack of education as typically provided in the individual's community context. Third, the learning difficulty cannot be attributed to a neurological (e.g., pediatric stroke) or motor disorders or to vision or hearing disorders, which are often associated with problems learning academic skills but are distinguishable by presence of neurological signs.

Finally, the learning difficulty may be restricted to one academic skill or domain (e.g., reading single words, retrieving or calculating number facts).

Comprehensive assessment is required. Specific learning disorder can only be diagnosed after formal education starts but can be diagnosed at any point afterward in children, adolescents, or adults, providing there is evidence of onset during the years of formal schooling (i.e., the developmental period). No single data source is sufficient for a diagnosis of specific learning disorder. Rather, specific learning disorder is a clinical diagnosis based on a synthesis of the individual's medical, developmental, educational, and family history; the history of the learning difficulty, including its previous and current manifestation; the impact of the difficulty on academic, occupational, or social functioning; previous or current school reports; portfolios of work requiring academic skills; curriculum-based assessments; and previous or current scores from individual standardized tests of academic achievement. If an intellectual, sensory, neurological, or motor disorder is suspected, then the clinical assessment for specific learning disorder should also include methods appropriate for these disorders. Thus, comprehensive assessment will involve professionals with expertise in specific learning disorder and psychological/cognitive assessment. Since specific learning disorder typically persists into adulthood, reassessment is rarely necessary, unless indicated by marked changes in the learning difficulties (amelioration or worsening) or requested for specific purposes.

## **Associated Features Supporting Diagnosis**

Specific learning disorder is frequently but not invariably preceded, in preschool years, by delays in attention, language, or motor skills that may persist and co-occur with specific learning disorder. An uneven profile of abilities is common, such as above-average abilities in drawing, design, and other visuospatial abilities, but slow, effortful, and inaccurate reading and poor reading comprehension and written expression. Individuals with specific learning disorder typically (but not invariably) exhibit poor performance on psychological tests of cognitive processing. However, it remains unclear whether these cognitive abnormalities are the cause, correlate, or consequence of the learning difficulties. Also, although cognitive deficits associated with difficulties learning to read words are well documented, those associated with other manifestations of specific learning disorder (e.g., reading comprehension, arithmetic computation, written expression) are underspecified or unknown. Moreover, individuals with similar behavioral symptoms or test scores are found to have a variety of cognitive deficits, and many of these processing deficits are also found in other neurodevelopmental disorders (e.g., attention-deficit/hyperactivity disorder [ADHD], autistic spectrum disorder, communication disorders, developmental coordination disorder). Thus, assessment of cognitive processing deficits is not required for diagnostic assessment. Specific learning disorder is associated with increased risk for suicidal ideation and suicide attempts in children, adolescents, and adults.

There are no known biological markers of specific learning disorder. As a group, individuals with the disorder show circumscribed alterations in cognitive processing and brain structure and function. Genetic differences are also evident at the group level. But cognitive testing, neuroimaging, or genetic testing are not useful for diagnosis at this time.

## **Prevalence**

The prevalence of specific learning disorder across the academic domains of reading, writing, and mathematics is 5%–15% among school-age children across different languages and cultures. Prevalence in adults is unknown but appears to be approximately 4%.

## **Development and Course**

Onset, recognition, and diagnosis of specific learning disorder usually occurs during the elementary school years when children are required to learn to read, spell, write, and learn

mathematics. However, precursors such as language delays or deficits, difficulties in rhyming or counting, or difficulties with fine motor skills required for writing commonly occur in early childhood before the start of formal schooling. Manifestations may be behavioral (e.g., a reluctance to engage in learning; oppositional behavior). Specific learning disorder is lifelong, but the course and clinical expression are variable, in part depending on the interactions among the task demands of the environment, the range and severity of the individual's learning difficulties, the individual's learning abilities, comorbidity, and the available support systems and intervention. Nonetheless, problems with reading fluency and comprehension, spelling, written expression, and numeracy skills in everyday life typically persist into adulthood.

Changes in manifestation of symptoms occur with age, so that an individual may have a persistent or shifting array of learning difficulties across the lifespan.

Examples of symptoms that may be observed among preschool-age children include a lack of interest in playing games with language sounds (e.g., repetition, rhyming), and they may have trouble learning nursery rhymes. Preschool children with specific learning disorder may frequently use baby talk, mispronounce words, and have trouble remembering names of letters, numbers, or days of the week. They may fail to recognize letters in their own names and have trouble learning to count. Kindergarten-age children with specific learning disorder may be unable to recognize and write letters, may be unable to write their own names, or may use invented spelling. They may have trouble breaking down spoken words into syllables (e.g., "cowboy" into "cow" and "boy") and trouble recognizing words that rhyme (e.g., cat, bat, hat). Kindergarten-age children also may have trouble connecting letters with their sounds (e.g., letter b makes the sound /b/) and may be unable to recognize phonemes (e.g., do not know which in a set of words [e.g., dog, man, car] starts with the same sound as "cat").

Specific learning disorder in elementary school-age children typically manifests as marked difficulty learning letter-sound correspondence (particularly in English-speaking children), fluent word decoding, spelling, or math facts; reading aloud is slow, inaccurate, and effortful, and some children struggle to understand the magnitude that a spoken or written number represents. Children in primary grades (grades 1–3) may continue to have problems recognizing and manipulating phonemes, be unable to read common one-syllable words (such as mat or top), and be unable recognize common irregularly spelled words (e.g., said, two). They may commit reading errors that indicate problems in connecting sounds and letters (e.g., "big" for "got") and have difficulty sequencing numbers and letters. Children in grades 1–3 also may have difficulty remembering number facts or arithmetic procedures for adding, subtracting, and so forth, and may complain that reading or arithmetic is hard and avoid doing it. Children with specific learning disorder in the middle grades (grades 4–6) may mispronounce or skip parts of long, multisyllable words (e.g., say "conible" for "convertible," "aminal" for "animal") and confuse words that sound alike (e.g., "tornado" for "volcano"). They may have trouble remembering dates, names, and telephone numbers and may have trouble completing homework or tests on time. Children in the middle grades also may have poor comprehension with or without slow, effortful, and inaccurate reading, and they may have trouble reading small function words (e.g., that, the, an, in). They may have very poor spelling and poor written work. They may get the first part of a word correctly, then guess wildly (e.g., read "clover" as "clock"), and may express fear of reading aloud or refuse to read aloud.

By contrast, adolescents may have mastered word decoding, but reading remains slow and effortful, and they are likely to show marked problems in reading comprehension and written expression (including poor spelling) and poor mastery of math facts or mathematical problem solving. During adolescence and into adulthood, individuals with specific learning disorder may continue to make numerous spelling mistakes and read single words and connected text slowly and with much effort, with trouble pronouncing multi-syllable words. They may frequently need to reread material to understand or get the main point and have trouble making inferences from written text. Adolescents and adults may

avoid activities that demand reading or arithmetic (reading for pleasure, reading instructions). Adults with specific learning disorder have ongoing spelling problems, slow and effortful reading, or problems making important inferences from numerical information in work-related written documents. They may avoid both leisure and work-related activities that demand reading or writing or use alternative approaches to access print (e.g., text-to-speech/speech-to-text software, audiobooks, audiovisual media).

An alternative clinical expression is that of circumscribed learning difficulties that persist across the lifespan, such as an inability to master the basic sense of number (e.g., to know which of a pair of numbers or dots represents the larger magnitude), or lack of proficiency in word identification or spelling. Avoidance of or reluctance to engage in activities requiring academic skills is common in children, adolescents, and adults. Episodes of severe anxiety or anxiety disorders, including somatic complaints or panic attacks, are common across the lifespan and accompany both the circumscribed and the broader expression of learning difficulties.

## Risk and Prognostic Factors

**Environmental.** Prematurity or very low birth weight increases the risk for specific learning disorder, as does prenatal exposure to nicotine.

**Genetic and physiological.** Specific learning disorder appears to aggregate in families, particularly when affecting reading, mathematics, and spelling. The relative risk of specific learning disorder in reading or mathematics is substantially higher (e.g., 4–8 times and 5–10 times higher, respectively) in first-degree relatives of individuals with these learning difficulties compared with those without them. Family history of reading difficulties (dyslexia) and parental literacy skills predict literacy problems or specific learning disorder in offspring, indicating the combined role of genetic and environmental factors.

There is high heritability for both reading ability and reading disability in alphabetic and nonalphabetic languages, including high heritability for most manifestations of learning abilities and disabilities (e.g., heritability estimate values greater than 0.6). Covariation between various manifestations of learning difficulties is high, suggesting that genes related to one presentation are highly correlated with genes related to another manifestation.

**Course modifiers.** Marked problems with inattentive behavior in preschool years is predictive of later difficulties in reading and mathematics (but not necessarily specific learning disorder) and nonresponse to effective academic interventions. Delay or disorders in speech or language, or impaired cognitive processing (e.g., phonological awareness, working memory, rapid serial naming) in preschool years, predicts later specific learning disorder in reading and written expression. Comorbidity with ADHD is predictive of worse mental health outcome than that associated with specific learning disorder without ADHD. Systematic, intensive, individualized instruction, using evidence-based interventions, may improve or ameliorate the learning difficulties in some individuals or promote the use of compensatory strategies in others, thereby mitigating the otherwise poor outcomes.

## Culture-Related Diagnostic Issues

Specific learning disorder occurs across languages, cultures, races, and socioeconomic conditions but may vary in its manifestation according to the nature of the spoken and written symbol systems and cultural and educational practices. For example, the cognitive processing requirements of reading and of working with numbers vary greatly across orthographies. In the English language, the observable hallmark clinical symptom of difficulties learning to read is inaccurate and slow reading of single words; in other alphabetic languages that have more direct mapping between sounds and letters (e.g., Spanish, German) and in non-alphabetic languages (e.g., Chinese, Japanese), the hallmark feature is

slow but accurate reading. In English-language learners, assessment should include consideration of whether the source of reading difficulties is a limited proficiency with English or a specific learning disorder. Risk factors for specific learning disorder in English-language learners include a family history of specific learning disorder or language delay in the native language, as well as learning difficulties in English and failure to catch up with peers. If there is suspicion of cultural or language differences (e.g., as in an English-language learner), the assessment needs to take into account the individual's language proficiency in his or her first or native language as well as in the second language (in this example, English). Also, assessment should consider the linguistic and cultural context in which the individual is living, as well as his or her educational and learning history in the original culture and language.

## **Gender-Related Diagnostic Issues**

Specific learning disorder is more common in males than in females (ratios range from about 2:1 to 3:1) and cannot be attributed to factors such as ascertainment bias, definitional or measurement variation, language, race, or socioeconomic status.

## **Functional Consequences of Specific Learning Disorder**

Specific learning disorder can have negative functional consequences across the lifespan, including lower academic attainment, higher rates of high school dropout, lower rates of postsecondary education, high levels of psychological distress and poorer overall mental health, higher rates of unemployment and under-employment, and lower incomes. School dropout and co-occurring depressive symptoms increase the risk for poor mental health outcomes, including suicidality, whereas high levels of social or emotional support predict better mental health outcomes.

## **Differential Diagnosis**

**Normal variations in academic attainment.** Specific learning disorder is distinguished from normal variations in academic attainment due to external factors (e.g., lack of educational opportunity, consistently poor instruction, learning in a second language), because the learning difficulties persist in the presence of adequate educational opportunity and exposure to the same instruction as the peer group, and competency in the language of instruction, even when it is different from one's primary spoken language.

**Intellectual disability (intellectual developmental disorder).** Specific learning disorder differs from general learning difficulties associated with intellectual disability, because the learning difficulties occur in the presence of normal levels of intellectual functioning (i.e., IQ score of at least  $70 \pm 5$ ). If intellectual disability is present, specific learning disorder can be diagnosed only when the learning difficulties are in excess of those usually associated with the intellectual disability.

**Learning difficulties due to neurological or sensory disorders.** Specific learning disorder is distinguished from learning difficulties due to neurological or sensory disorders (e.g., pediatric stroke, traumatic brain injury, hearing impairment, vision impairment), because in these cases there are abnormal findings on neurological examination.

**Neurocognitive disorders.** Specific learning disorder is distinguished from learning problems associated with neurodegenerative cognitive disorders, because in specific learning disorder the clinical expression of specific learning difficulties occurs during the developmental period, and the difficulties do not manifest as a marked decline from a former state.

**Attention-deficit/hyperactivity disorder.** Specific learning disorder is distinguished from the poor academic performance associated with ADHD, because in the latter condition the problems may not necessarily reflect specific difficulties in learning academic skills but rather may reflect difficulties in performing those skills. However, the co-occurrence of specific learning disorder and ADHD is more frequent than expected by chance. If criteria for both disorders are met, both diagnoses can be given.

**Psychotic disorders.** Specific learning disorder is distinguished from the academic and cognitive-processing difficulties associated with schizophrenia or psychosis, because with these disorders there is a decline (often rapid) in these functional domains.

## Comorbidity

Specific learning disorder commonly co-occurs with neurodevelopmental (e.g., ADHD, communication disorders, developmental coordination disorder, autistic spectrum disorder) or other mental disorders (e.g., anxiety disorders, depressive and bipolar disorders). These comorbidities do not necessarily exclude the diagnosis specific learning disorder but may make testing and differential diagnosis more difficult, because each of the co-occurring disorders independently interferes with the execution of activities of daily living, including learning. Thus, clinical judgment is required to attribute such impairment to learning difficulties. If there is an indication that another diagnosis could account for the difficulties learning keystone academic skills described in Criterion A, specific learning disorder should not be diagnosed.

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# Motor Disorders

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## Developmental Coordination Disorder

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### Diagnostic Criteria

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- A. The acquisition and execution of coordinated motor skills is substantially below that expected given the individual's chronological age and opportunity for skill learning and use. Difficulties are manifested as clumsiness (e.g., dropping or bumping into objects) as well as slowness and inaccuracy of performance of motor skills (e.g., catching an object, using scissors or cutlery, handwriting, riding a bike, or participating in sports).
  - B. The motor skills deficit in Criterion A significantly and persistently interferes with activities of daily living appropriate to chronological age (e.g., self-care and self-maintenance) and impacts academic/school productivity, prevocational and vocational activities, leisure, and play.
  - C. Onset of symptoms is in the early developmental period.
  - D. The motor skills deficits are not better explained by intellectual disability (intellectual developmental disorder) or visual impairment and are not attributable to a neurological condition affecting movement (e.g., cerebral palsy, muscular dystrophy, degenerative disorder).
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### Diagnostic Features

The diagnosis of developmental coordination disorder is made by a clinical synthesis of the history (developmental and medical), physical examination, school or workplace report, and individual assessment using psychometrically sound and culturally appropriate standardized tests. The manifestation of impaired skills requiring motor coordination (Criterion A) varies

with age. Young children may be delayed in achieving motor milestones (i.e., sitting, crawling, walking), although many achieve typical motor milestones. They also may be delayed in developing skills such as negotiating stairs, pedaling, buttoning shirts, completing puzzles, and using zippers. Even when the skill is achieved, movement execution may appear awkward, slow, or less precise than that of peers. Older children and adults may display slow speed or inaccuracy with motor aspects of activities such as assembling puzzles, building models, playing ball games (especially in teams), handwriting, typing, driving, or carrying out self-care skills.

Developmental coordination disorder is diagnosed only if the impairment in motor skills significantly interferes with the performance of, or participation in, daily activities in family, social, school, or community life (Criterion B). Examples of such activities include getting dressed, eating meals with age-appropriate utensils and without mess, engaging in physical games with others, using specific tools in class such as rulers and scissors, and participating in team exercise activities at school. Not only is ability to perform these actions impaired, but also marked slowness in execution is common. Handwriting competence is frequently affected, consequently affecting legibility and/or speed of written output and affecting academic achievement (the impact is distinguished from specific learning difficulty by the emphasis on the motoric component of written output skills). In adults, everyday skills in education and work, especially those in which speed and accuracy are required, are affected by coordination problems.

Criterion C states that the onset of symptoms of developmental coordination disorder must be in the early developmental period. However, developmental coordination disorder is typically not diagnosed before age 5 years because there is considerable variation in the age at acquisition of many motor skills or a lack of stability of measurement in early childhood (e.g., some children catch up) or because other causes of motor delay may not have fully manifested.

Criterion D specifies that the diagnosis of developmental coordination disorder is made if the coordination difficulties are not better explained by visual impairment or attributable to a neurological condition. Thus, visual function examination and neurological examination must be included in the diagnostic evaluation. If intellectual disability (intellectual developmental disorder) is present, the motor difficulties are in excess of those expected for the mental age; however, no IQ cut-off or discrepancy criterion is specified.

Developmental coordination disorder does not have discrete subtypes; however, individuals may be impaired predominantly in gross motor skills or in fine motor skills, including handwriting skills.

Other terms used to describe developmental coordination disorder include *childhood dyspraxia*, *specific developmental disorder of motor function*, and *clumsy child syndrome*.

## Associated Features Supporting Diagnosis

Some children with developmental coordination disorder show additional (usually suppressed) motor activity, such as choreiform movements of unsupported limbs or mirror movements. These "overflow" movements are referred to as *neurodevelopmental immaturities* or *neurological soft signs* rather than neurological abnormalities. In both current literature and clinical practice, their role in diagnosis is still unclear, requiring further evaluation.

## Prevalence

The prevalence of developmental coordination disorder in children ages 5–11 years is 5%–6% (in children age 7 years, 1.8% are diagnosed with severe developmental coordination disorder and 3% with probable developmental coordination disorder). Males are more often affected than females, with a male:female ratio between 2:1 and 7:1.

## Development and Course

The course of developmental coordination disorder is variable but stable at least to 1 year follow-up. Although there may be improvement in the longer term, problems with coor-

dinated movements continue through adolescence in an estimated 50%–70% of children. Onset is in early childhood. Delayed motor milestones may be the first signs, or the disorder is first recognized when the child attempts tasks such as holding a knife and fork, buttoning clothes, or playing ball games. In middle childhood, there are difficulties with motor aspects of assembling puzzles, building models, playing ball, and handwriting, as well as with organizing belongings, when motor sequencing and coordination are required. In early adulthood, there is continuing difficulty in learning new tasks involving complex/automatic motor skills, including driving and using tools. Inability to take notes and handwrite quickly may affect performance in the workplace. Co-occurrence with other disorders (see the section “Comorbidity” for this disorder) has an additional impact on presentation, course, and outcome.

## Risk and Prognostic Factors

**Environmental.** Developmental coordination disorder is more common following prenatal exposure to alcohol and in preterm and low-birth-weight children.

**Genetic and physiological.** Impairments in underlying neurodevelopmental processes—particularly in visual-motor skills, both in visual-motor perception and spatial mentalizing—have been found and affect the ability to make rapid motoric adjustments as the complexity of the required movements increases. Cerebellar dysfunction has been proposed, but the neural basis of developmental coordination disorder remains unclear. Because of the co-occurrence of developmental coordination disorder with attention-deficit/hyperactivity disorder (ADHD), specific learning disabilities, and autism spectrum disorder, shared genetic effect has been proposed. However, consistent co-occurrence in twins appears only in severe cases.

**Course modifiers.** Individuals with ADHD and with developmental coordination disorder demonstrate more impairment than individuals with ADHD without developmental coordination disorder.

## Culture-Related Diagnostic Issues

Developmental coordination disorder occurs across cultures, races, and socioeconomic conditions. By definition, “activities of daily living” implies cultural differences necessitating consideration of the context in which the individual child is living as well as whether he or she has had appropriate opportunities to learn and practice such activities.

## Functional Consequences of Developmental Coordination Disorder

Developmental coordination disorder leads to impaired functional performance in activities of daily living (Criterion B), and the impairment is increased with co-occurring conditions. Consequences of developmental coordination disorder include reduced participation in team play and sports; poor self-esteem and sense of self-worth; emotional or behavior problems; impaired academic achievement; poor physical fitness; and reduced physical activity and obesity.

## Differential Diagnosis

**Motor impairments due to another medical condition.** Problems in coordination may be associated with visual function impairment and specific neurological disorders (e.g., cerebral palsy, progressive lesions of the cerebellum, neuromuscular disorders). In such cases, there are additional findings on neurological examination.

**Intellectual disability (intellectual developmental disorder).** If intellectual disability is present, motor competences may be impaired in accordance with the intellectual disabil-