

# Attention-deficit hyperactivity disorder

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## SUMMARY

*Attention-deficit hyperactivity disorder (ADHD) affects between 1.4% and 6% of children. The importance of the role of primary care in the recognition and joint management of this disorder is being increasingly highlighted. Despite a wealth of research, the diagnosis and management of ADHD have attracted a good deal of controversy. In this discussion paper, we focus on the empirical basis for some of the more controversial aspects of ADHD, such as diagnosis (discussing both under- and overdiagnosis), aetiology, outcomes, and the role of psychosocial factors in this disorder. We conclude that, provided the diagnosis of ADHD is made accurately and systematically, there are no good scientific grounds for dismissing the concept of ADHD or for failing to intervene.*

**Keywords:** attention-deficit hyperactivity disorder; diagnosis; management.

## Introduction

ATTENTION-deficit hyperactivity disorder is characterised by early onset, significant inattention, impulsiveness, and overactivity. These features need to be developmentally inappropriate and should be associated with functional impairment. The term 'attention-deficit hyperactivity disorder' (ADHD) is used in the current American Diagnostic Classification system (DSM-IV),<sup>1</sup> whereas 'hyperkinetic disorder' is classified under the ICD-10 classification system.<sup>2</sup> Although these diagnostic definitions of ADHD are more similar than they have been in the past, DSM-IV ADHD remains a more broadly defined category than hyperkinetic disorder, with one view being that the latter is essentially a subgroup of the former.<sup>3</sup> Indeed, reported prevalence rates of childhood ADHD have generally been higher (between 1.4% and 6%), than estimates of hyperkinetic disorder (in boys, between 0.5%<sup>4</sup> and 1.4%<sup>5</sup>). As most (but not all) available research evidence is based on samples of children with ADHD, the term ADHD will be used in this article.

It is clear from research conducted both in the United Kingdom (UK) and the United States (US)<sup>4,6</sup> that ADHD affects boys more frequently than girls and is associated with considerable educational and social disruption for children, as well as significantly increased use of health care resources and costs.<sup>7</sup> Moreover, ADHD frequently persists into adolescence and many symptoms of the disorder continue into adulthood.<sup>6,8</sup> Follow-up studies have also shown that ADHD is subsequently associated with substantially increased rates of difficulties with employment, antisocial behaviour, driving offences, increased rates of criminal activity, as well as substance abuse.<sup>6,9</sup>

Contrary to popular belief, ADHD is not a newly identified condition, but has been recognised for at least a hundred years.<sup>10</sup> During this period there has been intense speculation in the scientific literature about the aetiology and clinical validity of the disorder. In recent years, the validity of using a diagnostic label has been frequently challenged<sup>11</sup> and others have regarded ADHD as being overdiagnosed, inappropriately medicalised, and overtreated.<sup>12</sup> Moreover, despite large randomised controlled trials showing the efficacy of medication,<sup>13-15</sup> there has been escalating media, public, and in some instances medical concern about the increasing readiness to use a controlled, class 1 drug for children. Until recently, these issues have largely remained the concern of the specialist sector.

However, the increased recognition and treatment of ADHD has led to recommendations that primary care services should play a more important role. The American Academy of Pediatrics has produced guidelines that promote a central role for primary care in the diagnosis and management of this disorder.<sup>16</sup> In the UK the National Institute of Clinical Excellence (NICE)<sup>14</sup> and the Scottish Intercollegiate Guidelines Network (SIGN)<sup>15</sup> have both produced detailed guidance on the management of ADHD and

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suggest a role (albeit vaguely defined) for general practice in the identification and management of this disorder. There are also moves towards producing shared care protocols in some areas.<sup>17,18</sup> A recent study has also highlighted the crucial role of the general practitioner (GP) in the recognition of this disorder.<sup>19</sup>

Given this increased interest in the role of primary care in the diagnosis and/or management of this disorder, the aim of this article is to give a brief overview of some key issues regarding the diagnosis, aetiology, and prognosis of ADHD, rather than a guideline or a comprehensive clinical review (several of which are available<sup>20-22</sup>).

## Diagnosis

Primary care professionals have a key role in first recognising ADHD, particularly as children with ADHD are more likely to see their GP. In a recent UK survey, about a half of all children with hyperkinetic disorder had attended their GP in the previous year (for any reason), as opposed to just over one-third (36%) of children without psychiatric disorder.<sup>5</sup> Non-recognition of ADHD by GPs appears to be the main barrier to affected children being referred to secondary care.<sup>19</sup> It is important that GPs are able to distinguish ADHD from childhood 'behaviour problems' (which are very much more common) and specific behavioural disorders (oppositional defiant disorder and conduct disorder, which are at least twice as common as ADHD). It is of note, however, that ADHD commonly occurs with these behavioural disorders, and this subgroup show increased severity of symptoms and a worse prognosis.<sup>6</sup> Specific questions should be asked, not only about symptoms of ADHD, but whether these are manifest in different situations (such as at school and at home). It is important to recognise that children with ADHD do not always manifest symptoms during the consultation. It is currently recommended that a diagnosis of ADHD should only be made after thorough assessment by a child psychiatrist or paediatrician with special expertise.<sup>14</sup> Clinical assessment should involve a diagnostic interview with the child and family. Additional information about the child's behaviour and functioning in different settings should be obtained from other informants before making the diagnosis using an internationally acceptable diagnostic system.

## Assessment

### Screening questionnaires

Screening questionnaires for ADHD (for example, the parent and teacher-rated Conners' scales<sup>23,24</sup>) are widely used in the assessment of ADHD and are useful as an initial screen. The most widely used scales seem to have acceptable sensitivity and specificity and result in a score being generated. If this score is above a certain cut-off point then this suggests that ADHD may be present (much like the use of the Hospital Anxiety and Depression scale for depression). These screening questionnaires may be useful tools for the recognition of ADHD in primary care. However, all questionnaire-based diagnostic assessments have lower specificity rates than clinical interviews, and so should not be the sole method used for clinical assessment. Moreover, individual clinical judgement is needed to assess the level of impair-

ment of functioning and whether or not symptoms are developmentally inappropriate. Teacher-rated scales are often used in the specialist sector to assess the presence of symptoms in school.

### Clinical interviews

A comprehensive assessment of a child's symptoms at home and at school is needed. Careful consideration needs to be made of the possibility of co-morbid psychiatric conditions (for example, conduct disorder, depression, autistic disorder, tics, Tourette's syndrome, specific learning problems such as dyslexia), accompanying medical and developmental conditions (for example, developmental coordination disorder, hearing deficits) and assessment of the different domains of functioning of the child.<sup>25</sup>

### Diagnostic criteria and ADHD subtypes: DSM-IV and ICD-10

As mentioned earlier, there are two different psychiatric diagnostic systems that are in widespread use internationally. The International Classification of Diseases (ICD), which is published by the World Health Organisation and is traditionally favoured in Europe, uses the term 'hyperkinetic disorder'. The Diagnostic and Statistical Manual of Mental Disorders (DSM) (published by the American Psychiatric Association<sup>1</sup>) is used primarily in the United States and defines ADHD. These diagnostic systems are detailed and comprehensive and are regularly revised. The current versions are ICD-10 and DSM-IV.

Diagnostic criteria for ADHD and hyperkinetic disorder are now more similar than they have been in the past when earlier versions of the DSM classificatory system were used. Both criteria include the same core symptoms (overactivity, inattention, and impulsiveness) and require an early onset (before the age of seven years) and impairment of functioning. In contrast with previous DSM classifications, both systems now require the presence of symptoms in more than one setting, which is why teacher as well as parent reports are required.

However, some key differences between ICD-10 and DSM-IV remain. First, the ICD-10 diagnosis of hyperkinetic disorder requires symptoms from each of three groups (overactivity, inattention, and impulsiveness). In contrast, the DSM-IV criteria for ADHD, which are based on results from field trials,<sup>26</sup> involve the subdivision of symptoms into two groups: hyperactive-impulsive and inattentive. ADHD-combined type (most intervention studies have been based on this group) requires symptoms from both of these two symptom groups. Second, (and it is largely this difference that accounts for the varying reports of prevalence rates), DSM-IV allows for the diagnosis of ADHD subtypes. The diagnosis of ADHD-inattentive subtype requires only a certain number of inattentive symptoms, and the category of ADHD-hyperactive-impulsive type requires only a specific number of hyperactivity/impulsiveness symptoms alone.

### 'Overdiagnosis' of ADHD

Good epidemiological studies of ADHD have used highly reliable research diagnostic interviews administered by

trained interviewers, followed by the application of an operationalised diagnostic system. This has been standard practice in psychiatric research.<sup>27</sup> In clinical practice, however, rigorous, systematic assessments accompanied by the use of operationalised diagnostic criteria are unlikely to constitute usual practice. There has been little systematic work examining this. Epidemiological studies in the US<sup>28</sup> suggest that clinical assessment and diagnostic rigour vary considerably from area to area. This has led some commentators to suggest that ADHD may be overdiagnosed in clinical practice, given the results of some,<sup>28</sup> (but not all<sup>29</sup>) US studies, which suggest that some children who are given methylphenidate do not meet diagnostic criteria for ADHD. It could be argued, however, that prevalence figures for diagnoses based on the application of tight diagnostic criteria and the clinical need for stimulant medication cannot be equated (for example, children who are one symptom short of meeting full diagnostic criteria for ADHD but who show severe impairment of functioning). The clinical effect of methylphenidate, whereby it can improve some symptoms, even in those individuals who do not fulfil diagnostic criteria, undoubtedly has an important influence on this. Additionally, socio-cultural influences, such as family and school misperceptions as to what constitutes ADHD, may increase pressure on a clinician to provide medication without accurately diagnosing the disorder. A lack of available resources outside the National Health Service to help children with difficulties (for example, special educational help, family support) could also potentially lead to increased pressure on a clinician to overdiagnose and inappropriately prescribe. However, there is no evidence yet to suggest that overdiagnosis or inappropriate prescribing has become a problem in the UK. In summary, it is important to reiterate that, while some evidence of instances of overprescribing exist (although not in the UK) there is little empirical evidence that the disorder is overdiagnosed.

### *'Underdiagnosis' of ADHD*

Nevertheless, it is also clear from the US studies mentioned above, and the recent UK epidemiological studies, that a substantial number of children who meet full diagnostic criteria for ADHD are not known to services, and recent reports in the UK have been more concerned about underdiagnosis rather than overdiagnosis of ADHD. In the recent survey by the Office of National Statistics,<sup>5</sup> 19% of those who met ICD-10 criteria for hyperkinetic disorder had not consulted with their GP or a specialist in the previous year (for any reason). The recent NICE guidance also highlights under-recognition and undertreatment of this disorder. This situation — that is, the combination of misdiagnosis, over- and underdiagnosis of a disorder — is, however, common to many areas of medicine; for example, asthma and epilepsy. Why could these problems have arisen?

These difficulties may be attributable to the following:

1. Patient and general public factors that may impact on parents, relatives, and teachers. Underdiagnosis may be influenced by factors such as low levels of awareness among the UK population about ADHD (especially as behavioural difficulties in children are common) and

stigma (lay beliefs, such as 'poorly-behaving children represent poor parenting', being referred to child and adolescent mental health services), and fears about the potential use of psychotropic medication in children. The importance of parental factors has recently been highlighted.<sup>19</sup>

2. Service-related issues, such as shortages of child and adolescent psychiatrists or paediatricians with special expertise in the management of ADHD, as well as evidence of many GPs not having training or confidence in managing and identifying the disorder,<sup>30</sup> are likely to be important.
3. Health professionals may harbour misgivings about diagnosing and managing this condition. There is some empirical evidence for this assertion. The media is an important source of information about ADHD for primary care professionals,<sup>30,31</sup> and discredited theories, such as poor parenting, are still quoted as being primary aetiological factors for ADHD by the media. There have also been highly publicised concerns about inappropriate prescribing and overprescribing of psychotropic medication in young children.<sup>32</sup> In addition, some have suggested that when methylphenidate (Ritalin, Equasym, Concerta) is used symptomatically (for example, during school hours) this indicates that the use of medication must be inappropriate. Interestingly, however, this is normal practice throughout much of clinical medicine to improve functioning in a specific context (e.g. Desmopressin spray for nocturnal enuresis, use of analgesia).
4. The features of ADHD are not qualitatively different from 'normal' (unlike, for example, the presence of hallucinations or myoclonic jerks) and thus there may be difficulty in distinguishing normal development from 'problems' or disorder.

### *Is ADHD a real disorder?*

The question of whether or not ADHD is a 'real disorder' is a recurring one and may seem difficult to answer, given the lack of specific, objectively measured clinical signs or diagnostic tests. It could be argued, therefore, that the diagnostic criteria for ADHD, although derived from empirical findings, do not necessarily define a 'real disorder'. However, this is not a problem specific to ADHD, or indeed psychiatry. Migraine, where no such signs or diagnostic tests exist, is considered a 'disorder' that warrants medical help and is defined purely on the basis of a cluster of reported symptoms. There is also clear evidence that children who meet diagnostic criteria for ADHD show a distinct pattern of clinical, biological, and neuropsychological correlates (compared with controls and those with behaviour disorders<sup>4</sup>), show impaired functioning, and are at increased risk of adverse outcomes. There is also clear evidence from well-designed randomised controlled trials that intervention alleviates symptoms, at least in the short term<sup>14,15</sup> (although there is no evidence yet to suggest long-term benefits).

Some have argued that it is more helpful to view ADHD as a trait that is continuously distributed in the general population, given the body of evidence that ADHD symptoms behave as a dimensional attribute in terms of aetiology and

risk effects,<sup>33,34</sup> with higher levels of ADHD symptoms being associated with more risk of adverse outcomes and impaired functioning. However, this view is still compatible with the concept of ADHD as a diagnostic category that is qualitatively different from normal functioning. Furthermore, even for measured traits that are more traditionally considered as warranting medical attention, such as depression and hypertension, there is considerable controversy as to what constitutes normality and the level at which we should intervene. These cut-off values change over time, depending on available evidence<sup>35</sup> and there is no reason to assume that the diagnostic boundaries for ADHD will necessarily remain fixed when new research (either from genetic or epidemiological studies) emerges. Additionally, categorical definitions are useful in medicine, given that many clinical decisions that have to be made are also categorical — for example, to intervene or not intervene, to offer medication or not. The question of what intervention is most effective at these different cut-off points is of course another issue.

### Aetiology

The precise aetiology of ADHD is still unknown. However, increasing evidence of the importance of neurobiological influences on the disorder are now emerging from genetic, neuroimaging, and other biological studies.

1. Attention-deficit hyperactivity disorder is one of the most strongly genetically influenced common childhood mental health disorders. The genetic basis of ADHD has been established by a plethora of studies, including twin studies, family, and adoption studies.<sup>33</sup> There is consistent evidence that ADHD is highly heritable and that it is a complex multifactorial disorder. Specific gene variants associated with ADHD have been identified and different research groups worldwide have replicated findings for gene variants involved in dopamine neurotransmission (specifically the dopamine receptor DRD4 gene, dopamine transporter gene and dopamine receptor DRD5 gene<sup>33</sup>). Thus, the genetic aetiology of this disorder is much better established than for many other conditions.
2. Evidence of brain dysfunction in individuals with ADHD has been found in cerebral imaging studies, including functional magnetic resonance imaging (fMRI), positron emission tomography (PET), and single photon computed emission tomography (SPECT) studies.<sup>36,37</sup> Again, many of these studies have suggested involvement of the prefrontal cortex and basal ganglia, but it is clear that the neurobiological basis of ADHD is complex, with involvement of many pathways. It is striking that a recent well-designed controlled study published in the *Journal of the American Medical Association* reported clear evidence that children with ADHD had decreased grey and white matter volume and significantly smaller cerebellum volumes, compared with control children.<sup>38</sup>
3. Good quality randomised controlled trials (The MTA trial<sup>13</sup> is the largest and most rigorously designed to date) have found that pharmacological treatment (primarily stimulant medication) is clearly superior in effectiveness in the short term to intensive non-pharmacological interventions.

The mode of action by which stimulant medication is thought to act (dopamine transporter blockade as shown in imaging studies, leading to increased levels of extracellular dopamine), is compatible with the hypothesis that dopamine pathways are involved.<sup>39</sup> Although further work is needed to clarify mechanisms of drug action and disease aetiology, this again supports the view that specific biological mechanisms are involved in the aetiology of ADHD.

4. Neuropsychological functioning — again, there have been many studies showing that children with ADHD show specific and global deficits which distinguish children with ADHD from not only unaffected children but children with behaviour problems.<sup>4,37</sup>

### *Are psychosocial and other environmental factors unimportant?*

It has been suggested that psychosocial and other environmental factors must play a crucial role in the aetiology of ADHD, given the increasing prevalence of the disorder and differences in prevalence between countries. However, where standard diagnostic tools have been used, there has been no compelling evidence to suggest that the condition is becoming markedly more prevalent.<sup>4,5</sup> Similarly, ADHD is recognised in non-Western cultures, although there has been too little research to judge whether or not there are marked differences between developed and developing countries in the prevalence of ADHD.<sup>6,40</sup> It has been suggested that increased recognition, rather than increased prevalence, is the reason for increases in the numbers of diagnosed cases of ADHD and medication use.<sup>41</sup> However, there is only limited research information available at the present time.

Nevertheless, it is plausible that rates of ADHD might be affected by socio-cultural factors. However, this does not necessarily support the conclusion that ADHD is a social phenomenon and is therefore not a disorder that warrants intervention. The rates of many common medical conditions are increasing, such as hypertension and cancer, and some (for example, hypertension and heart disease) are known to be affected by socio-cultural factors, such as diet. Clearly, it is the case for many disorders where genetic neurobiological factors play a major role in the aetiology, that change at a population level must be influenced by socio-cultural or other environmental factors, rather than a sudden change in genes.<sup>42</sup> Environmental factors may also play an important role in mediating and moderating the effects of genes.

What evidence is there that specific environmental factors are associated with ADHD? Families of children with ADHD do show increased psychosocial adversity, but some factors — for example, the mother-child relationship<sup>43</sup> — appear to influence outcome rather than onset. What evidence is available also suggests that some of this environmental adversity is secondary to the child's symptoms. For example, in a study where ADHD children were treated with stimulant medication, parents of these children showed less controlling parenting and improved parent-child relationships.<sup>44</sup> Similarly, prenatal maternal smoking, alcohol, and drugs appear to be associated with ADHD but there is no clear evidence yet that these are causative.<sup>6</sup> Dietary factors have

also been proposed as playing an important role in ADHD. Although this may contribute to symptoms in a small selected group,<sup>45</sup> and this should be noted by GPs, there is no reliable evidence at the current time that this a major factor.

### Prognosis and outcome

There is evidence that, although symptoms often markedly attenuate by the time of puberty, most children with ADHD will have some symptoms that persist into adulthood.<sup>46</sup> This has been recognised for many years but, as yet, there is still a paucity of validated instruments to diagnose 'adult ADHD'. More research to determine the long-term prognosis of children with ADHD, and in particular to determine which subgroups of children with ADHD are at particular risk of persistence, is needed. So far, it is known that children with both ADHD and conduct disorder seem to show a worse prognosis than children with either disorder alone.<sup>6</sup> It is also important to examine the prognosis and prognostic factors for children on the 'fringes' of the diagnosis, and investigate what interventions are effective for this group. This group may be more important for primary health care professionals, given that those without a clear-cut diagnosis are less likely to be under the care of the specialist sector. Finally, although there is evidence of the short-term efficacy of medication, uncertainty remains about the long-term benefits. It is equally clear, though, that untreated ADHD in the short and long term is associated with a range of adverse outcomes. There are thus potentially major implications of failing to recognise ADHD and of not intervening.

### Conclusion and implications for primary care

In this paper we have focused on the diagnosis, aetiology, and prognosis of ADHD. We have discussed some of the areas of current controversy. ADHD is likely to become increasingly important for primary care, given the increasing recognition of this disorder, increased parental expectations, the limited availability of specialist services, and the need for medication in the management of this disorder. The main role of primary care at the present time is likely to be in identification and referral, in follow-up (for example, with shared care protocols) and in information provision to families who have children with this disorder. Primary care may be an especially important bridge when these children enter adulthood, given the persistence of symptoms and increasing recognition of adult ADHD. Children who do not fulfil diagnostic criteria, i.e. children on the fringes of diagnosis, may also need monitoring by primary care (as for 'borderline' elevated blood pressure readings), with health visitors playing a central role to ensure that appropriate help can be offered if their symptoms and functioning worsen or if management guidelines change. The resource implications for this role of primary care have been discussed in a previous paper<sup>47</sup> and need to be made explicit. Finally, although there has been much interest in and guidance on the treatment of ADHD, the evidence base here is relatively good. What is crucial is that the condition is first recognised and then accurately diagnosed. In other areas of medicine (for example, epilepsy), there has been much concern about inappropriate diagnosis and subsequent problems ensuing from labelling and treatment. These issues are clearly relevant for ADHD.

Although at the present time there is more evidence to suggest that under-, rather than overdiagnosis, is a problem in the UK, this may change with time. We argue, however, that provided a diagnosis is made accurately and carefully, GPs need to recognise that there are no good scientific grounds for dismissing the concept of ADHD or for failing to intervene.

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