

ORIGINAL ARTICLES

Do children with ADHD use the Emergency Department more often? — retrospective cohort study

Mariana Bravo¹ , Diana Valbom Gonçalves² , Tomás Ferrão² , Catarina Rodrigues² , Raquel Zenha² , Sandra Rebimbas² 

ABSTRACT

Introduction: Attention-deficit/hyperactivity disorder (ADHD) has been associated with increased use of emergency department (ED) services. This study aims to compare ED visits due to illness between children with and without ADHD at a level I hospital in Portugal.

Methods: A retrospective cohort study was conducted including a sample of children diagnosed with ADHD and a control group of children without neurodevelopmental disorders. Data were collected on the number of illness-related ED visits from the age of six years onwards, as well as severity of the episode (i.e., triage category, need for additional exams, and hospitalisation).

Results: The sample included 316 cases and 316 controls, with a mean age of 11.9 ± 2.4 years in both groups. Children with ADHD had a higher rate of illness-related ED visits compared to the control group, with an incidence rate ratio (IRR) of 1.67 ($p < 0.001$). Even after excluding children with other underlying conditions such as asthma, the ADHD group continued to show higher ED utilization (IRR 1.45; $p < 0.001$). The ADHD patients also had more ED visits related to anxiety ($p = 0.022$) and were triaged as 'more urgent' more often ($p < 0.001$), although no difference was found regarding hospitalization rates ($p = 0.206$).

Conclusion: This study demonstrates an association between ADHD and increased utilization of the ED for illness-related reasons. Despite being categorized as higher urgency cases upon triage, patients with ADHD did not show a greater need for hospitalization.

Keywords: ADHD; disease; emergency department

1. Department of Pediatrics, Hospital Pediátrico de Coimbra, Unidade Local de Saúde de Coimbra, 3000-602 Coimbra, Portugal
marianacrbb@gmail.com

2. Department of Pediatrics, Unidade Local de Saúde da Região de Aveiro, 3814-501 Aveiro, Portugal.
dianavalbom@gmail.com; tomasferrao@gmail.com; catarinarodrigues050@gmail.com; 71000@chbv.min-saude.pt; sandrarebimbas@gmail.com

INTRODUCTION

Attention-deficit/hyperactivity disorder (ADHD) is one of the most prevalent neurodevelopmental disorders in pediatric patients and has been associated with increased utilization of the emergency department (ED).⁽¹⁻²⁾

Several studies have demonstrated a correlation between ADHD and a higher frequency of ED visits due to accidents, which are often linked to the behavioral characteristics of the disorder.⁽³⁻⁵⁾ Moreover, children with ADHD tend to seek emergency care more frequently due to psychological comorbidities, arising not only from the social impact of the disorder but also from the associated neuropsychological dysfunctions.⁽⁶⁻⁷⁾ In addition, other physiological alterations associated with ADHD, such as autonomic dysregulation and immune system abnormalities may predispose individuals to autoimmune, inflammatory, and infectious diseases, thereby contributing to an increased demand for emergency services.⁽⁸⁻⁹⁾

This study aims to assess differences in ED utilization for medical conditions at a level I hospital in Portugal between groups of children with and without ADHD. The comparison focuses on the number of ED visits, as well as the reasons for and severity of the episodes.

METHODS

This study is a retrospective cohort analysis including a sample of children with ADHD followed up in a neurodevelopmental outpatient service in 2023, and a control group consisting of children born at the same hospital, excluding those followed up in neurodevelopmental, pediatric neurology, adolescent medicine, or child psychiatry outpatient services.

The number of ED visits for medical conditions (excluding visits due to trauma and accidents) was recorded from age six up to December 2023. The severity of each episode was assessed based on triage category, need for complementary diagnostic tests, and hospitalization, and the two groups were compared accordingly.

Demographic data (age, sex) and clinical variables were collected, including: family history of neurodevelopmental or psychiatric disorders in first- or second-degree relatives; ADHD presentation type (inattentive, hyperactive or combined); neurodevelopmental comorbidities; reason for ED visit; and presence of any underlying medical condition.

An underlying condition was defined as any previously diagnosed pathology that could potentially lead to increased ED utilization. Recurrent acute otitis media (AOM) was defined as at least three episodes within six months or a minimum of four episodes within twelve months, with at least one occurring in the past six months. Recurrent urinary tract infection (UTI) was defined as at least two episodes of pyelonephritis, or one episode of pyelonephritis plus at least one episode of cystitis,

or a minimum of three episodes of cystitis. Asthma and other pathologies were considered based on preexisting diagnoses documented in the electronic medical records.

Two specific reasons for ED visits were analyzed: anxiety (defined as children who received a diagnosis of anxiety/anxiety state/anxiety crisis upon ED discharge) and pain complaints of undefined etiology (defined as children whose ED visit was coded with this diagnosis in the electronic medical record). This latter symptom was selected not only due to its reported association with ADHD, but also based on the authors' clinical perception of high ED utilization for such complaints among children with neurodevelopmental disorders.⁽¹⁰⁻¹²⁾ Pain complaints without a defined cause included any type of pain that could not be attributed to a specific diagnosis (e.g., abdominal pain not caused by constipation, acute gastroenteritis, or surgical pathology).

Statistical analysis was performed in accordance with the characteristics of the data. The normality of variables was assessed prior to selecting the appropriate statistical tests. Due to overdispersion in the data, a negative binomial regression was employed to compare the incidence rate (IR) of ED visits for medical conditions between the ADHD and control groups. The incidence rate ratio (IRR) was calculated to determine the relative risk of disease-related ED episodes in the ADHD group compared to controls.

To evaluate the effect of different ADHD presentation types on the proportion of ED visits from age six onward, an analysis of covariance (ANCOVA) was conducted. The dependent variable was the IR of disease-related ED episodes. Age was used as a covariate in all IR comparisons to control for potential age-related effects. In regression models, $\log(\text{age})$ was used instead of age to account for potential non-linear relationships between age and disease incidence. This transformation was chosen to stabilize variance and improve model fit, providing a more accurate representation of the relationship between age and the likelihood of disease-related ED visits.

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS), version 29 (IBM Corp., Armonk, NY, USA), with statistical significance set at $p < 0.05$.

RESULTS

The sample included 316 cases and 316 controls. The mean age of the ADHD group was 11.9 years (standard deviation = 2.4), with 66.5% male participants, with no statistically significant differences compared to the control group. The characteristics of both groups are presented in **Table 1**.

Within the ADHD group, the most frequent presentation type was combined (48.4%), followed by inattentive (40.8%); 40.2% had a family history of neurodevelopmental or psychiatric disorders.

The prevalence of underlying medical conditions was significantly higher in the ADHD group ($n = 63$; 19.9%) compared to the control group ($n = 14$; 4.4%) ($p < 0.001$). Among

the 63 children with ADHD and an identified comorbid organic condition, 42 (66.7%) had asthma; 14 (22.2%) had recurrent AOM; 2 (3.2%) had recurrent UTI; 2 (3.2%) had migraines; 1 (1.6%) had obliterative bronchiolitis; 1 (1.6%) had a congenital heart defect; and 1 (1.6%) had cerebral palsy. In the control group, asthma was identified in 10 children, recurrent UTI in 3, and recurrent AOM in 1 child.

Over the study period, the ADHD group recorded 1086 ED visits for medical conditions, while the control group had a total of 653 visits. A statistically significant difference was found in the number of ED visits for medical reasons between the two groups, with an IRR of 1.67 ($p<0.001$) (**Table 2**).

Although children with ADHD used the ED more frequently, there was no significant difference in return visits for the same illness episode (IR of 1.60/100 person-years in the ADHD group vs. 1.25/100 person-years in the control group; $p=0.171$).

In a secondary analysis excluding children with other underlying medical conditions (described above) from both groups, the ADHD group ($n = 253$) still exhibited higher ED utilization, with a total of 661 episodes compared to 543 episodes in the control group ($n = 302$), yielding an IRR of 1.45 ($p=0.001$) (**Table 2**).

Regarding the reasons for ED visits, episodes related specifically to anxiety symptoms were analyzed: the ADHD group accounted for 11 such visits, whereas the control group had 1, resulting in an IRR of 11.01 ($p=0.022$). Similarly, there was a statistically significant difference in ED visits for

pain complaints of undefined etiology (including headaches, abdominal pain, and chest pain), with the ADHD group accounting for 32 visits and the control group for 4 (IRR 8.33; $p<0.001$).

The average frequency of a green triage category (non-urgent) was similar between the two groups (30.8% in the ADHD group vs. 30.4% in the control group). However, yellow (urgent) and orange (very urgent) triage categories showed statistically significant differences between groups ($p<0.001$). Triage data are presented in **Table 3**.

In 58.5% of ED visits by children with ADHD, complementary diagnostic procedures were required, with no statistically significant difference compared to the control group (52.0%; $p=0.130$). Likewise, no significant difference was found regarding the need for hospitalization ($p=0.355$).

Most children with ADHD ($n = 170$; 53.8%) had other neurodevelopmental comorbidities, with the most frequent being specific learning disorders (18.0%) and language disorders (15.0%). The presence of these comorbidities was associated with greater ED utilization for medical reasons (IR 31.5 episodes/100 person-years), with a significant difference compared to children without comorbidities (IR 26.9 episodes/100 person-years; $p=0.01$).

No statistically significant difference was found among the three ADHD presentation types ($p=0.565$), with ED visit IR of 25.7 episodes/100 person-years for the inattentive type, 38.4 for the hyperactive type, and 30.0 for the combined type.

Table 1 - Demographic and clinical characteristics of the study sample.

	ADHD Group (N = 316)	Control Group (N = 316)
Age (years), mean (SD)	11.9 (SD 2.4)	11.9 (SD 2.4)
Male sex, n (%)	210 (66.5%)	210 (66.5%)
ADHD presentation, n (%)		
- Combined	153 (48.4%)	NA
- Inattentive	129 (40.8%)	NA
- Hyperactive/Impulsive	33 (10.4%)	NA
- Not reported	1 (0.3%)	NA
Family history of neurodevelopmental/psychiatric disorders, n (%)	127 (40.2%)	NA
Neurodevelopmental comorbidities, n (%)	170 (53.8%)	NA
Underlying medical conditions, n (%)	63 (19.9%)	14 (4.4%)

Legend: ADHD: Attention-deficit/hyperactivity disorder; NA: Not applicable; SD: Standard deviation.

Table 2 - Emergency Department visits for the ADHD and control groups.

	Total Sample		Sample excluding children with underlying medical conditions	
	ADHD Group	Control Group	ADHD Group	Control Group
Number of children	316	316	253	302
Number of ED visits	1086	653	661	543
IRR	1.67		1.45	
p-value	p<0.001		p=0.001	

Legend: ADHD: Attention-deficit/hyperactivity disorder; ED: Emergency Department; IRR: Incidence rate ratio

Table 3 - Triage levels of Emergency Department visits in the ADHD and control groups.

Triage	ADHD Group	Control Group	p-value
% Green (non-urgent)	30.8%	30.4%	p=0.379
% Yellow (urgent)	22.8%	14.6%	p<0.001
% Orange (very urgent)	4.7%	2.7%	p<0.001

Legend: ADHD: Attention-deficit/hyperactivity disorder

DISCUSSION

The results revealed that children with ADHD utilize ED service for medical reasons more frequently than a control group without ADHD.

Moreover, these children presented a higher prevalence of underlying medical conditions, such as asthma and recurrent AOM. These findings support and expand upon the existing literature suggesting an association between ADHD and an increased incidence of medical comorbidities, particularly of infectious and inflammatory conditions.^(7,8,13)

There is a well-documented association between ADHD and chronic inflammatory conditions such as asthma, likely related to the immune dysregulation characteristic of this disorder.^(13–14) A recent meta-analysis further suggests that atopic disease is implicated in the severity of ADHD.⁽¹⁵⁾

The present study demonstrates that even after excluding children with ADHD who also have medical comorbidities, a higher rate of ED utilization persists in the ADHD group compared to the control group. This suggests that the increased frequency of ED visits is not solely attributable to the presence of chronic medical conditions. Additionally, children with ADHD were more likely to seek emergency care for

anxiety-related symptoms than their non-ADHD counterparts. Similar findings have been reported in the literature, with several authors noting that psychiatric comorbidities such as anxiety and depression contribute to increased healthcare utilization among children with ADHD, resulting in healthcare costs approximately 3.5 times higher than for children with ADHD without psychiatric comorbidities.^(6,7)

On one hand, the increased healthcare utilization may be driven by acute infectious diseases, potentially resulting from the inflammatory and immunological alterations associated with ADHD.^(9,16) On the other hand, core ADHD symptoms such as impulsivity and inattention may contribute to lower adherence to preventive health measures, leading to greater exposure to infectious agents.^(17–20) Some authors suggest that these core symptoms may hinder compliance with basic infection control practices, such as proper hand hygiene and social distancing.^(17–18,20) Treatment with methylphenidate, by improving core ADHD symptoms, appears to enhance self-regulation and thus promote adherence to preventive behaviors, reducing infection risk.^(17,19)

Furthermore, caregivers of children with ADHD often experience heightened parental concern, which may lead to more frequent use of healthcare services, even for non-

severe conditions.⁽²¹⁾ A 2010 study involving 2965 adolescents estimated that approximately 30.0% of annual ED visits by children with ADHD could be considered avoidable.⁽²²⁾

Despite the high frequency of ED visits and more urgent triage classifications compared to the control group, children with ADHD did not present with more severe episodes requiring complementary diagnostic tests ($p=0.130$) or hospitalization ($p=0.355$). However, other studies have reported a higher need for hospitalization due to infectious diseases in children with ADHD compared to control groups.^(19,23) Pharmacological treatment with psychostimulants may reduce the overutilization of healthcare services for infectious pathology in this patient population, for the reasons previously outlined.⁽¹⁹⁾

These findings underscore the need for an integrated approach in the care of children with ADHD, which should consider not only neuropsychiatric symptoms, but also general physical health. Healthcare professionals must remain vigilant to the possibility of organic comorbidities, particularly infectious diseases, and should establish preventive strategies accordingly.

Parental and caregiver education on the importance of preventive health measures and regular outpatient follow-up may improve adherence to medical treatment and healthy behaviors. Furthermore, greater integration between pediatric care and mental health services is essential for this population.^(7,21)

Although this study highlights important points, some limitations must be acknowledged. The data were collected from a single hospital, limiting the inclusion of ED visits occurring at other healthcare facilities. Additionally, the findings rely on available medical records, which may introduce information bias. Factors beyond the ADHD diagnosis itself, such as caregiver education level and access to primary healthcare services, may also influence ED utilization. Future longitudinal studies are needed to investigate in greater depth the reasons for ED use among children with ADHD, as well as the underlying causes for the association between ADHD and the increased prevalence of organic pathology.

The literature suggests that parent training programs can yield positive outcomes in the functioning of children with ADHD, adherence to pharmacological treatment, and family management of behavioral symptoms associated with the disorder.^(24–26) To date, no studies have evaluated the impact of such interventions on healthcare utilization by children with ADHD, and it would be valuable to investigate whether parent education programs can contribute to reduced ED usage. It is also relevant to explore whether therapeutic interventions that enhance emotional and behavioral regulation in children with ADHD could reduce their vulnerability to infectious diseases and assist both children and parents in managing acute illness episodes.

Support from primary healthcare services (PHC) could decrease ED visits for less severe situations, preventing overcrowding in hospital services and improving the quality

of care provided to patients with more serious conditions. Additionally, PHC involvement would allow these children to be seen by their regular physician, who is familiar with the family context and can provide more individualized support.⁽²⁷⁾

Thus, the findings reinforce the importance of a multidisciplinary approach in managing patients with ADHD. It is considered that, when necessary, ADHD may be partially addressed during acute care consultations, just as the medical comorbidities of these children could be monitored during neurodevelopmental follow-up appointments.⁽²⁸⁾ Family physicians and developmental pediatricians play a central role in the prevention of medical, somatic, and psychiatric comorbidities that may prompt ED visits among this population.⁽²⁸⁾

CONCLUSION

As described in the literature, this study reinforces the association between ADHD and increased utilization of ED for illness. Even after excluding children with underlying medical conditions from the ADHD group, this difference remained significant.

Despite being triaged as more urgent, children with ADHD did not show a higher need for complementary diagnostic tests or hospitalization. These findings highlight the importance of a multidisciplinary approach that integrates both physical and mental health in the clinical management of children with ADHD.

As one of the first studies on this topic in Portugal, it may serve as a starting point for future research and for the development of strategies to reduce ED overutilization, as well as to improve outpatient care for these patients and their families. Further studies to more precisely identify the reasons for ED use, evaluate seasonal patterns, and understand the relationship between treatment adherence and ED visits in children with ADHD will be essential to ensure more effective and targeted management.

AUTHORSHIP

Mariana Bravo - conceptualization; data curation; methodology; writing – original draft; supervision

Diana Valbom Gonçalves - data curation; writing – original draft

Tomás Ferrão - data curation, methodology; formal analysis; writing – review & editing

Catarina Rodrigues - data curation; writing – original draft

Raquel Zenha - validation; supervision; writing – review & editing

Sandra Rebimbas - project administration; visualization; supervision; writing – review & editing

REFERENCES

1. Danielson ML, Claussen AH, Bitsko RH, Katz SM, Newsome K, Blumberg SJ, *et al.* ADHD Prevalence Among U.S. Children and Adolescents in 2022: Diagnosis, Severity, Co-Occurring Disorders, and Treatment. *J Clin Child Adolesc Psychol.* 2024;53(3):343–60.
2. Sayal K, Prasad V, Daley D, Ford T, Coghill D. ADHD in children and young people: prevalence, care pathways, and service provision. *The Lancet Psychiatry.* 2018;5(2):175–86.
3. Chen VCH, Yang YH, Yu Kuo T, Lu ML, Tseng WT, Hou TY, *et al.* Methylphenidate and the risk of burn injury among children with attention-deficit/hyperactivity disorder. *Epidemiol Psychiatr Sci.* 2020.
4. Altun H, Altun İ. Risk of mild head injury in preschool children: Relationship to attention deficit hyperactivity disorder symptoms. *Child's Nerv Syst.* 2018;34(7):1353–9.
5. Wiener RC, Waters C, Bhandari R, Shockey AKT. Healthcare utilization and morbidity among adolescents with ADHD in children aged 11-17 years, NHIS, 2017. *Child Dev Res.* 2019.
6. Schein J, Cloutier M, Gauthier-Loiselle M, Bungay R, Chen K, Chan D, *et al.* Healthcare resource utilization and costs associated with psychiatric comorbidities in pediatric patients with attention-deficit/hyperactivity disorder: a claims-based case-cohort study. *Child Adolesc Psychiatry Ment Health.* 2024;18(1):1–10.
7. Merrill RM, Merrill AW, Madsen M. Attention-Deficit Hyperactivity Disorder and Comorbid Mental Health Conditions Associated with Increased Risk of Injury. *Psychiatry J.* 2022;2022:1–9.
8. Pan PY, Bölte S. The association between ADHD and physical health: a co-twin control study. *Sci Rep.* 2020;10(1):1–13.
9. Chen MH, Su TP, Chen YS, Hsu JW, Huang KL, Chang WH, *et al.* Comorbidity of Allergic and Autoimmune Diseases Among Patients With ADHD: A Nationwide Population-Based Study. *J Atten Disord.* 2017;21(3):219–27.
10. Mundal I, Schei J, Lydersen S, Thomsen PH, Nøvik TS, Kvitland LR. Prevalence of chronic and multisite pain in adolescents and young adults with ADHD: a comparative study between clinical and general population samples (the HUNT study). *Eur Child Adolesc Psychiatry.* 2024;33(5):1433–42.
11. Merzon E, Magen E, Levy Y, Ashkenazi S, Manor I, Weizman A, *et al.* Pain-Associated Diagnoses in Childhood Before the Diagnosis of Attention-Deficit/Hyperactivity Disorder: A Population-Based Study. *Children.* 2024;11(11):1–10.
12. Berggren SS, Bergman S, Almquist-Tangen G, Dahlgren J, Roswall J, Malmberg JS. Frequent Pain is Common Among 10-11-Year-Old Children with Symptoms of Attention Deficit Hyperactivity Disorder. *J Pain Res.* 2024;17(November):3867–79.
13. Boemanns L, Staab J, Meyer T. Associations of attention-deficit/hyperactivity disorder with inflammatory diseases. Results from the nationwide German Health Interview and Examination Survey for Children and Adolescents (KiGGS). *Neuropsychiatrie.* 2023.
14. Cortese S, Sun S, Zhang J, Sharma E, Chang Z, Kuja-Halkola R, *et al.* Association between attention deficit hyperactivity disorder and asthma: a systematic review and meta-analysis and a Swedish population-based study. *The Lancet Psychiatry.* 2018;5(9):717–26.
15. Chuang YC, Wang CY, Huang WL, Wang LJ, Kuo HC, Chen YC, *et al.* Two meta-analyses of the association between atopic diseases and core symptoms of attention deficit hyperactivity disorder. *Sci Rep.* 2022;12(1):1–18.
16. Zhou RY, Wang JJ, Sun JC, You Y, Ying JN, Han XM. Attention deficit hyperactivity disorder may be a highly inflammation and immune-associated disease (review). *Mol Med Rep.* 2017;16(4):5071–7.
17. Li DJ, Chen YL, Hsiao RC, Chen HL, Yen CF. Risk of respiratory infectious diseases and the role of methylphenidate in children with attention-deficit/hyperactivity disorder: A population-based cohort study. *Int J Environ Res Public Health.* 2021;18(11).
18. Pollak Y, Shoham R, Dayan H, Gabrieli-Seri O, Berger I. Symptoms of ADHD Predict Lower Adaptation to the COVID-19 Outbreak: Financial Decline, Low Adherence to Preventive Measures, Psychological Distress, and Illness-Related Negative Perceptions. *J Atten Disord.* 2022;26(5):735–46.
19. Chen VCH, Kao KL, Chen YL, Wu SI, Lee MJ, Gossop M. Methylphenidate Use and Infectious Diseases in Children With Attention Deficit and Hyperactivity Disorder: A Population-Based Study. *Front Med.* 2022;8(February):1–10.
20. Haag K, Du Toit S, Mikus N, Skeen S, Steventon Roberts K, Marlow M, *et al.* Does pre-COVID impulsive behaviour predict adherence to hygiene and social distancing measures in youths following the COVID-19 pandemic onset? Evidence from a South African longitudinal study. *BMC Public Health.* 2023;23(1):1–12.
21. Biederman J, Petty CR, Clarke A, Lomedico A, Faraone S V. Predictors of persistent ADHD: An 11-year follow-up study. *J Psychiatr Res.* 2011;45(2):150–5.
22. Lynch S, Bautista M, Freer C, Kalynych C, Cuffe S, Hendry P. Toward Effective Utilization of the Pediatric Emergency Department: The Case of ADHD. *Soc Work Public Health.* 2016;31(1):9–18.
23. Silva D, Colvin L, Hagemann E, Stanley F, Bower C. Children diagnosed with attention deficit disorder and their hospitalisations: population data linkage study. *Eur Child Adolesc Psychiatry.* 2014;23(11):1043–50.
24. Dixon JF, Akins R, Miller E, Breslau J, Gill S, Bisi

- E, *et al.* Changing Parental Knowledge and Treatment Acceptance for ADHD: A Pilot Study. *Clin Pediatr.*2023;62(4):301–8.
25. Zwi M, Jones H, Thorgaard C, York A, Dennis JA. Parent training interventions for attention deficit hyperactivity disorder. *Cochrane Database Syst Rev.* 2009;(3).
26. Sugaya LS, Salum GA, de Sousa Gurgel W, de Moraes EM, Del Prette G, Pilatti CD, *et al.* Efficacy and safety of methylphenidate and behavioural parent training for children aged 3–5 years with attention-deficit hyperactivity disorder: a randomised, double-blind, placebo-controlled, and sham behavioural parent training-controlled trial. *Lancet Child Adolesc Heal.* 2022;6(12):845–56.
27. Weed ED. ADHD in school-aged youth: Management and special treatment considerations in the primary care setting. *Int J Psychiatry Med.* 2016;51(2):120–36.
28. Muskens JB, Velders FP, Staal WG. Medical comorbidities in children and adolescents with autism spectrum disorders and attention deficit hyperactivity disorders: a systematic review. *Eur Child Adolesc Psychiatry.* 2017;26(9):1093–103.

CORRESPONDENCE TO

Mariana Bravo
Department of Pediatrics
Hospital Pediátrico de Coimbra
Unidade Local de Saúde de Coimbra
Avenida Afonso Romão
3000-602 Coimbra
Email: marianacrfb@gmail.com

Received for publication: 01.08.2025
Accepted in revised form: 04.12.2025