

Review article

Issues in the diagnosis of attention-deficit/hyperactivity disorder in children

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Abstract

This paper provides a brief overview of the nature of attention-deficit/hyperactivity disorder (ADHD) in children and the current criteria used in its clinical diagnosis. While the disorder continues to be viewed as one of inattention and/or hyperactive-impulsive behavior, theories of ADHD are beginning to focus more on poor inhibition and deficient executive functioning (self-regulation) as being central to the disorder. Problems have been identified by research pertaining to the clinical diagnostic criteria outlined in the DSM-IV that, at present, remain unresolved. Clinicians should be aware of these problems and the adjustments that need to be made to them when dealing with special populations that were not represented in the field trials used to develop these criteria.

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1. Introduction

Diagnostic labels for children presenting with overactive, inattentive, and impulsive behavioral problems have changed numerous times over the last century, yet the actual nature of the disorder has changed little, if at all, from descriptions nearly a century ago [1]. This constellation of behavior problems may constitute one of the most well studied childhood disorders of our time. Yet these children remain an enigma to the public who struggle to accept the notion that the disorder may be a biologically rooted developmental disability when nothing seems physically, outwardly wrong with them. When children possess the above attributes to a degree that is highly deviant for their developmental level and sufficient to create impairments in major life activities, they may be diagnosed as having attention-deficit/hyperactivity disorder, or ADHD [2]. Their problematic behavior is thought to arise early in childhood, often in the preschool years, and to be persistent over development in most cases. This paper provides a brief overview of the nature of this disorder, describes its diagnostic criteria, and discusses some as yet unresolved issues that may need to be addressed in future revisions of the current diagnostic criteria. Given the thousands of scientific papers on ADHD, this paper must, of necessity, represent but a cursory

survey of what is known about the disorder. Greater detail can be found in entire textbooks devoted to the topic [3–5].

Healthy debate is occurring at the moment on the core deficit(s) involved in ADHD. While clinical descriptions have focused on inattentive, impulsive, and overactive behavior, theoretical work gives increasing weight to problems with response inhibition, self-regulation, and the related domain of executive functioning [6–8]. Recent studies suggest that the inattention evident in the disorder may not be a problem with attention to the immediate environment so much as with attention to the future (intentional behavior). This may arise from impaired working memory (holding mental representations actively in mind so as to use them to guide behavior) and not from perceptual, filtering, or selection (input) problems [6]. Debate is also occurring around the place of a subtype of the disorder that is composed primarily of inattention and whether it represents a true subtype of ADHD or a separate and distinct disorder from it (see *Clinical Psychology: Science and Practice*, 2001, Vol. 8(4) for a debate on this issue). Relatively consistent, however, is the opinion that a subset of inattentive children with high levels of cognitive sluggishness and hypoactivity probably represent a qualitatively different disorder of attention (deficient selective attention and sluggish cognitive processing) than is seen in ADHD (poor persistence, inhibition, and resistance to distraction).

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2. Diagnosis

2.1. The core symptoms

Two distinct behavioral dimensions characterize the various behavioral problems (symptoms) seen in ADHD [9,10]. These two dimensions are represented in the DSM-IV diagnostic guidelines for the disorder (see Table 1) [2] that are the standard for diagnosis in the US and increasingly so in other parts of the world. These behavioral dimensions have been identified across various ethnic and cultural groups.

2.1.1. Inattention

Attention is a multidimensional construct [11,12] and thus complaints of inattention are not useful for differential diagnosis without further clarifying the type of attention that is impaired. ADHD seems to involve an inability to sustain

responding to tasks or other activities, to remember and follow through on rules and instructions, and to resist distractions while doing so.

2.1.2. Hyperactive-impulsive behavior (disinhibition)

As with attention, inhibition is a multidimensional construct [13,14] and thus various, qualitatively distinct forms of inhibitory impairments may eventually be found in children. The problems with inhibition seen in ADHD involve voluntary or executive inhibition of prepotent responses rather than impulsiveness that may be more motivationally controlled, as in a heightened sensitivity to available reward (reward seeking) or to excessive fear [8].

As with the inattention seen in the disorder, mounting evidence shows that these inhibitory deficits are not a function of other psychiatric disorders that may overlap with ADHD [15–18]. The problems with inhibition arise first

Table 1
DSM-IV Criteria for ADHD^a

A. Either (1) or (2):

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

Inattention

- (a) often fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities
- (b) often has difficulty sustaining attention in tasks or play activities
- (c) often does not seem to listen when spoken to directly
- (d) often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (not due to oppositional behavior or failure to understand instructions)
- (e) often has difficulty organizing tasks and activities
- (f) often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort such as schoolwork or homework
- (g) often loses things necessary for tasks or activities (e.g. toys, school assignments, pencils, books, or tools)
- (h) is often easily distracted by extraneous stimuli
- (i) is often forgetful in daily activities

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

Hyperactivity

- (a) often fidgets with hands or feet or squirms in seat
- (b) often leaves seat in classroom or in other situations in which remaining seated is expected
- (c) often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness)
- (d) often has difficulty playing or engaging in leisure activities quietly
- (e) is often 'on the go' or often acts as if 'driven by a motor'
- (f) often talks excessively

Impulsivity

- (g) often blurts out answers before the questions have been completed
- (h) often has difficulty awaiting turn
- (i) often interrupts or intrudes on others (e.g. butts into conversations or games)

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

C. Some impairment from the symptoms is present in two or more settings (e.g. at school (or work) and at home).

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

E. The symptoms do not occur exclusively during the course of a Pervasive Developmental Disorder, Schizophrenia, or other Psychotic Disorder and are not better accounted for by another mental disorder (e.g. Mood Disorder, Anxiety Disorder, Dissociative Disorder, or a Personality Disorder).

Code based on type:

314.01 Attention-Deficit/Hyperactivity Disorder, Combined Type: if both Criteria A1 and A2 are met for the past 6 months

314.00 Attention-Deficit/Hyperactivity Disorder, Predominantly Inattentive Type: if Criterion A1 is met but Criterion A2 is not met for the past 6 months

314.01 Attention-Deficit/Hyperactivity Disorder, Predominantly Hyperactive-Impulsive Type: if Criterion A2 is met but Criterion A1 is not met for the past 6 months

^a From American Psychiatric Association [2] (pp. 83–85). Copyright, 1994 by the American Psychiatric Association. Reprinted by permission. Coding note: For individuals (especially adolescents and adults) who currently have symptoms that no longer meet full criteria, 'In Partial Remission' should be specified.

(at age 3–4 years) ahead of those related to inattention (at age 5–7 years), or than the sluggish cognitive tempo that characterizes the predominantly inattentive subtype and that may arise even later in development (ages 8–10) [19–21].

2.2. *Situational and contextual factors*

The symptoms comprising ADHD are greatly affected in their level of severity by a variety of situational and task-related factors. The performance of ADHD children is worse: (1) later in the day than earlier [22]; (2) in greater task complexity such that organizational strategies are required [23]; (3) when restraint is demanded [24]; (4) under low levels of stimulation [25]; (5) under more variable schedules of immediate consequences in the task [26]; (6) under longer delay periods prior to reinforcement availability [27]; and (7) in the absence of adult supervision during task performance [28]. Besides the aforementioned factors, which chiefly apply to task performance, variability has also been documented across more macroscopic settings. For instance, children with ADHD are most problematic in their behavior when persistence in work-related tasks is required (i.e. chores, homework, etc.) or where behavioral restraint is necessary, especially in settings involving public scrutiny (i.e. in church, in restaurants, when a parent is on the phone, etc.) than in free play situations [29]. Although they will be more disruptive when their fathers are at home than during free play, children with ADHD are still rated as much less problematic when the father is at home than in most other contexts. Fluctuations in the severity of ADHD symptoms have also been documented across a variety of school contexts [29]. In this case, contexts involving task-directed persistence and behavioral restraint (classroom) are the most problematic, with significantly fewer problems posed by contexts involving less work and behavioral restraint (i.e. at lunch, in hallways, at recess, etc.), and even fewer problems being posed during special events (i.e. field trips, assemblies, etc.) [30].

2.3. *Associated cognitive deficits*

Children with ADHD often demonstrate deficiencies in many other cognitive abilities. Among these, are difficulties with: (1) physical fitness, gross and fine motor coordination, and motor sequencing [30,31,32]; (2) speed of color naming [33]; (3) verbal and nonverbal working memory and mental computation [16,34]; (5) planning and anticipation [35]; (6) verbal fluency and confrontational communication [36]; (5) effort allocation [37]; (6) developing, applying, and self-monitoring organizational strategies [38]; (7) the internalization of self-directed speech [39]; (8) adhering to restrictive instructions [40]; and (9) self-regulation of emotion [41]. The latter difficulties with emotional control may be especially salient in children having ADHD with comorbid oppositional defiant disorder (ODD) [42]. Several studies have also demonstrated that ADHD may be associated with less mature or diminished moral development [43,44].

These seemingly disparate abilities have been considered to fall within the domain of ‘executive functions’ in the field of neuropsychology [6] or ‘metacognition’ in developmental psychology [44]. All seem to be mediated by the frontal cortex, and particularly the prefrontal lobes [45]. Executive functions have been defined as those neuropsychological processes (self-directed covert actions) that assist with self-regulation [6,46]. Current efforts to construct a theory of ADHD have suggested that the inattention that characterizes the disorder may result from these problems with executive functioning, particularly that component known as working memory [6].

2.4. *Diagnostic criteria and related issues*

The most recent diagnostic criteria for ADHD [2] are set forth in Table 1. These diagnostic criteria are some of the most rigorous and most empirically derived criteria ever available in the history of clinical diagnosis for this disorder. They were derived from a committee of some of the leading experts in the field, a literature review of ADHD, an informal survey of empirically derived rating scales assessing the behavioral dimensions related to ADHD by the committee, and from statistical analyses of the results of a field trial of the items using 380 children from 10 different sites in North America [10]. Despite its empirical basis, the DSM criteria have some problems worth keeping in mind in clinical practice and that are likely to be addressed in subsequent editions:

- As noted earlier, evidence is mounting that the predominantly inattentive type of ADHD (ADHD-PI) may be comprised of a rather heterogeneous mix of children, a subset of whom have a qualitatively different disorder of attention and cognitive processing [21]. This subset manifests a sluggish cognitive style and selective attention deficit, has less comorbidity with oppositional and conduct disorder, demonstrates a more passive style of social relationship, may have memory retrieval problems, and, probably have a different, more benign, developmental course. Clinicians should be aware that this subset exists and understand that what is known about the nature, causes, and management of ADHD may not apply to this subset of children.
- The diagnostic thresholds for the two symptom lists (6 of 9) may not be applicable to age groups outside of those used in the field trial (ages 4–16 years, chiefly). The behavioral items comprising these lists, particularly those for hyperactivity, decline significantly with age [19]. Applying the same threshold across such a declining developmental slope could produce a situation where a larger percentage of young preschool aged-children (ages 2–3 years) would be inappropriately diagnosed as ADHD (false positives), whereas a smaller than expected percentage of adults would meet the criteria (false negatives) [47].

- A related conceptual problem arises from viewing ADHD as a static psychopathology in which the symptoms remain essentially the same regardless of age as opposed to a developmental disorder, meaning a delay in the rate with which a normal trait is developing. In the latter case, disorders are determined by comparison to same-age peers, which the DSM does not do. Available research indicates that ADHD is most likely a dimensional disorder [48] representing the extreme of or delay in a normal trait(s), and so is akin to other developmental disorders, such as mental retardation. It needs to be diagnosed as a developmentally relative deficit, say for instance the 93rd or 98th percentile in severity of symptoms for age.
- The content of the item set may not apply equally well to different ages. The items for inattention may have a wider developmental applicability across school-age ranges of childhood and even into adolescence and young adulthood. Those for hyperactive-impulsive behavior, in contrast, seem much more applicable to young children and less appropriate or not at all to older teens and adults (e.g. climbs on things, cannot play quietly, etc.).
- The symptom cutoff score may need to be adjusted for sex. Male youngsters display more of these items and to a more severe degree than do female youngsters in the general population [49,50]. Given that the majority of children in the DSM field trial were boys [10], the symptom threshold chosen in the DSM is most appropriate to males. This results in girls having to meet a higher threshold under the DSM relative to other girls to be diagnosed as ADHD than do boys relative to other boys.
- The age of onset for ADHD symptoms (7 years) is not justifiable on any historical, empirical, and pragmatic grounds [51]. Qualitative differences are not evident between those who meet the criterion (early onset) and those who do not (late onset). An earlier onset before age 6 years may have more severe and persistent symptoms and more problems with reading and school performance more generally [52] but this reflects a matter of degree and not kind.
- There may need to be a lower bound age group for giving the diagnosis below which no diagnosis should be made. This is important because research on preschool children has shown that a separate dimension of hyperactive-impulsive behavior from aggression or defiant behavior does not seem to emerge until about 3 years of age [49,53]. Below this age, these behaviors cluster together to form what has been called behavioral immaturity, externalizing problems, or an under-controlled pattern of conduct. This implies that the symptoms of ADHD may be difficult to distinguish from other early behavioral disorders until at least 3 years of age, and so this age might serve as a lower bound for diagnostic applications.
- The duration requirement of 6 months may be too short. There is no research for selecting this particular length of time for symptom presence. It is undoubtedly important that the symptoms be relatively persistent if we are to view this disorder as a developmental disability rather than arising purely from context or out of a transient, normal developmental stage. Where problems lasted at least 12 months or beyond age 4 years, the behavior problems may be highly persistent and predictive of continuance into the school-age range – perhaps the duration should set at 12 months or more [54,55].
- The DSM requirement that the symptoms be demonstrated in at least two of three environments so as to establish pervasiveness of symptoms is new to this edition and problematic. The DSM implies that two of three sources of information (parent, teacher, employer) must agree on the presence of the symptoms. This confounds settings with sources of information. The degree of agreement between parents and teacher for any dimension of child behavior is modest, often ranging between 0.30 and 0.50 [56]. This sets an upper limit on the extent to which parents and teachers are going to agree on the severity of ADHD symptoms and, thus, on whether or not the child has the disorder in that setting. Such disagreements among sources certainly reflect differences in the child's behavior as a function of true differential demands of these settings. But they also reflect differences in the attitudes and judgments between different people. Insisting on such agreement may reduce the application of the diagnosis to some children unfairly as a result of such well-established differences between parent and teacher opinions. Evidence that diagnosis based on parents' reports will lead to a diagnosis based on teacher reports 90% of the time [57] is reassuring that parent reports can suffice for diagnostic purposes for now. The best discrimination of ADHD children from other groups might be achieved by blending the reports of parents and teachers such that one counts the number of different symptoms endorsed across *both* sources of information [58,59].
- Finally, the DSM criteria give little guidance to clinicians on the differential diagnosis of the disorder from other psychiatric disorders with which it may often co-exist. As Table 2 illustrates, ADHD is frequently associated with a variety of cognitive, psychiatric, educational, emotional, and social impairments. Some of these arise directly as a consequence of the disorder while others, such as the comorbid psychiatric disorders and learning disabilities, may be associated conditions or arise from other primary disorders that overlap with ADHD at a level greater than expected by chance (population base rates) alone. Clinicians need to be aware of the primary symptoms associated with these other disorders and their core nature in order to carefully differentiate ADHD from them or to document their separate co-existence with the ADHD.

2.5. Conclusion

Many of these problematic issues with current clinical

diagnostic criteria for ADHD are likely to be addressed in future editions of the DSM. Even so, the present criteria are actually some of the best ever advanced for the disorder and

represent a vast improvement over the state of affairs that existed prior to 1980. With some attention to the above issues, the DSM criteria could be made to be even more

Table 2
Summary of impairments likely to be associated with ADHD^a

Cognitive

- Mild deficits in intelligence (approximately 7–10 points)
- Deficient academic achievement skills (range of 10–30 standard score points)
- Learning disabilities: Reading (8–39%), Spelling (12–26%), Math (12–33), and Handwriting (common but unstudied)
- Poor sense of time, inaccurate time estimation and reproduction
- Decreased nonverbal and verbal working memory
- Impaired planning ability
- Reduced sensitivity to errors
- Possible impairment in goal-directed behavioral creativity (??)

Language

- Delayed onset of language (up to 35% but not consistent)
- Speech impairments (10–54%)
- Excessive conversational speech (commonplace), reduced speech to confrontation
- Poor organization and inefficient expression of ideas
- Impaired verbal problem-solving
- Co-existence of central auditory processing disorder (minority but still uncertain)
- Poor rule-governed behavior
- Delayed internalization of speech (>30% delay)
- Diminished development of moral reasoning

Adaptive functioning: 10–30 standard score points behind normal

Motor development

- Delayed motor coordination (up to 52%)
- More neurological ‘soft’ signs related to motor coordination and overflow movements
- Sluggish gross motor movements

Emotion

- Poor self-regulation of emotion
- Greater problems with frustration tolerance
- Under-reactive arousal system

School performance

- Disruptive classroom behavior (commonplace)
- Underperforming in school relative to ability (commonplace)
- Academic tutoring (up to 56%)
- Repeat a grade (30% or more)
- Placed in one or more special education programs (30–40%)
- School suspensions (up to 46%)
- School expulsions (10–20%)
- Failure to graduate from high school (10–35%)

Task performance

- Poor persistence of effort/motivation
- Greater variability in responding
- Decreased performance/productivity under delayed rewards
- Greater problems when delays are imposed within the task and as they increase in duration
- Decline in performance as reinforcement changes from being continuous to intermittent
- Greater disruption when non-contingent consequences occur during the task

Medical/health risks

- Greater proneness to accidental injuries (up to 57%)
 - Difficulties surrounding sleeping (up to 30–60%)
 - Greater driving risks: vehicular crashes and speeding tickets
 - Greater risk of cigarette smoking, nicotine dependence, or abuse
 - Greater risk of alcohol use, dependence, or abuse
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rigorous, valid, and useful. In the mean time, clinicians need to be aware of these problems and consider modifications to the current DSM criteria when dealing with the special populations and situations discussed above.

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