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# Retrospective Analysis of ADHD Diagnoses in an Outpatient Pediatric Clinic

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## Abstract

Accurate diagnosis of Attention Deficit/Hyperactivity Disorder is an important clinical event in the life of a child and their family, and is often made by the family's primary care provider or pediatrician. As such, it is imperative that these practitioners continue to critically evaluate and improve the diagnostic methods used to diagnose children presenting for an evaluation of ADHD symptoms. We evaluated the clinical records of children presenting to a pediatric office for evaluation to determine if they have ADHD. We found that all of the children presenting for evaluation were diagnosed as having some form of ADHD and stimulant medication treatments were recommended for all, even though a third of the children were found to have less than 1% probability of having ADHD based upon symptom information documented in the medical record. We discuss methods to improve diagnostic accuracy using an objective combination of clinical information from multiple sources.

**Key Words:** ADHD; misdiagnosis; assessment.

## Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a common and debilitating condition that is associated with patterns of inattentive, impulsive, and hyperactive behaviors (American Psychiatric Association [APA], 1994). Estimates of the prevalence of this disorder range from 5% to 15% of the school-age population (APA, 1994; Barkley, 1990; Rie, 1975). Similar to most psychiatric disorders, the diagnosis of ADHD relies on subjective criteria. Unlike a neurological condition such as stroke, in which examination and neuroimaging provide clear, objective criteria in diagnosis, ADHD lacks the "hard evidence" that aids in evaluation and treatment.

This difficulty in clinical diagnosis is reflected in the frequent shifts in the diagnostic criteria for ADHD (APA, 1980, 1987, 1994). The DSM-IV diagnostic criteria for ADHD include "a persistent

pattern of inattention and/or hyperactivity-impulsivity that is more frequent and severe than is typically observed in individuals in a comparable level of development (APA, 1994)." Evidence of six of nine inattentive behaviors and/or six of nine hyperactive-impulsive behaviors must have been present before age seven, and the symptoms must clearly interfere with social, academic, and/or occupational functioning (APA, 1994).

Additional factors complicate the diagnosis of ADHD, including the high prevalence of co-morbid psychological disorders with ADHD (Barkley, 2005), and the fact that other psychiatric disorders of childhood, such as Conduct Disorder, Oppositional Defiant Disorder, and Asperger's Syndrome share similar symptoms with ADHD, such as risk taking, disorderly or impulsive behavior, and social awkwardness. The lack of formal diagnostic criteria for older children and adults (Kube, Petersen, & Palmer, 2002; Nahlik, 2004) is an additional complication in diagnosing ADHD. Consequently, ADHD presents special problems for primary care and family practice physicians who are expected to accurately and quickly diagnose this disorder. Many physicians may feel largely unprepared to make such a diagnosis (Shaw, Wagner, Eastwood, & Mitchel, 2003).

Accurate diagnosis of ADHD is important for several reasons, including the negative psychosocial consequences of ADHD, and the possible dangers of long-term stimulant medication use. First, there are many negative psychosocial consequences associated with ADHD. For example, learning disabilities, including reading, spelling, and math disorders, are prevalent among those with ADHD (Barkley, 2005). In addition, children with ADHD are more likely to repeat a grade, drop out of school, or be expelled from school (Weiss & Hechtman, 1993). Finally, children diagnosed with ADHD have a higher rate of automobile accidents and physical injury than children without ADHD (Barkley, Murphey, & Kwasnik, 1996; DiScala, Lesocohier, Barthel, & Li, 1998).

Second, there has been a substantial increase in the utilization of stimulant therapy for children over the past 20 years (Olfson, Marcus, Weissman, & Jensen, 2002). This increase was most visible from the late 1980s to the mid 1990s, and has leveled off somewhat since then (Zuvekas, Vitiello, & Norquist, 2006). Although most reviews of the adverse side effects of stimulant medication have suggested that such medications have a low risk of substantial harm, less serious side effects such as insomnia and anorexia are relatively common (Graham & Coghill, 2008). Stimulants used to treat ADHD are increasingly being used and abused by children and teenagers to get high and/or improve cognitive performance or endurance in those not diagnosed with ADHD. For example, the University of Michigan's Monitoring the Future Survey indicates that 3-4 percent of high school seniors in the United States abused the drug at least once in the past year (Johnston, O'Malley, Bachman & Schulenberg, 2008). Furthermore, less is known about the possible dangers of long-term stimulant medication use and/or abuse (Lerner & Wigal, 2008). Areas of concern, which remain controversial, include cardiovascular effects, reduced growth rate, and carcinogenic effects (Lerner & Wigal, 2008). As stimulant therapy for the treatment of ADHD is becoming more prevalent in young children (Zito et al., 2000), researchers are beginning to dialogue about how to study the effects of psychotropic medications on children as they age (Greenhill et al., 2003).

Given these issues, there has been concern about the process of diagnosing ADHD, and there has been debate about whether ADHD is overdiagnosed (LeFever, Arcona, & Antonuccio, 2003; Sciutto & Eisenberg, 2007). Indeed, ADHD is one of the most commonly diagnosed childhood behavioral disorders (Barkley, 2005). Physicians may be overdiagnosing ADHD in children for several reasons, including: (a) the desire to prevent the negative consequences associated with ADHD; (b) the ready availability of effective pharmacotherapy to treat ADHD; and (c) the ongoing heavy media coverage of ADHD and pharmacotherapy treatments for it.

Research has supported these concerns about the accurate diagnosis of ADHD. For example, Cotungo (1993) evaluated 92 children who were referred to a specialized ADHD clinic. All children had a prior diagnosis of ADHD, and were given a comprehensive evaluation. Only 22% of children were given a primary diagnosis of ADHD, and 37% were given a secondary diagnosis of ADHD when evaluated thoroughly by the specialist in ADHD. Similarly, in a review of 375 patient records, Desgranges, Desgranges, & Karsky (1995) found that 119 cases either requested an ADHD evaluation or presented concerns related to ADHD, but only 45 cases had a confirmed ADHD diagnosis when a thorough diagnostic evaluation was conducted.

Problems in making an accurate diagnosis of ADHD may relate to problems with assessment procedures (Sciutto & Eisenberg, 2007). When assessing ADHD symptoms, best practice generally involves using a multi-method approach involving different sources and settings that assesses symptoms according to standardized diagnostic criteria such as the DSM (American Academy of Pediatrics, 2000; Hoff, Doepke, & Landau, 2002). These sources often include interviews with the adult, child, and teacher, as well as behavior rating scales, review of school records, and behavioral observation (Barkley, 2005; Dulcan & Benson, 1997).

These best practices are not always followed, however. For example, Handler and DuPaul (2005) found that only 15% of psychologists reported using multiple methods consistent with the standards of best practices. Similar problems were found in surveys of the practices of pediatricians and family physicians (Copeland, Wolraich, Lindgren, Milich, & Woolson, 1987; Moser & Kallail, 1995). Many rely on clinical interviews and some may not adhere to DSM criteria or use standardized assessment instruments at all (Wasserman et al., 1999).

In order to help address some of the difficulties that are present in the assessment and diagnosis of ADHD, we have created an objective integrated assessment program that is able to combine different measures of ADHD into a single assessment (Penberthy et al., 2005; Robeva, Penberthy, Loboschefski, Cox, & Kovatchev, 2004). The integrated assessment program employs a Bayesian algorithm that allows for the linking of disparate assessment instruments into one assessment that generates a probability score that represents a patient's likelihood of having ADHD as well as which subtype. In previous research, this integrated assessment program was able to classify ADHD diagnosis better than any one single test alone (Robeva et al., 2004).

In the present study, we explore that rates of diagnosis of ADHD in a general pediatric clinic, and we use the integrated assessment

program to evaluate the diagnosis and treatment of ADHD in this community-based pediatric clinic. Specifically, we examined a small sample of medical records of children who presented to their pediatrician for evaluation of ADHD, in order to evaluate the standard assessments for ADHD, diagnosis of ADHD, and treatment recommendations.

## Method

### *Participants*

All medical records of patients reviewed were seen by the same pediatrician at the same clinic, and data was collected from the medical charts during a three-month period of time. All were first time visits. Medical charts of 24 children who presented for an ADHD evaluation at a small, rural, pediatric clinic in the Southeastern United States were evaluated. The medical charts of these patients reflected the following demographics: 25% were female and 75% were male, and they ranged in age from 5 to 12 years. Data collected from the chart included ratings of symptoms by parents, teachers, and clinicians when available. Data from at least two different sources (i.e., parents, teachers, physicians) were needed to be available for inclusion in the study.

### *Measures*

*Demographic information*. Demographic information was collected from the medical record, including participant's age and gender.

*Diagnosis*. The primary Axis I diagnosis given by the pediatrician was obtained from the medical record.

*Symptom checklists:* Information on symptoms of ADHD was collected from the medical chart. These included symptom checklists assessing the DSM-IV symptoms of ADHD completed by the physician, the parents or caregivers, teachers, or the child. Any observational data recorded in the medical chart was also included. Overall, we found that data from the Conners Rating Scale for ADHD (Conners, Parker et al., 1998; Conners, C.K., Sitarenios, 1998), the Vanderbilt ADHD Diagnostic Rating scale (Wolraich ML, Feurer ID, Hannah JN, et al. 1998), and the Behavior Assessment System for Children (BASC; Gladman, M. & Lancaster, S, 2003) Rating scales where present in some of the medical records, including both versions for parents and teachers. There was no biological data, such as EEG, for any child.

*Treatment*: Any data on recommended treatment, such as prescriptions for stimulant or other medication written by the physician was collected.

### *Procedure*

After IRB approval, we searched the medical records of the pediatric clinic for three months and found 24 cases that met criteria for inclusion in the study. Data were de-identified, collected and entered into a secure database for analysis.

The scores of the various symptom checklists and ratings recorded in the medical record were standardized and converted into a probability score for ADHD. This was done in order to combine the scores from disparate psychometric tests into a single assessment of ADHD. The integrated assessment program evaluates the score of each particular test in steps. At each step of the overall assessment, the patient's score depends on (a) whether or not the subject meets criteria for ADHD according to the individual test or assessment, and (b) which subtype of ADHD the patient meets criteria for, and (c) the severity of the disorder as indicated by the same measure.

Once the standardization of measures was completed, the results from the individual assessments were linked following the Bayesian algorithm described by Robeva et al. (2004) and Penberthy et al. (2005) to calculate the combined probability for ADHD for each individual. The combined probability for ADHD ranges from 0 to 100% and represents a continuum of symptoms, with greater number and severity of disruptions resulting in placement on the high end of the continuum. We determined a priori that a probability of less than 50% would be categorized as not having ADHD and a probability of greater than or equal to 50% would be categorized as having ADHD.

## Results

With regards to diagnosis and treatment of the participants, all of the 24 children (100%) were given the diagnosis of ADHD, either primarily hyperactive/impulsive type (75%), or primarily inattentive type (21%), or combined type (4%) by the pediatrician at the first visit. Nineteen of the 24 children (79%) were also prescribed stimulant medications at the first visit. The results of our integrated assessment of ADHD symptoms were as follows: 16 of the 24 children met criteria for ADHD with a probability of greater than 50%. Eleven patients had a very high probability of having ADHD (greater than 80%). Five patients had a moderately high probability of having ADHD (between 50% and 80%). Eight participants had a very low probability of ADHD (less than 1%).

In males and females, 33% who were diagnosed with ADHD primarily hyperactive/impulsive type and primarily inattentive type, were found to have less than a 1% probability of the diagnosis based upon the actual diagnostic criteria recorded in the medical chart. For the males, the larger majority (83%) of those found to have less than 1% probability of ADHD, were diagnosed with ADHD, predominately hyperactive/impulsive type. In females, there were equal numbers of those diagnosed with ADHD primarily hyperactive/impulsive type and primarily inattentive type who were calculated to have a less than 1% probability of the diagnosis.

## Discussion

In this retrospective analysis of the diagnosis and treatment of ADHD in a small outpatient clinic, we found that 1/3 of our sample of children diagnosed with ADHD and prescribed stimulant medication at the first visit actually had a very low probability of having ADHD based on a summation of objective checklists of symptoms recorded in the medical record. Instead of being prescribed stimulant medication for a disorder they are unlikely

to have, we would have recommended these children be referred for a more comprehensive assessment. This finding supports past research that has shown that health professionals vary in their use of best practices when assessing and diagnosing ADHD (Handler & DuPaul, 2005, Moser & Kallail, 1995; Wasserman et al., 1999).

This study highlights another difficulty in making an accurate assessment and diagnosis of ADHD. Best practices dictate that health professionals use a multimethod approach that incorporates a variety of sources (e.g., child, parent, teacher, and clinician) and settings (e.g., office, home, school). However, it may be difficult to organize and combine these discrepant sources of information into a coherent conclusion. Even comprehensive evaluations that assess multiple domains often lead to incomplete or conflicting data. In other words, clinicians encounter "gray zones," where the diagnosis is not clear. This was found to be the case even in our comprehensive assessment, where 21% of the children were found to have a probability of ADHD that fell in the "gray zone," an area in the probability realm that is neither conclusively affirmative nor negative. Clinicians are then forced to make a dichotomous diagnosis, based primarily upon their own subjective clinical judgment or external pressures from patients or other systems. This is a particular problem when diagnosing ADHD, since no laboratory tests are available that provide sufficient sensitivity and specificity of diagnosis. This problem is made more urgent because early recognition, assessment, and management of ADHD can redirect the educational and psychosocial development of most children with this disorder, thereby having a significant impact upon the well-being of a child accurately diagnosed with ADHD.

Limitations of this preliminary study include a small sample size from a small clinic, a single physician seeing all patients, and some missing data. Because we evaluated the diagnoses and treatment choices of a single clinician, the findings may not be generalizable to the larger population.

Despite these limitations, we believe this study has added to the ever-important dialogue of accurately diagnosing and treating ADHD. We have highlighted the innovative nature of our objective integrated assessment program which combines disparate symptom ratings and information from single sources to produce an overall probability of diagnosis that we believe is more accurate and precise than any single measure. This probabilities model allows a clinician to investigate in a systematic method areas of discrepancies in diagnosis for a more complete understanding of the symptoms for the individual under question. Further research is needed, including using this model with additional questionnaires, physiological data, and behavioral ratings. In addition, further research is needed to evaluate changes over time in the diagnostic abilities of the model to evaluate treatment effects. Such research would help discern the sensitivity and specificity to diagnose ADHD versus non-ADHD, both on and off medication or in response to other treatments. Overall, development of a reliable method to evaluate ADHD would increase accurate screening and diagnosis of this potentially destructive disorder and thereby facilitate and ensure that appropriate treatment is administered early and effectively.

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