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#### ORIGINAL ARTICLE

# Analysis of the factors linked to a diagnosis of attention deficit hyperactivity disorder in children\*

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#### **KEYWORDS**

Attention deficit hyperactivity disorder; Epidemiology; Paediatric neurology; Age factors

#### Abstract

Introduction: Attention deficit hyperactivity disorder (ADHD) is a neuropsychiatric disorder originating from multiple factors. The aim of this study is to determine the percentage of patients with ADHD out of all patients referred to our clinic for assessment, and to explore the epidemiological and clinical factors linked to this diagnosis.

Patients and methods: Retrospective analytical study of a sample of patients under 15 years old sent to the paediatric neurology clinic for suspected ADHD. DSM-IV criteria were used for diagnosis. We completed a binary logistic regression analysis to determine which risk factors were associated with the diagnosis.

Results: Of the 280 selected patients, 224 were male (male/female ratio 4:1); mean age (SD) was 8.4 (3.08) years. Almost half (49%) of the patients were referred by their schools and 64.9% were born in the second half of the year, but this tendency was more marked in girls than in boys. Assessment according to DSM-IV criteria resulted in diagnosis of 139 subjects (49.7%). The risk factors linked to diagnosis were male sex, parents with ADHD, associated sleep disorders, tics, and absence of neurodevelopmental delay.

Conclusion: Only half of the children referred for suspected ADHD were diagnosed with that condition, and most were among the youngest in their classes, which suggests that suspected ADHD is overestimated. An exhaustive clinical interview investigating the family's psychological disorders and the patient's sleep disorders and tics is needed to improve the diagnostic process. © 2015 Sociedad Española de Neurología. Published by Elsevier España, S.L.U. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

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#### PALABRAS CLAVE

Trastorno por déficit de atención con hiperactividad; Epidemiología; Neurología infantil; Factores de edad Análisis de los factores ligados al diagnóstico del trastorno por déficit de atención e hiperactividad en la infancia

#### Resumen

Introducción: El trastorno por déficit de atención e hiperactividad (TDAH) es un trastorno neuropsiquiátrico de origen multifactorial. El objetivo de este estudio es determinar el porcentaje de pacientes que presentan TDAH del global de los enviados a la consulta por este motivo, y explorar los factores epidemiológicos y clínicos asociados al diagnóstico.

Pacientes y métodos: Estudio retrospectivo analítico de una muestra de pacientes derivados a la consulta de neuropediatría por sospecha de TDAH, a la que se le aplican los criterios diagnósticos del DSM-IV. Se realiza un análisis de regresión logística para explorar los factores asociados al diagnóstico.

Resultados: De los 280 pacientes, 224 eran varones (relación niños/niñas 4/1) con una edad media  $\pm$  desviación estándar de 8,4 $\pm$ 3,08 años. El 49% fue remitido desde el ámbito escolar. El 64,9% de ellos nacieron en el segundo semestre del año, fenómeno que es más acusado en las mujeres. Tras la evaluación de los sujetos, un total de 139 casos fueron diagnosticados (49,7%). Los factores asociados a un incremento de diagnósticos de TDAH fueron: el sexo varón, el TDAH parental, trastornos del sueño asociados, la presencia de tics y la ausencia de retraso del desarrollo psicomotor.

Conclusiones: Solo la mitad de los niños enviados con sospecha de TDAH fueron diagnosticados del trastorno. La mayoría se encuentra entre los más jóvenes del curso escolar, sugiriendo una sobreestimación de la sospecha. Una entrevista clínica donde se explore la psicopatología parental, los trastornos del sueño y los tics parece necesaria para mejorar el proceso diagnóstico.

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#### Introduction

The number of patients diagnosed with attentiondeficit/hyperactivity disorder (ADHD), and consequently the consumption of medications for the condition, has increased in many countries. At present, ADHD is the most frequent neuropsychiatric disorder among paediatric patients and poses a major public health problem. 1 According to the literature, prevalence of ADHD ranges from 2.2% to 17.8%. Such a pronounced variation in prevalence rates may be explained by a number of factors: differences in the sources of information used for diagnosis (parents, teachers, or healthcare professionals), diagnosis based on the presence of behavioural disorders in one or more fields, the study methodology (DSM or ICD criteria), and ethnic and cultural differences in study samples. In Spain, studies report prevalence rates of ADHD between 0.2% and 15%. A systematic review and meta-analysis of epidemiological studies conducted in Spain reported an overall pooled prevalence rate of 6.8%.

The fact that the rates published in the literature are high and vary between studies may indicate misdiagnosis or lack of precision in diagnosis. The aetiology of ADHD is heterogeneous and involves numerous genetic and environmental factors. Knowing the underlying causes of ADHD improves diagnosis. ADHD has been found to have a highly heritable component; this, combined with perinatal (low birthweight, pre-term birth, hypoxia, maternal substance abuse during pregnancy), environmental, and psychosocial

factors (poverty, mistreatment, stress), has a considerable impact on a child's neurodevelopment and the pathogenesis of the disease. Several studies have shown that the risk of ADHD diagnosis is higher in young-for-grade children.<sup>4–7</sup> According to these studies, children born in the month previous to the cut-off date of birth for starting school are more likely to be diagnosed with ADHD and are more frequently prescribed methylphenidate than those born in the months following the cut-off date.

The purpose of this study was to determine the percentage of patients referred to the paediatric neurology department with suspected ADHD who are finally diagnosed with ADHD after thorough assessment. Furthermore, we aimed to determine the comorbidities and family and psychosocial factors associated with this condition. Likewise, we analysed whether children diagnosed with ADHD were more frequently born during the second semester, given that the cut-off date for starting school in Spain is 1 January.

#### Patients and methods

We conducted a retrospective analysis of a cohort of patients referred to a paediatric neurology department with suspected ADHD and analysed clinical variables associated with diagnosis. We included all patients aged under 15 who were referred to the paediatric neurology department at Hospital de Sagunto, in the region of Valencia, Spain. This is the only hospital in its health district. Consultations were

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