EDITORIAL

Attention deficit disorder/hyperactivity: a scientific overview

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According to the American Medical Association, attention deficit hyperactivity disorder (ADHD) is ''one of the best-researched disorders in medicine, and the overall data on its validity are far more compelling than for most mental disorders and even for many medical conditions'' (1). Despite the robust body of research that makes ADHD one of the ''best-researched disorders in medicine'', there is still a lack of knowledge about this disorder in Brazil. To address this gap, we present an overview of the current scientific understanding of ADHD.

ADHD is a chronic disorder with onset in childhood that affects approximately 5% of children and adolescents worldwide, irrespective of the country in which they live (2). The disorder persists into early adulthood in approximately 65-75% of cases (3). ADHD has a variable clinical presentation that includes inattentiveness, hyperactivity or impulsivity (4). The symptoms of ADHD cause significant functional impairment, such as social and family life problems, low educational attainment and an increased school dropout risk; this functional impairment frequently leads to low self-esteem and has a negative influence on emotional development (4). ADHD is also associated with negative physical outcomes, such as injuries, including traffic accidents, premature pregnancy, and sexually transmitted diseases, among others. Individuals with ADHD are also at significant risk of concurrent or future psychiatric comorbidities, such as conduct disorder, anxiety and mood disorders, antisocial behavior and substance abuse (5).

The diagnosis is established according to reliable clinical criteria, which require a persistent pattern of inattention and/or hyperactivity-impulsivity that must be maladaptive and inconsistent with the developmental age of the child (6). The symptoms should cause clinically significant impairment in social, academic, or occupational functioning. The symptoms must occur often, in more than one setting, and must have persisted for at least six months. Additionally, the diagnosis is only made if at least some of the behavioral symptoms were present before the age of seven years (6). Presently, there are no biological, electrophysiological or neuroimaging markers with clinical utility for the diagnosis of ADHD. Therefore, clinical skills and knowledge are essential for establishing an accurate diagnosis because ADHD symptoms must be differentiated from normal development and other causes must be excluded. In addition, comorbid disorders must be identified.

Etiological studies evaluating families, adopted children and twins with ADHD have identified a strong genetic contribution, with a pooled heritability rate of 76% (7). Meta-analyses have identified genes involved in the dopaminergic and serotoninergic systems, among other systems, as susceptibility genes. Environmental factors, such as intra-uterine exposure to tobacco, prematurity and low birth weight also seem to increase the susceptibility to ADHD (5). Similar to data for other complex diseases, such as cardiovascular disease and diabetes, the current data for ADHD suggest that multiple risk alleles with small effects and environmental factors are involved in the etiology of ADHD. Emerging evidence also suggests an important role of copy number variations (8).

Neuropsychological and neuroimaging studies have demonstrated a clear biological substrate for ADHD, implicating neural systems and areas involved in attention, inhibitory control and other executive functions (9). Many different studies have demonstrated that neural networks in the dorsolateral prefrontal cortex, the dorsal anterior cingulate, the parietal, striatum, and the cerebellum are primarily involved in ADHD (9,10). In addition, a landmark study conducted by the US National Institute of Mental Health demonstrated a marked delay in brain maturation in children with ADHD, with the peak cortical thickness occurring approximately three years later in children with ADHD than in healthy controls. The delay was most prominent in the prefrontal regions linked to the mechanisms of attention control and executive functions (11).

More than 200 randomized controlled trials have evaluated pharmacological, psychosocial and alternative treatments for ADHD (12). Medication results in marked improvements in the cardinal symptoms and is the first-choice treatment for school-age children, adolescents and adults (12). However, behavioral intervention is the first-choice treatment for preschoolers. Stimulants are the first-line medications and have been used to treat ADHD for several decades, with consistent data demonstrating the efficacy and safety of these drugs (13). Stimulants (e.g., methylphenidates and amphetamines) have a

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pooled effect size of 0.7-1 for children and 0.7-0.9 for adults for the reduction of ADHD symptoms (14,15). Non-stimulants (e.g., atomoxetine and clonidine) have a pooled effect size of 0.6 for children and 0.4 for adults for the same symptoms (12,14).

Despite the robust ability of medications to reduce ADHD symptoms, there is increasing recognition of the relevance of a comprehensive approach with multimodal interventions that also target the associated conditions, such as school difficulties, family dysfunction, low self-esteem and comorbid disorders (5). It is important to identify the target outcomes to formulate the best treatment plan. For most patients, other interventions of varying type and intensity are needed. The individual's needs dictate which professionals are involved in the treatment and which techniques should be used (13).

In conclusion, ADHD is an extensively studied disorder, with consistent high-quality data demonstrating its validity. Children and adolescents with ADHD exhibit significant impairment and are at increased risk of deficits in social, emotional and educational development. Although there are concerns about misdiagnosis, which may be related to the small number of well-trained professionals in the field, studies conducted in Brazil indicate that approximately 95% of children with ADHD do not receive treatment (16). The lack of adequate training, stigma, and misconceptions are important barriers to the recognition and treatment of ADHD and must be actively combated.

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AUTHOR CONTRIBUTIONS

Polanczyk GV and Casella EB prepared the first draft of the manuscript. Miguel EC and Reed UC reviewed the draft of the manuscript. All the authors approved the final version of the manuscript.

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