

# Characterization of Epidemiological ADHD Studies: A Systematic Review

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## Abstract

Attention Deficit Hyperactivity Disorder is a multidetermined phenomenon of high incidence affecting children, adolescents and adults worldwide, resulting in impairment in several areas of development such as social relationships, academic performance, professional and romantic relationships. The objective of this study was to review systematically the literature to verify the epidemiological picture of the disorder under three main aspects: 1) what is the ADHA definition; 2) what is the epidemiology of the disorder; and 3) what are the instruments used for diagnostic evaluation. The search was performed in the database Periódicos CAPES, PsycInfo, and MedLine using the keywords “Epidemiology and ADHD” and its correlation in English and Spanish. 331 articles, of which only 21 met the inclusion criteria, were retrieved. The results suggest that there is a consensus on the ADHD definition; however epidemiological data ranged from 0.04% to 24.5%. The studies also varied as to the use of diagnostic instruments, being more used the DSM-IV criteria.

## Keywords

ADHD, Epidemiology, Diagnosis, Prevalence, Diagnostic Instruments

## 1. Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is the most common neurodevelopment disorder in childhood and may persist during adolescence and adulthood. ADHD is characterized by three main symptoms: inattention, hyperactivity and impulsivity (Conners, 1999; Homer et al., 2000; Mercugliano, 1999). The disorder comprises impairments in behavioral inhibition, sustained attention, resistance to distraction, and in regulating the activity level of the person in specific situations, being frequently observed excessive and irrelevant

motor activity to the task in execution (Barkley & Murphy, 2008; Farré & Narbonne, 2001).

These features of the disorder imply losses in several areas of functioning, such as school, society, emotion, and the losses vary according to symptoms, age, and risk and protective factors (Araújo, 2002; Pondé & Freire, 2005; Rohde, Dorneles, & Costa, 2006).

Tracking studies have been conducted with the aim of outlining the epidemiology of ADHD. Globally, the prevalence of the disorder varies from 5% to 8% (Barkley & Murphy, 2008; Rohde et al., 1998). In Brazil, studies have found different results, nevertheless this may be related to the nature of the study, assessment instrument used, and sample (Andrade & Flores-Mendoza, 2010). These investigations are important to trace the epidemiological framework of the disorder, functioning as starting point for the scientific development of treatment (Pastura, Mattos, & Araújo, 2007; Vasconcelos et al., 2003).

Although the results are still heterogeneous in screening studies; this does not constitute lack of knowledge in the area, since the interest in ADHD is not a recent event. From the first assertion researchers have been conducting epidemiological studies to identify how this phenomenon affects the population. Thus, based on the notion that there is an accumulation of knowledge on the subject, this paper aims to review the literature systematically to describe the epidemiological framework of the disorder presented at national and international studies on ADHD, concerning on three main questions:

- 1) What's the definition of ADHD?
- 2) What's the Prevalence of ADHD?
- 3) What are the most widely used instruments for diagnostic assessment of ADHD?

## 2. Method

331 articles were retrieved from the search in the database Periodicals CAPES, PsycInfo and MedLine, in which we used the combination of descriptors "Epidemiologia" [and] "Transtorno de Déficit de Atenção e Hiperatividade", and its correlates in English (Epidemiology; ADHD) and Spanish (Epidemiología; Trastorno por Déficit de Atención/Hiperactividad). The retrieved articles were analyzed based on the following criteria: 1) Have been published between 2000 and 2013; 2) Set up as an empirical study; 3) Have used standardized test for sample evaluation. After additional criteria were applied:

- 1) Definition of ADHD: Studies were selected whose definition of the disorder was based on the diagnostic criteria of Diagnostic and Statistical Manual of Mental Disorders 3rd, 4th, and 5th Edition, and International Code of Diseases (ICD) 10th Edition.
- 2) Sample: Participants of both sexes with no age criteria. Regarding to the selection of the sample was not of convenience the study was included.
- 3) Source of information: Family members, caregivers, and teachers.
- 4) Applied Instruments: Studies using checklists, scripts history or standar-

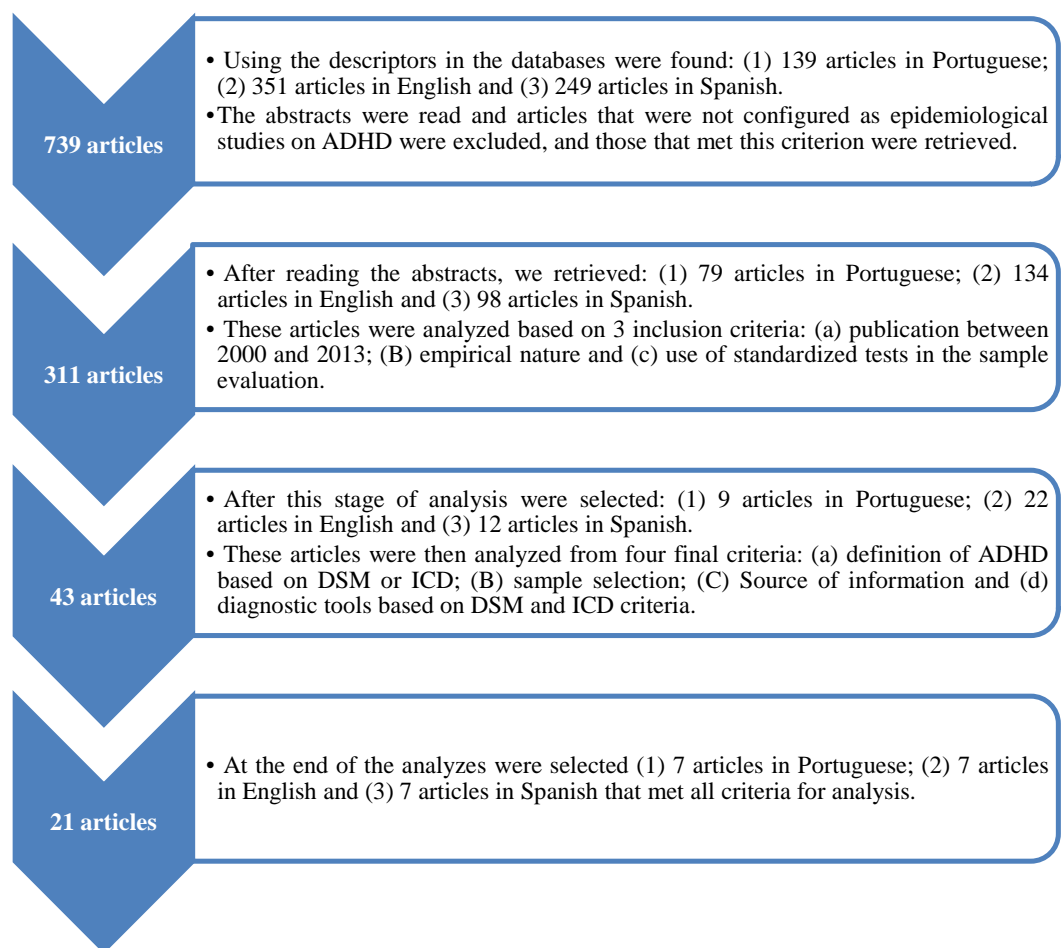
dized based on DSM III, DSM IV, DSM V and ICD 10. Their validity needed to be ratified in clinical and epidemiological studies, under specific protocols to guarantee the generalization of the finds.

The description of the selection stages of the articles that compose this study and that are analyzed in the results session, is described in the **Figure 1**.

### 3. Results and Discussion

#### 3.1. Definition of ADHD

ADHD has become a focus of study to improve knowledge of professionals in health and education. The investigation of the disease occurs by the atypical conditions of development with higher incidence and prevalence in the population of school age around the world. Seems to be a consensus among researchers about the definition of ADHD, which is considered a disorder of multifactorial origin, whose main symptoms are motor hyperactivity, impulsivity and attention deficit. This major triad co-occurs with secondary symptoms such as emotional disorders, learning disabilities, oppositional defiant disorder, conduct disorder, depression and anxiety (Andrade & Flores-Mendoza, 2010; Aragonès et al., 2010; Oscar & Alma, 2010; Faraone, Sergeant, Gillberg, & Biederman, 2003; Lindblad,



**Figure 1.** Description of the stages of selection of the articles.

Weitoft, & Hjern, 2010; Londoño, Cifuentes, & Lubet, 2011).

Pondé and Freire (2007) define the disorder as follows:

The disorder is characterized by three groups of symptoms, the prevalence of each define disease subtype: 1) predominantly inattentive, 2) predominantly hyperactive-impulsive or 3) combined. Children with ADHD may have difficulty in school, relationship problems and low self-esteem. Comorbidity with other psychiatric disorders, according the authors, can result in serious social repercussions and exclusion. (p. 241)

In other analysis there is convergence as the chronicity of ADHD. Different from the previous procedures in the treatment two decades ago, currently, researchers have focused on developing procedures of intervention strategies on different stages of life. This is important to the fact that ADHD does not qualify as a disorder of childhood and adolescence, and may persist with significant functional impact on at least 50% of cases on adulthood. The symptoms of the disorder changes with advancing age, already possible to determine which features are more common in two main stages of life, childhood and adulthood (Aragonès et al., 2010; Blázquez-Almería et al., 2005; Faraone et al., 2003; Poeta & Rosa Neto, 2004).

Fayyad et al. (2007) state that:

It has been observed through clinical studies in children with attention-deficit/hyperactivity disorder and hyperactivity symptoms often persist into adulthood deficit. (p. 402)

Childhood is the phase that commonly identifies ADHD-like symptoms. It can be observed more frequent in frequent exchange of activities; problems in academic organization; difficulty to maintaining friendship relationship with children of the same age; accumulation of different activities; motor disturbance; impulsivity; learning disability, and often school failure (Andrade & Flores-Mendoza, 2010; Poeta & Rosa Neto, 2004; Pondé & Freire, 2007). There are even indications that the transition to adolescence, individuals with ADHD, especially those with comorbid conduct disorder, has increased to engage in delinquent behavior trend, substance abuse and sexual risk practices (Faraone et al., 2003). Already in adulthood, lack of attention, impulsivity, irritability and low frustration tolerance mark the life of these people, as emphasized Poet and Rose (2004).

The prevalence of the pathology in adults is approximately 4%. North-American researchers claim that the sequelae of ADHD affects between 2% to 2.5% of adults, whom have inattention, impulsivity, irritability, intolerance and frustration. (p. 151).

### 3.2. Prevalence of ADHD and Comorbidity with Psychiatric Disorders

If the definition of ADHD achieves a consensus in the scientific community, the same did not occur with the epidemiological findings. Some authors argue that

the main problematic is the use of procedures not considering the diagnostic criteria recommended by the World Health Organization (WHO), the DSM IV, with inaccurate or nosological definitions for inadequacies in the methods of data collection (Andrade & Flores-Mendoza, 2010; Blasquez-Almería et al., 2005; Faraone et al., 2003; Pineda, Lopera, Palacio, & Castellanos, 2001).

Regarding this matter Montiel-Nava, Peña and Montiel-Barbero (2003) highlight:

The prevalence of the disorder, attention deficit hyperactivity disorder (ADHD) is a condition with greater variability in different published epidemiological studies. Data on the prevalence of ADHD vary substantially from country to country and offer a range of heterogeneous data that describe the same clinical syndrome in children. Several epidemiological studies in different countries that use different classification and diagnosis (ICD-9, ICD-10, DSM-III-R, DSM-IV) systems, data indicated prevalence controversial. (p. 815)

The data on the prevalence of ADHD change according to the region where the survey was conducted, analytical and collected. Barkley and Murphy (2008) estimate that the disorder reaches 3% - 7% of school-age children. Holmes et al. (2002) argue that this rate is actually 10%. Brazelton and Sparrow (2003) present another estimation, that the disorder affects 5% of school-age children. Regarding this diversity of results, Golfeto and Barbosa (2003) informs that differences in epidemiological data can vary from 1% to 20%, requiring a careful analysis of the studies. This is corroborated with the studies contained in Table 1, where one can observe a great disparity between the data on the prevalence of ADHD, ranging from 0.04% in the study of Aragonès et al. (2010) to 24.5% in Azevedo, Caixeta, Andrade and Bordin (2010).

### 3.3. Diagnostic Assessment of ADHD

The assessment for the diagnosis of ADHD has been the key point for the design of epidemiological profile of the disorder (Barkley & Murphy, 2008; Vasconcelos et al., 2003; Pastura, Mattos, & Araújo, 2007). Three main aspects affect the quality of these finds: 1) ADHD Definition; 2) Respondent and 3) Instruments used to collect the results.

On this behalf Andrade and Flores-Mendoza (2010) state:

Although it is a recurrent disorder with personal and social negative consequences, its epidemiological research and determination are searched by means of various evaluation methods and informants, which does not provide precise data on its prevalence in the general population. (p. 17)

ADHD is frequently confused with other developmental disorders, episodic diseases, and behavior problems without any organic component or environmental situations, such as home education without objective rules (Andrade & Flores-Mendoza, 2010; Cardoso, Sabbag, & Beltrame, 2007). It is necessary to

**Table 1.** Synthesis of epidemiological studies.

Studies	Sample	Epidemiology
Andrade & Flores-Mendonza (2010)	135 schoolchildren of 5 <sup>th</sup> , 6 <sup>th</sup> and 7 <sup>th</sup> grades of elementary school.	3.7% with Attention deficit disorder. 4.7% with Hyperactivity.
Aragonès et al. (2010)	A cross-sectional with 2,452,107 adults patients aged between 18 and 44, enrolled in a primary care program.	0.04%
Azevedo, Caixeta, Andrade, & Bordin (2010)	Indians of the Karajá tribe aged between 7 and 16 years.	24.5%
Blázquez-Almería et al. (2005)	2401 students of both sexes aged between 6 - 12 from 10 different educational centers in Barcelona and the Area of Vallès Occidental.	12%
Cardoso, Sabbag, & Beltrame (2007)	84 children aged between 6 and 16 years.	7%
Fayyad et al. (2007)	11,442 participants aged between 18 and 44, from 10 countries.	3.4%
Fontana et al. (2007)	461 students from 1 <sup>st</sup> to 4 <sup>th</sup> grade, aged between 6 and 12 years.	13%
Graaf et al. (2012)	7075 participants aged between 18 - 44, from 10 countries.	3.5%
Kessler et al. (2007)	3199 participants aged 18 - 44 years	4.4%
Lindblad, Weitoft, & Hjern (2010)	16,134 participants born between 1985 and 2000 in Sweden.	5.3%
Molinero et al. (2009)	Students aged between 6 and 16 years old from the city of Lyon, France.	6.6%
Montiel-Nava, Peña, & Montiel-Barbero (2003)	657 schoolchildren between 3 and 13 years old.	7.9%
Oscar & Alma (2010)	92 students aged between 9 to 19 years	19.5%
Pastura, Mattos, & Araújo (2007)	304 students of elementary school do College of Application of UFRJ	8.6%
Pineda et al. (2001)	341 students of both sexes, aged between 4 and 17 years.	21.5%
Poeta & Rosa Neto (2004)	1898 students from grades 1 to 4, between the ages of 6 and 12.	5%
Pondé & Freire (2007)	774 public school students aged 6 to 12 years.	6.7%
Rowland et al. (2001)	362 students in grades 1 to 5.	16%
Scandar (2003)	801 students aged 6 to 9 years of primary school.	4.99%
Úrzua et al. (2009)	Parents and Teachers of 640 children aged between 6 and 11 years. Pais e Professores de 640 com idades entre 6 e 11 anos.	It varied between 5% and 15% depending on the informant. When agreement between parents and teachers was required, prevalence dropped to 2%.
Vasconcelos et al. (2003)	403 pupils from primary school	17.1%

consider also cultural patterns that interfere significantly in establishment of pattern behaviors that are considered appropriate and inappropriate in a specific reunion.

Montiel-Nava, Peña-Barbera and Montiel (2003) discuss this issue as follows:

In recent decades, changes in psychiatric nosology systems on the conceptualization of the disease, which affected the number and the combination of signals required for the diagnosis of ADHD. These changes contribute

greatly to the disparity in prevalence rates reported in several studies. Other factors are related to the methods used, type of sample studied (clinical or community), the source of communication (parents, teachers, children), and sociocultural characteristics. Culture is one of the most powerful influencers in the normal development of a child or the occurrence of psychopathological variables, such as expectations and standards associated with adequate performance and children that vary from country to country behaviors. (p. 815)

The quality of information is directly related to the source. That means, depending on the level of relationship between those responding to the protocols and participants (with ADHD) behavior can be observed under different analyzes. The level of understanding of the respondent on the ADHD phenomenon is an important matter to discuss. Moreover, the validity of the instruments used to collect information plays decisive role for the establishment of epidemiological data (Molinero, Villalobos, Redondo, Martín Rivera, & Sanz, 2009; Montiel-Nava, Peña, & Montiel-Barbero, 2003).

Studies of this nature that use procedures of in their own scales in detriment of the diagnostic criteria of DSM IV they avoid to discuss and to analyze critically consistent characteristics with ADHD in a range of situations that can assign or delete the final diagnosis. It is necessary to consider the age of symptomatological onset, frequency, damaged areas and levels of prejudice. It is this set of information that will ensure greater reliability to the results. In most studies, it is observed that these variables are not considered, and assigned a diagnosis of ADHD to all those who filled out a number compatible with the 1st criteria of DSM IV symptoms, without considering the other. Thus, multidimensional investigation is abandoned.

Molinero et al. (2009) state that:

The variability in prevalence figures is influenced by the determination of the sample, clinical and/or psychometric strategy, the cut used in the scales, the informant, age, origin, geographical location, diagnostic criteria and whether or not the proper definition of dysfunction. All this suggests that the comparison of the values obtained in different studies is not straightforward and should be done carefully because we are aware that the use of older samples, include measures of impairment or use two instead of one informant tend to offer a lower prevalence, while use against DSM-IV and DSM-III-R criteria ICD-10 improves prevalence. (p. 253)

Although the criteria for diagnostic assessment of ADHD is increasingly standardized based on DSM IV. Some researchers have extrapolated the use of a single checklist to ensure the highest reliability of the data obtained. As observed in studies of Graaf et al. (2008), Kessler et al. (2006), Londoño, Cifuentes and Lubert (2011), Molinero et al. (2009), Montiel-Nava, Montiel-Barbero and Peña (2007), Montiel-Nava, Peña and Montiel-Barbero (2003), Pineda, Lopera, Henao, and Palacio Castellanos (2001), Scandar (2003) and Vasconcelos et al.

(2003).

In general, we can arrange the instruments used in data collection in three main groups:

**Behavioral Rating Scales:** Checklists compounds of descriptive items of topography and frequency of behaviors. *Likerts* scales have been widely used for initial screening of repertoires consistent with the clinical picture of ADHD. These scales were developed with the primary basis of the diagnostic criteria of DSM IV and are usually applied in the form of interviews with parents and teachers. The adoption of instruments based on DSM IV strengthens the predictive quality and reliability of the data obtained, considering that these scales are based on observation of pattern behaviors, as well as the reports of others about the development of the person assessed. Among the articles that make up this work identified themselves quite often the scales (**Table 2**).

**Neuropsychological Assessment Scales:** Neuropsychological assessment is the use of tests to assess the level of cognitive development, as well as identify possible (functional) areas affected by ADHD. In the studies reviewed here, the scales were used (**Table 3**).

**Table 2.** Behavioral assessment scales used in the 21 articles.

Evaluation instruments	Studies
ADHD Rating Scale: for teachers	Andrade & Flores-Mendonza, 2010; Pondé & Freire, 2007
ADHD Rating Scale Adapted for Parents	Andrade & Flores-Mendonza, 2010
Diagnostic criteria from DSM IV	Azevedo, Caixeta, Andrade, & Bordin, 2010; Cardoso, Sabbag & Beltrame, 2007; Fayyad et al., 2007; Fontana et al., 2006; Kessler et al., 2006; Molinero et al., 2009; Oscar & Alma, 2010; Pineda, Lopera, Palacio, & Castellanos, 2001; Rowland et al., 2001; Vasconcelos et al., 2003
Evaluación del trastorno por Déficit de Atención con Hiperactividad—EDAH	Blázquez-Almería et al., 2005; Cardoso, Sabbag, & Beltrame, 2007; Poeta & Rosa Neto, 2004
Adult ADHD Clinical Diagnostic Scale Version	Fayyad et al., 2007
Disability Assessment Schedule—WHO/DAS	Graaf et al., 2012
Attention-Deficit/Hyperactivity Disorder Rating Scales IV to parents and teachers	Molinero et al., 2009; Úrzua, 2009
SNAP-IV Rating Scale	Pastura, Mattos, & Araújo, 2007
Children's interview for psychiatric syndromes: parent version-P—ChIPS	Pastura, Mattos, & Araújo, 2007
Sistema de Evaluación de la Conduita para Niño Colombian versión	Pineda, Lopera, Palacio, & Castellanos, 2001
Semi-structured Interview for Psychopathology according to DSM IV Criteria	Pineda, Lopera, Palacio, & Castellanos, 2001
Escala de Áreas de Conductas Problemas—EACP	Scandar, 2003
Checklist EMTDA-H for parents and teachers	Scandar, 2003

**Clinical Interview:** The medical protocols have been important in identifying the developmental pathway of the subject. Thus, it is possible to exclude episodic diseases of atypical developmental conditions that have chronic nature, such as ADHD. In general, care services or health research groups in which the designs have been developed own history, which, unlike the scales for behavioral and neuropsychological assessment, do not go through the process of validation protocols. Some clinical routes used are listed in **Table 4**.

#### 4. Conclusions

The findings of this study corroborate previous findings in the literature regarding the difficulty of establishing the prevalence of ADHD. Epidemiological studies are very important to emerge as the starting point for the development of intervention technology for this audience; however, the designs are presenting many different patterns to achieve the results, making it impossible for the data to be a crossed view of the complete picture about the disorder.

Among the main criticisms are the different definitions used for ADHD; instruments used, which are not infrequently inadequate public studied with respect

**Table 3.** Neuropsychological assessment scales used in 21 articles.

Evaluation instruments	Studies
Computerized task of basic cognitive processing-Perceptual Discrimination	Andrade & Flores-Mendonza, 2010
Computerized work memory task-Alphabet	Andrade & Flores-Mendonza, 2010
A self-reporting version of the <i>Conners' Parent and Teacher Rating Scales</i>	Montiel-Nava, Peña & Montiel-Barbero, 2003
Wechsler Intelligence Scale for Children-3rd Edition (WISC-III)	Montiel-Nava, Peña & Montiel-Barbero, 2003
The Wechsler Preschool and Primary Scale of Intelligence (WPPSI)	Montiel-Nava, Peña & Montiel-Barbero, 2003
Neuropsychological Evaluation	Pineda, Lopera, Palacio, & Castellanos, 2001

**Table 4.** Clinical interview guide used in the 21 articles.

Evaluation instruments	Studies
Clinical history of primary health care	Aragonès et al., 2010
Psychiatric Interview	Fontana et al., 2007
<i>Diagnostic Interview for Children and Adolescents-Revised-Parent Version-DICA-P</i>	Montiel-Nava, Peña & Montiel-Barbero, 2003
Development History	Montiel-Nava, Peña & Montiel-Barbero, 2003
Neurological Evaluation and Review of Medical Histories	Pineda, Lopera, Palacio, & Castellanos, 2001
Developmental and Clinical History	Vasconcelos et al., 2003

to age, gender, culture and the data source, who are usually parents and teachers. Furthermore, the selection of instruments inspired by the DSM IV criteria, which have not gone through validation, makes the fragile quality of the information be obtained, which can generate incidence data below what is real.

In general, one can observe that for definition data of safer prevalence, it is important to extend the sample to statistical significance thresholds, selecting the instruments that have been tested and finally efficiency draws a parallel between the data obtained from different sources of information, since it is necessary to discard information that refer to behaviors that are manifested in specific environmental conditions. Thus, studies of an epidemiological nature should consider the multidimensional character of ADHD, considering then, instruments that reach this condition and allow the researcher the direct contact with historical family, developmental and clinical variables.

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