The Need for Rigorous Training in ADHD Identification

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Abstract

The diagnostic process of childhood ADHD heavily relies upon reports from knowledgeable informants such as parents and teachers. These reports equip clinicians with valuable insight about patients' behaviors in various contexts, but these informants often lack formal training in ADHD identification, potentially affecting the accuracy of the diagnosis. Misdiagnosis of ADHD not only burdens society and the healthcare system, but also risks the current and future health of misdiagnosed patients. This review illustrates the need for more comprehensive training in ADHD identification, and offers suggestions for future research in this domain.

Introduction

Attention Deficit/Hyperactivity Disorder, or ADHD, is a neurobiological disorder characterized by the maladaptive presence of inattention, impulsivity and hyperactivity. Since its official classification in 1968, ADHD has become the world's most commonly diagnosed psychiatric disorder among children (Sayal et al., 2018).

The notable increase in ADHD diagnoses in the U.S. is believed to be due to a combination of factors, including the recent recognition of ADHD in nationwide education laws regarding children with disabilities, updated methods of ADHD diagnosis, and a significant growth in public awareness of the disorder (Danielson et al., 2018; Moldavsky & Sayal, 2013; Visser et al., 2014).

Due to the subjective nature of the diagnostic process, misconceptions about ADHD among knowledgeable informants (KIs) — such as parents and teachers — have likely led to a high rate of ADHD misdiagnosis, and consequently, insufficient or improper medical treatment (Cuffe et al., 2020). Misdiagnosis not only costs families and taxpayers hundreds of millions of dollars per year, but also results in unnecessary alterations of previously healthy brain chemistry, and may exacerbate comorbidities in misdiagnosed children (Elder, 2010; Manos et al., 2017; Stevens et al., 2013).

Providing KIs with comprehensive educational resources about ADHD, including how to avoid common misconceptions, will reduce the negative impact of ADHD misdiagnosis.

Background

Approximately 11% of children in the United States are currently diagnosed with ADHD (Sayal et al., 2018). Data collected by the U.S. National Survey of Children's Health in 2014 showed that the prevalence rate of ADHD in children ages 2-17 in the United States increased by 43% between the years 2003 and 2011, and has continued to increase since (Sayal et al., 2018; Visser et al., 2014).

Scientists agree that ADHD is caused by imbalances of the neurotransmitters dopamine (responsible for working memory and learning) and norepinephrine (responsible for alertness and attention) (Mehta et al., 2019). Brain scans of children with ADHD also show deficits in the development of the prefrontal and temporal cortices — the areas of the brain that are responsible for decision-making and impulse control — as well as rapid development in the basal ganglia of the motor cortex — responsible for body movement. (Rubia et al., 2014).

Though it is one of the most common psychiatric disorders, experts remain unsure of the exact biological mechanisms that lead to ADHD. Researchers have proposed many possible risk factors, including such diverse causes as toxin or drug exposure in utero, premature birth, or brain injury (Powell & Voeller, 2004).

Pointing to a potential genetic mechanism, neuroscientists recognize that ADHD is highly heritable: "Parents with ADHD have a better than 50% chance of having a child with ADHD, and about 25% of children with ADHD have parents who meet the formal diagnostic criteria for ADHD," (Danielson et al., 2018).

The search for a mechanism is further complicated by cases of incorrectly identified symptoms. Symptoms of ADHD may overlap with typical childhood behavior, and the classification of healthy children as ADHD-positive would obscure true heritability or biomarker rates (Khoury et al., 2013; Paris et al., 2015).

Symptoms

The primary symptoms of ADHD, as defined by the latest edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) are *inattention*, difficulty maintaining focus even when effortful attempts are made to do so; *impulsivity,* an inability to control urges; and *hyperactivity,* an abnormal urge to engage in physically active behaviors. Symptom severity is measured based on four criteria (American Psychiatric Association, 2013, p. 59):

(1) a persistent pattern of inattention for at least six months,

(2) display of symptoms in two or more contexts,

(3) whether behaviors are considered "inappropriate" based on developmental stage, and

(4) whether the symptoms interfere with and/or impair daily life.

Though these criteria are widely accepted in the psychiatric community, many of these terms are open to interpretation.

Knowledgeable informants who lack an understanding of ADHD may attribute certain behaviors to the presence of ADHD, when in reality, the behaviors are indicative of relative maturity level and do not require intervention. Conversely, actual symptoms of ADHD may be wrongly identified by KIs as poor behavior or as indicators of a different disorder (Ford-Jones, 2015). KIs must recognize that ADHD cases do not all present identically, and that the presence of certain individual symptoms may be sufficient for diagnosis (Danielson et al., 2018; Rowland et al., 2008).

ADHD Subtype Diagnosis

ADHD generally presents as one of three distinct subtypes. Brain scans of ADHD patients indicate that "different subtypes are associated with different etiological bases and neural networks," (Chang et al., 2020). Each presentation is characterized by the excessive presence of certain symptoms:

Hyperactive-Impulsive ADHD (ADHD-HI) is characterized by particularly severe symptoms of hyperactivity and impulsivity. Children with ADHD-HI engage in constant movement and have difficulty acting in socially appropriate ways. Impulsivity — particularly the presentation of incessant talking and interrupting — is strongly characteristic of ADHD-HI (American Psychiatric Association, 2013, p. 61; Rucklidge, 2008).

Primarily Inattentive ADHD (ADHD-PI), is distinguished by persistent inattention, manifesting as careless oversights and poor memory of details. Inattention is not as easily observable as other ADHD symptoms, so ADHD-PI oftens remains unnoticed (American Psychiatric Association, 2013, p. 60; Quinn & Madhoo, 2014; Rucklidge, 2008).

The combined presence of both ADHD-HI and ADHD-PI symptoms is diagnosed as *Combined ADHD*, or ADHD-C. To receive a diagnosis of ADHD-C, children must exhibit at least five manifestations of both inattention and hyperactivity (American Psychiatric Association, 2013, p. 61; Epstein & Loren, 2013).

ADHD subtype prevalence varies between different countries and cultures. In a 2012 American study, ADHD-PI was the most common subtype among American children (Willcutt, 2012). These results are similar to those of a 2017 Chinese study, which found the same relative prevalence in a population of Chinese children (Wang et al., 2017). In contrast, a 2016 Spanish study of ADHD-diagnosed children found that ADHD-HI affected most participants (Canals et al., 2018).

Unlike many other disorders, there is no official evidence-based diagnostic assessment for ADHD (American Psychiatric Association, 2013, p. 61). Instead, the process heavily relies on family history and information from KIs.

In a typical case, knowledgeable informants report to a medical practitioner regarding their observations of a child's behaviors. Though the DSM-V states that "confirmation of substantial symptoms across settings typically cannot be done accurately without consulting informants who have seen the individual in those settings," in clinical practice, it is common for KI reports to contain subjective information about symptom observations, which may mislead

practitioners and affect the accuracy of the diagnosis (American Psychiatric Association, 2013, p. 61; Voigt et al., 2007). A 2014 study showed that only half of ADHD-diagnosed children had been evaluated by practitioners based on actual evidence and standardized scales, rather than reports from KIs alone (Epstein et al., 2014). This suggests that the other 50% of practitioners made an official diagnosis based solely on KI reports.

Researchers in a 2020 Saudi Arabian study collected data from medical students before and after they completed their medical school psychiatric rotations. Medical students who participated in the study self-reported that after completion of the psychiatric rotation, they had more knowledge of ADHD and were also less likely to make an ADHD diagnosis without thorough objective examination (Alsuhaibani et al., 2020). The study demonstrates that those without medical education may have inadequate knowledge of ADHD, and that education about the disorder results in more accurate and objective ADHD identification.

Factors Driving Prevalence Rates

ADHD is comorbid with many other psychiatric conditions, including dyslexia, depression, conduct disorder, bipolar disorder, obsessive-compulsive disorder, anxiety, and mood disorders (Canals et al., 2018; Cuffe et al., 2020). These co-occurring conditions may mask or exacerbate ADHD-associated behaviors, contributing to the risk of misdiagnosis (Cuffe et al., 2020; Hechtman, 2016).

Though neurobiological differences between male and female ADHD patients are minimal, ADHD symptom identification and diagnosis strongly covaries with gender (Gómez-Benito et al., 2019). Boys usually present with hyperactivity and impulsivity —

symptoms of ADHD-HI — and are diagnosed at around seven years old. In contrast, girls tend to exhibit inattentiveness — a primary symptom of ADHD-PI — and are most commonly diagnosed at around 12 years of age. Boys are diagnosed with ADHD approximately ten times more frequently than girls (Stevens et al., 2013).

ADHD in girls is often overlooked or improperly identified because girls more commonly present with *internalizing* rather than *externalizing* symptoms of ADHD (eg., inattentiveness) which are less apparent to knowledgeable informants. Girls with ADHD also more frequently have coexisting conditions (such as depression or anxiety) that may mask ADHD symptoms (Quinn & Madhoo, 2014).

Prevalence rates of ADHD also vary between socioeconomic classes. Children in lower-income socioeconomic groups more commonly display ADHD symptoms than children in higher-income groups, but are less frequently diagnosed or treated (Bax et al., 2019; Russell et al., 2015).

Statistically, caucasian male children with medical insurance have higher odds of receiving treatment for ADHD symptoms than children of other ethnicities, genders, and socioeconomic groups (Bax et al., 2019). As with many other diseases and disorders in countries with private healthcare, economic and educational barriers often result in a lack of referral for necessary medical treatment (Bax et al., 2019; Gennatas et al., 2017; Russell et al., 2015).

Treatment

Approximately 70% of ADHD-diagnosed children are prescribed psychostimulant medication, which increases general dopamine and norepinephrine levels (Danielson et al., 2018;

Stevens et al., 2013). Higher levels of dopamine and norepinephrine in the brain lead to both increased working memory and concentration as well as decreased hyperactive urges. Though such medication is highly effective at treating ADHD symptoms, research has shown that only in combination with psychotherapy is medication most effective (Stevens et al., 2013).

Despite the established effectiveness of medication combined with talk-therapy, in a 2014 study of 1594 ADHD-diagnosed children across 50 medical practices, 92% were prescribed psychostimulant treatment, but only 13% of those with prescriptions were also receiving talk-therapy (Epstein et al., 2014). This shows that treatment plans are often not maximized to provide the most effective treatment, nor are they monitored very closely by practitioners. The lack of face-to-face interaction between children and their doctors allows for cases of misdiagnosis to continue to go unnoticed.

Long-term Patient Outcomes

People with residual impairing symptoms of ADHD in adulthood often continue to display behaviors such as disorganization, difficulty paying attention to details, and incessant talking. A remission of symptoms is also possible. The treatment of symptoms during childhood and the presence of comorbid mood and anxiety disorders may greatly impact whether a patient undergoes remission, and how severe the remissive symptoms may be (Cherkasova et al., 2013).

Adults with lifelong ADHD who did not receive treatment during childhood are at a higher risk for developing psychiatric comorbidities (such as anxiety and depression) if their symptoms remain untreated (Cuffe et al., 2020). Adults who had received comprehensive

treatment as children, or who had not exhibited symptoms of ADHD as children, tend to be less likely to develop such comorbidities (Cuffe et al., 2020; Sobanski, 2006).

Conversely, treating misdiagnosed children who do *not* actually have ADHD can result in dire consequences. Longitudinal studies show that extended use of unnecessary stimulant medication can result in not only developmental delays, but also in the exacerbation or development of other permanent psychological conditions such as anxiety, depression, substance abuse disorders, and adult-onset schizophrenia. These risks can be reduced by promoting more accuracy in diagnostic procedure (Cuffe et al., 2020; Dalsgaard et al., 2014; Lakhan & Kirchgessner, 2012; Stevens et al., 2013).

Discussion

Research indicates KIs are often not adequately trained in ADHD symptom identification, and misconceptions and negative attitudes often contribute to the frequency with which KIs wrongfully attribute certain typical behaviors to the presence of ADHD (Hossennia et al., 2020).

Teachers, who frequently function as KIs, are often quick to attribute hyperactivity to ADHD due to the disruptiveness of this behavior (Moldavsky & Sayal, 2013). Some may even exaggerate the severity of symptoms in their KI reports to ensure that a disruptive child is diagnosed and medicated (Hossennia et al., 2020; Moldavsky & Sayal, 2013). This is particularly alarming considering the importance of unbiased observations in the diagnostic process.

Negative attitudes about ADHD-associated behaviors are especially problematic in contexts where children are required to suppress their hyperactive urges, considering that

hyperactive behaviors in ADHD-diagnosed children could be an attempt to combat inattention (Ford-Jones, 2015; Hartanto et al., 2016; Hossennia et al., 2020; Moldavsky & Sayal, 2013).

One 2016 study found that ADHD-diagnosed children exhibited higher levels of cognitive control when engaging in hyperactive behaviors than when they suppressed their hyperactive urges (Hartanto et al., 2016). If hyperactive behaviors are involuntary coping strategies to improve attentiveness, then requiring ADHD students to suppress hyperactive urges in classrooms could contribute to poor academic performance (Hartanto et al., 2016; Sayal et al., 2018). It would also be possible, then, that allowing these children to engage in hyperactive behaviors during class could mitigate the effects of inattention, reducing the need for prescription stimulant medication.

Further, because psychostimulant medication *does* effectively improve attention and reduce hyperactivity even in children without the disorder, unnecessary prescription medication may be misinterpreted as successful, perpetuating the use of treatment for an incorrect diagnosis (Lakhan & Kirchgessner, 2012; Stevens et al., 2013).

Studies have tied earlier intervention, particularly prescription of stimulants, to lower rates of depression and suicide in adults with lifelong ADHD (Cuffe et al., 2020; Sobanski, 2006). This motivates practitioners to more readily diagnose ADHD and prescribe medication to young children in order to lower the likelihood of mental illness occurring later in life. The most important factor in the success of stimulant medication as a preventative measure, however, is that the ADHD diagnosis is truly accurate. In cases of ADHD misdiagnosis, practitioners may actually seed new mental illnesses in their patients (e.g., anxiety, substance abuse, psychosis, schizophrenia) rather than prevent them from developing in the future.

The use of prescription ADHD medication is far less common among certain ethnic and socioeconomic groups in the U.S. — specifically, non-White Hispanic children in low-income communities display ADHD symptoms more commonly than other ethnic and socioeconomic groups, but have the lowest rate of receiving official ADHD diagnoses and treatment (Bax et al., 2019; Russell et al., 2015). While some studies suggest this may be due to economic barriers to healthcare (Reyes et al., 2013), other studies have proposed that this may be due to cultural attitudes regarding the use of medication to treat mental health conditions (Hinojosa et al., 2020; Moldavsky & Sayal, 2013). These theories point to cultural values influencing the decision to pursue ADHD treatment, rather than socioeconomic factors preventing access to it.

Language barriers may also contribute to the difficulty in correct ADHD identification: Children who do not yet fully understand the language in which they are being taught may display inattention due to issues with language comprehension, rather than issues with maintaining focus (Araujo et al., 2017; Gómez-Benito et al., 2019). Behaviors due to boredom, such as inattention and hyperactivity, may be confused with ADHD behaviors, when in reality, these behaviors result from language barriers.

Regarding the influence of culture on ADHD, it is important to note that a 2012 American study of subtype prevalence yielded similar results to a 2017 Chinese study, even though the American study measured using DSM-IV criteria, and the Chinese study used DSM-V criteria. The fact that the results of these studies were similar, even among vastly culturally different populations, could potentially demonstrate the presence of underlying neurobiological causes of ADHD. This is challenged, however, by the fact that the same 2017 Chinese study yielded different results than a 2016 Spanish study, both using the same DSM-V

criteria. These results point to cultural differences having an effect on ADHD, or, if ADHD truly is primarily caused by biological factors, then these comparisons illustrate the impact of subjectivity during ADHD diagnosis (Canals et al., 2018; Wang et al., 2017; Willcutt, 2012).

It has been argued that the gender disparity in ADHD prevalence can be attributed to neurobiological differences that predispose boys to ADHD, rather than being due to errors in KI reports (Slobodin & Davidovitch, 2019). In reality, there is no evidence that neurobiological differences between genders cause ADHD more in boys than in girls (Gómez-Benito et al., 2019). Twin studies (Greven et al., 2018) show no evidence of ADHD predisposition in boys, indicating that the gender disparity is likely a result of subjectivity in symptom identification, rather than underlying biological mechanisms.

Several studies have shown that brain development occurs earlier in girls than boys, indicating that if gender differences in ADHD were simply due to neurobiology (eg., rates of brain development), then the average ages of symptom onset and diagnosis would likely be younger for girls than for boys rather than the other way around (Gennatas et al., 2017; Slobodin & Davidovitch, 2019).

Brain scans show that in girls with ADHD-PI, there is delayed maturation in the occipital lobe (Chang et al., 2020), illustrating that neurobiology may affect ADHD *presentation* between genders, but there is no evidence that it affects *predisposition*.

Beyond neurobiology, researchers recognize that certain deficits in neurotransmitters are consistent in those with ADHD (American Psychiatric Association, 2013, p. 59). While researchers have established that neuro*biology* is an unreliable measure of ADHD (Mapou,

2019), there is no consensus of whether neuro*chemistry* could be a potential evidence-based indicator of the disorder (Mehta et al., 2019).

Future research should examine whether neurochemistry could be a consistently valid indicator of ADHD. A reliable evidence-based assessment could reduce the need for practitioners to base ADHD diagnoses upon subjective reports from KIs.

Studies should also compare cultural attitudes regarding mental health to the frequency with which those particular cultural groups receive mental health treatment. These results could potentially rule out economic or language barriers as the cause of lower rates of ADHD diagnosis and treatment.

There is additional merit to exploring whether gender disparities are reduced when KIs are more informed about the different subtype presentations of ADHD. If misconceptions about ADHD symptom identification are reduced, and misdiagnosis becomes less common, then ADHD may actually be less prevalent than data has shown.

The current ADHD diagnostic process heavily relies upon firsthand knowledge, which provides insight into behaviors in various contexts, but also carries serious risks: KIs are often the primary drivers behind positive diagnoses, and they do not necessarily have the medical training or correct incentives to make informed and unbiased reports of their observations. By improving KIs' understanding of ADHD, we can reduce the rate of misdiagnosis, and improve the rigor of scientific data that we retrieve from ADHD studies.

Abbreviations

ADHD Attention-Deficit/Hyperactivity Disorder

[ADHD]-HI	Hyperactive-Impulsive Subtype of Attention-Deficit/Hyperactivity Disorder
[ADHD]-PI	Primarily-Inattentive Subtype of Attention-Deficit/Hyperactivity Disorder
[ADHD]-C	Combined Subtype of Attention-Deficit/Hyperactivity Disorder
DSM-V	Fifth Edition of the Diagnostic and Statistical Manual of Mental Disorders
KI	Knowledgeable informant

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