

Jacyra Azevedo Paiva de Araújo<sup>1</sup>  
<https://orcid.org/0000-0002-8258-8244>

Elisângela da Silva Rodrigues<sup>1,2</sup>  
<https://orcid.org/0000-0003-1207-5731>

Luis Fernando Silva  
 Castro-de-Araujo<sup>1,3</sup>  
<https://orcid.org/0000-0002-0952-5052>

Daiane Borges Machado<sup>1,4</sup>  
<https://orcid.org/0000-0003-2959-4650>

Maurício L. Barreto<sup>1,5</sup>  
<https://orcid.org/0000-0002-0215-4930>

# Use of routine health records to study mental health care of Brazilian children

*Assistência à saúde mental de crianças brasileiras utilizando dados ambulatoriais*

DOI: 10.1590/0047-2085000000385

## ABSTRACT

**Objective:** To investigate the clinical epidemiological characteristics of a large data set of visits to outpatient children mental health services in Brazil, as well as to identify relevant relationships between age, sex and three common mental disorders in childhood: pervasive developmental disorders, ADHD, and mild depressive disorders. **Methods:** We extracted data from the Ambulatorial Information System (SIA) part of a public repository, Datasus, regarding child outpatient mental health services in Brazil, from 2008 to 2012. We performed an analysis of the number of visits per one hundred thousand inhabitants and further analyses with logistic regressions for ADHD (F90.0), Pervasive Developmental Disorders (F84.0-F84.9), and Mild Depressive Episode (F32.0) as outcomes, controlling for age, year of the visit, number of new CAPSI stratified by region. **Results:** Attention-deficit hyperactivity disorder (ADHD) was the most common condition identified across the country. The analyses by region showed a high number of visits due to mental retardation in the Northeast and depressive episodes in the South. Regressions showed that older children are less likely to visit outpatient services with a diagnosis of ADHD (F90.0). **Conclusions:** Our analysis shows the conditions which cause the most burden to the child psychiatry outpatient centers in Brazil and relevant differences between regions. This information has immediate use for the training of staff and allocation of resources in each region.

## KEYWORDS

Epidemiology, child psychiatry, Datasus, routine records.

## RESUMO

**Objetivo:** Investigar as características clínico-epidemiológicas, em uma grande base de dados, dos atendimentos ambulatoriais em saúde mental de crianças no Brasil e identificar relações relevantes entre idade, sexo e três transtornos mentais comuns na infância: transtorno invasivo do desenvolvimento, distúrbio da atividade e da atenção e transtorno depressivo leve. **Métodos:** Extraímos dados públicos de atendimento ambulatorial de crianças no Brasil, oriundos do Sistema de Informação Ambulatorial (SIA), parte do sistema Datasus, de 2008 a 2012. Realizamos análises das taxas de atendimento por 100 mil habitantes e análises posteriores, com regressões logísticas, para transtorno de atenção e hiperatividade (F90.0), transtorno pervasivo do desenvolvimento (F84.0-F84.9) e transtorno depressivo leve (F32.0), controlando por idade e ano da consulta, e estratificando por região. **Resultados:** Transtorno de atenção e hiperatividade foi a condição que mais gerou consultas em todo o país. Analisando por região, encontramos uma taxa elevada de visitas por retardo mental na região Nordeste e episódios depressivos leves na região Sul. As regressões mostraram que crianças mais velhas tinham menos probabilidade de ser consultadas por transtorno da atividade e da atenção (F90.0). **Conclusões:** Nossas análises mostram os padrões das condições psiquiátricas que geram maior demanda nos serviços ambulatoriais de atendimento em psiquiatria infantil e as significativas diferenças regionais. Essas informações podem subsidiar agentes administrativos na tomada de decisão sobre alocação de recursos e treino de equipes em cada região.

## PALAVRAS-CHAVE

Epidemiologia, psiquiatria infantil, Datasus, dados de rotina.

Received in: May/5/2021. Approved in: Jun/14/ 2022.

1 Center of Data and Knowledge Integration for Health (CIDACS), Salvador, BA, Brazil.

2 Federal University of Ceará, Campus Jardins de Anita, Itapajé, CE, Brazil.

3 University of Melbourne, Department of Psychiatry, Austin Health, Heidelberg, VIC, Australia.

4 Mental Health For All Lab, Harvard Medical School, Boston, MA, EUA.

5 Institute of Collective Health, Federal University of Bahia, Salvador, BA, Brazil.

**Address for correspondence:** Luis Fernando Silva Castro-de-Araujo. Center of Data and Knowledge Integration for Health (CIDACS), Rua Mundo, 121 – 41301-110 – Salvador, BA, Brazil. E-mail: ldearaujo@unimelb.edu.au



## INTRODUCTION

Mental disorders in children are frequent and require highly specialised treatment. The worldwide prevalence of any mental disorder in the youth ranges between 13%-20%<sup>1</sup>. Prompt diagnosis and early intervention are important to prevent chronification and other negative outcomes. In Brazil, the majority of children and adolescents with mental health issues are treated in public outpatient services. However, there are signs that the system is insufficient when it comes to children's mental health, as a previous study in Brazil found that only 19.8% of children/adolescents with a psychiatric disorder have used mental health services in the previous 12 months<sup>2</sup>. Psychiatric, psychological, and educational interventions are fundamental to improve the course of these disorders<sup>3</sup>.

The foundational work on the epidemiology of child mental health in Brazil was done by Almeida-Filho (1982). He found that 23% of children in a middle class neighborhood in Salvador, Brazil had a mental disorder<sup>4</sup> using the Child Psychiatric Morbidity Questionnaire (QMPI)<sup>5,6</sup>. However, the burden of these disorders in the Universal Health system are much less known. Later work found a prevalence of 18% in Ribeirão Preto, using the Strengths and Difficulties Questionnaire (SDQ)<sup>7</sup>; 12.7% in Taubaté<sup>8</sup>; and 13.5% in Pelotas<sup>9</sup>. Therefore, reports of prevalence were much lower than in Almeida-Filho (1982). Ceballos *et al.* (2019) were the first to assess the frequencies of psychiatry disorders at Psychosocial Centers for Children and Adolescents (CAPSi) in Brazil, however, their work dealt with the absolute number of visits<sup>10</sup>. Also, Fatori *et al.* (2019) reported that 81% of children with mental disorders from schools in São Paulo and Porto Alegre had had no prior treatment, pointing to problems in the access to mental health services in this age strata<sup>11</sup>.

Ceballos *et al.* (2019) reported that Behavioral and Emotional Disorders with Onset Usually Occurring in Childhood and Adolescence from zero to 19 years old (29.7%, F90-98), including ADHD, and Disorders Of Psychological Development (23.6%, F80-89), including autism spectrum disorders, were the most frequent conditions encountered at CAPSi. They reported frequencies without taking into account the variation in the population of the five Brazilian regions, which hinders comparisons between them. Furthermore, Fatori *et al.* (2019) assessed emotional disorders (mood and anxiety disorders) from the Brazilian High Risk Cohort Study using school-attending children between 6 and 12 years of age in São Paulo-SP and Porto Alegre-RS (two large cities in richer areas of the country). They analysed all the children of the cohort that met criteria for at least one mental disorder assessed with the Development and Well-Being Assessment instrument. They found that among children diagnosed with emotional disorders, 18.9% received treatment and 81.1% did not receive treatment. They also reported that

anxiety disorders, disruptive behaviour disorder, ADHD, and depressive disorders were the most common conditions.

Mental disorders in children are an important problem, and little is known with regard to the conditions that are the largest burden to children's mental health services in Brazil. Our objective in this paper is to describe the epidemiological characteristics of a large data set with visits to the outpatient children mental health services in Brazil, as well as to evaluate the most frequent diagnoses.

## METHODS

This study is a cross-sectional analysis but includes a description of the longitudinal trends of visits stratified by region. Data from outpatient services in Brazil were used to analyse the profiles of subjects 17 years of age or below who visited the mental health services in the country. This extraction was previously performed for a similar previous paper on elderly Brazilian subjects<sup>12</sup>. A total amount of 1,055,891 of the 1,120,141 pulled records (94%) were from CAPSi and the other 6% came from other outpatient services. Each observation (visit) had a diagnosis coded with the International statistical classification of diseases (ICD-10) categories<sup>13</sup>. It is important to note that although we usually classify CAPSi as an outpatient service, some patients are followed in a Day Hospital style while others have less frequent visits.

## Data sources

All the data used was processed, anonymized and shared online by Datasus ([www2.datasus.gov.br](http://www2.datasus.gov.br)) and we extracted them using the steps described below. Datasus is a public data repository maintained by the Brazilian government, we used the dataset from SIA (Ambulatorial Information System). It is important to note that the routine health data we used (APACS) does not discriminate return visits and first visits.

The number of inhabitants used was obtained from the census data. The Brazilian census is carried out by the Brazilian Bureau of Statistics (IBGE) every 10 years, available on the Datasus website. For the intermediary years, we used the "projection of the population in the unities of the Federation by sex and age groups: 2000-2030" by IBGE ([www.ibge.gov.br](http://www.ibge.gov.br)). The number of CAPSi that were opened in each region during the study period was extracted from the *Cadastro Nacional de Estabelecimentos de Saúde* (CNES) database ([cnes2.datasus.gov.br](http://cnes2.datasus.gov.br)) for each month and added to the total for the year.

## Data extraction

Until 2012, each visit to the outpatient mental health services generated a report that was often filled in by administrative staff. These are called high-complexity procedure authorizations (*Autorização de Procedimentos de Alta Complexidade* – APACs). Information from APACs was

extracted under the service area in the file transfer option. The files can be retrieved within the Outpatient Information System link, under the name miscellaneous AD-APAC reports (“AD-APAC *laudos diversos*”).

This data is made publicly available online by the Brazilian Ministry of Health, so there was no need for ethics approval for this project. Data management, import and analyses were fully performed using R environment version 3.5.1 (<https://cran.r-project.org/>). After data extraction and subsetting subjects younger than 18 years, the final number of observations was 1,120,141.

### Rates and association analyses

The analytic strategy of this work included a few steps. In order to improve what has been published regarding visits to CAPSi and to facilitate comparisons between regions, we not only presented total visits (Figure 1), but also generated rates of visits per inhabitants. This information is presented in table 1 stratified by region and in figure 2. The second step was to assess diagnostic differences across regions. For this, we performed pairwise comparisons of the proportions of diagnostic blocks (ICD-10) between regions (Table 1). The last step consisted in evaluating trends between some diagnosis of interest in terms of age and sex, for this we performed a series of linear regressions.

Sociodemographic data for each region is reported in table 1, comparisons between regions were performed using chi-square contingency table tests. The number of visits to the outpatient services by one hundred thousand inhabitants was calculated using the Brazilian census data for each year and for the five regions by main ICD-10 blocks (Table 1, second part)<sup>13</sup> Furthermore, we calculated frequencies of block of disorders per diagnosis, and performed ANOVA pair-wise post-hoc comparisons between pairs of regions, also reported in table 1 and Supplementary Material.

Logistic regressions were performed as a means to identify trends in the data. Three outcomes were used: Pervasive Developmental Disorders (F84.0-F84.9), mild depressive episode (F32.0) and Disturbance of activity and attention (F90.0). The reference variable was age stratified in quartiles (0-8, 8-12, 12-15, 15-17). Sex and number of new CAPSi over the period were used as controls. This was necessary because numerous new CAPSi were opened across the country during the period of this study. Except for the Central-West region, where only two new were opened from 2008 to 2012, so this variable was not included in the model for this region. A model was fitted for each Brazilian region. Model estimates are reported in figures 3, 4 and 5 as average marginal effect (AME), which is interpreted slightly differently from an odds ratio. AME is the increase in probability for each unit increase in the outcome. Model

parameters are provided in the Supplementary material. The level of significance considered for all analyses was 0.05.

## RESULTS

Main descriptive statistics can be found in table 1. The frequency of the disorders was calculated for each Brazilian region. Males paid more visits to outpatient services in Brazil overall (Figures 1 and S2).

The most common condition that led to a visit to an outpatient service was attention deficit hyperactivity disorder (ADHD) and it was more common among males (Figure 2). Table S1 shows the rate of disorders (per 100,000 inhabitants) by digit for the entire period (2008-12), some notable regional differences were: (A) hypomanic episodes were much more frequent in the South (1.42/100,000) than in other regions; (B) Mild and Moderate depressive episodes were more frequent in the South (respectively 28.01 and 11.92/100,000); (C) Childhood autism presented higher rates in the Southeast (38.12/100,000); and (D) ADHD had much higher rates in the Central-West (69.4/100,000).

Temporal trends within each region can be found in figure 2. Of note is the growing rate of visits due to mental retardation in the Northeast region until 2011. The geographic distribution pattern for the year 2012 can be seen in figure 6. The highest rates of ADHD (F90.0) were found in the Central-West area of Brazil (A), the highest levels of Childhood autism (F84.0) in the Southeast (B) and the highest levels of mild depressive episodes (F32.0) in the South (C).

According to our findings, males had higher risk of presenting ADHD at the visit. The younger the child, the higher the probability of receiving this diagnosis. For each unit change in this outcome in the Central-West, there was a 25% reduction in the probability of children between 15-17 years visiting to the outpatient services. In the same region, there was a 12% probability increase in males (Figure 3).

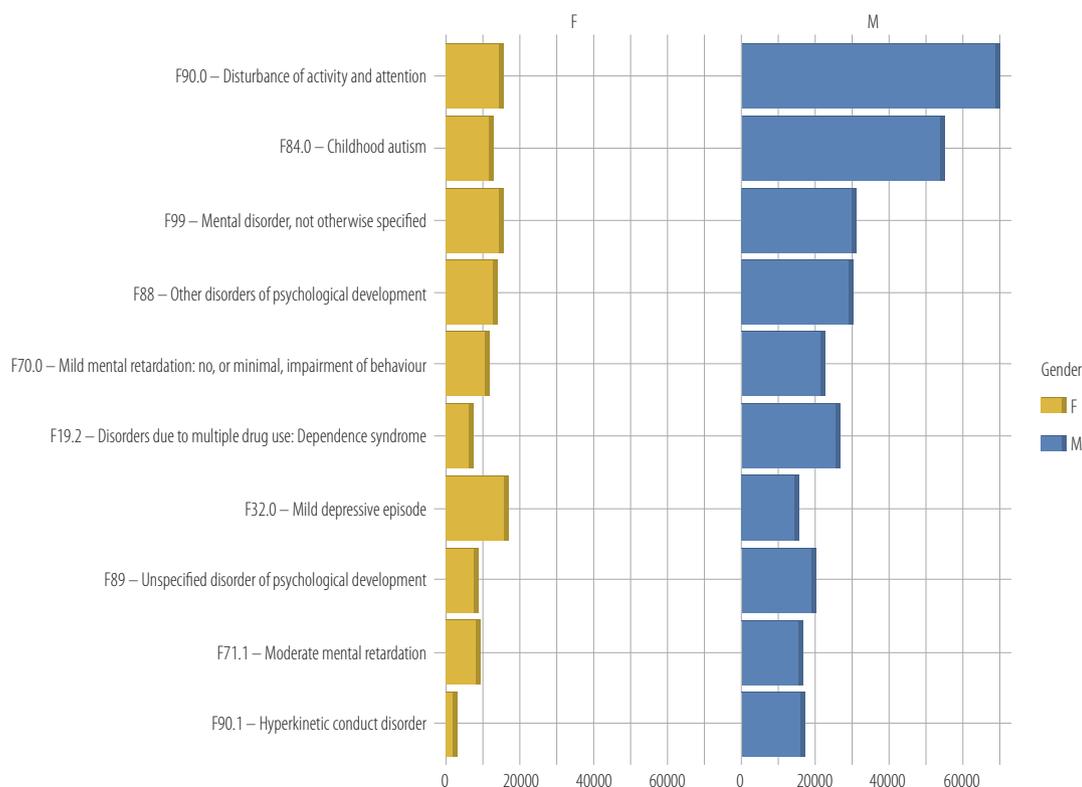
The entire block of pervasive developmental disorders was used due to the dimensional nature of autism<sup>14-16</sup> (Figures 3, 4 and 5). A higher risk in males was found for this diagnosis, and a more stable reduced risk in all ages above 8 years. Older children (15-17) in the Southeast had a probability reduction of 16% for each unit change in the outcome (Figure 4).

Finally, being male was associated with a lower chance of presenting mild depressive episodes in an outpatient visit across all regions, and a small probability increase in children above eight years of age. In the North, children between 15-17 years had a 5% probability rise for each unit change in the outcome (Figure 5).

**Table 1.** Main demographics and visits per 100,000 inhabitants for each diagnostic block (ICD-10)

	Central-West	North	Northeast	Southeast	South	Brazil	p
n	58800	33603	390898	396288	240552	1120141	
Age (%)							<0.001
[0,8]	291851 (26.1)	16263 (27.7)	8511 (25.3)	113622 (29.1)	105685 (26.7)	47770 (19.9)	
(8,12]	336842 (30.1)	18583 (31.6)	8925 (26.6)	113471 (29.0)	118830 (30.0)	77033 (32.0)	
(12,15]	278654 (24.9)	13683 (23.3)	7969 (23.7)	90773 (23.2)	97576 (24.6)	68653 (28.5)	
(15,17]	212794 (19.0)	10271 (17.5)	8198 (24.4)	73032 (18.7)	74197 (18.7)	47096 (19.6)	
Sex = M (%)	40774 (69.3)	20545 (61.1)	254108 (65.0)	276307 (69.7)	162073 (67.4)	753807 (67.3)	<0.001
Race/colour (%)							<0.001
Indigenous	28 (0.0)	20 (0.1)	70 (0.0)	35 (0.0)	84 (0.0)	237 (0.0)	
Mixed/Pardo	17293 (29.4)	14716 (43.8)	128362 (32.8)	58449 (14.7)	8533 (3.5)	227353 (20.3)	
NA	22832 (38.8)	16538 (49.2)	217242 (55.6)	186592 (47.1)	121753 (50.6)	564957 (50.4)	
White	11994 (20.4)	1325 (3.9)	32403 (8.3)	128184 (32.3)	100779 (41.9)	274685 (24.5)	
<b>Main ICD-10 blocks</b>							
F00-F09 Organic, Including Symptomatic, Mental Dis.	257 (0.4)	1682 (5.0)	9091 (2.3)	1292 (0.3)	439 (0.2)	12761 (1.1)	
F10-F19 Mental And Behav. Dis. Due To Substance Use	8262 (14.1)	1917 (5.7)	16229 (4.2)	42985 (10.8)	30279 (12.6)	99672 (8.9)	
F20-F29 Schizophrenia, Schizotypal And Delusional Dis.	2452 (4.2)	7045 (21.0)	33343 (8.5)	30065 (7.6)	10707 (4.5)	83612 (7.5)	
F30-F39 Mood [Affective] Dis.	6079 (10.3)	6573 (19.6)	27537 (7.0)	33437 (8.4)	40683 (16.9)	114309 (10.2)	
F40-F48 Neurotic, Stress Related And Somatoform Dis.	5026 (8.5)	3559 (10.6)	39520 (10.1)	33403 (8.4)	34462 (14.3)	115970 (10.4)	
F50-F59 Behav. Synd. Assoc. w/ Physical Factors	2176 (3.7)	210 (0.6)	5679 (1.5)	1767 (0.4)	2091 (0.9)	11923 (1.1)	
F60-F69 Dis. Of Adult Personality And Behaviour	121 (0.2)	185 (0.6)	1436 (0.4)	516 (0.1)	652 (0.3)	2910 (0.3)	
F70-F79 Mental Retardation	3926 (6.7)	5149 (15.3)	99057 (25.3)	33615 (8.5)	13574 (5.6)	155321 (13.9)	
F80-F89 Dis. Of Psychological Development	6593 (11.2)	1317 (3.9)	60866 (15.6)	102940 (26.0)	37032 (15.4)	208748 (18.6)	
F90-F98 Behavioural Dis. With Onset In Childhood	23141 (39.4)	5421 (16.1)	84309 (21.6)	94375 (23.8)	61196 (25.4)	268442 (24.0)	
F99 Unspecified Mental Dis.	767 (1.3)	545 (1.6)	13831 (3.5)	21893 (5.5)	9437 (3.9)	46473 (4.1)	

P-values calculated with chi-square contingency table test for categorical variables. n: number of observations. Parenthesis are percents in all elements of the table. We performed pairwise comparisons of the proportions of diagnostic blocks (ICD-10) between regions, and all comparisons were statistically significant ( $p < 0.05$ ). See test parameters and estimates at the supplemental material.

**Figure 1.** Most common conditions that resulted in a visit to the outpatient services by children. Total number of visits.

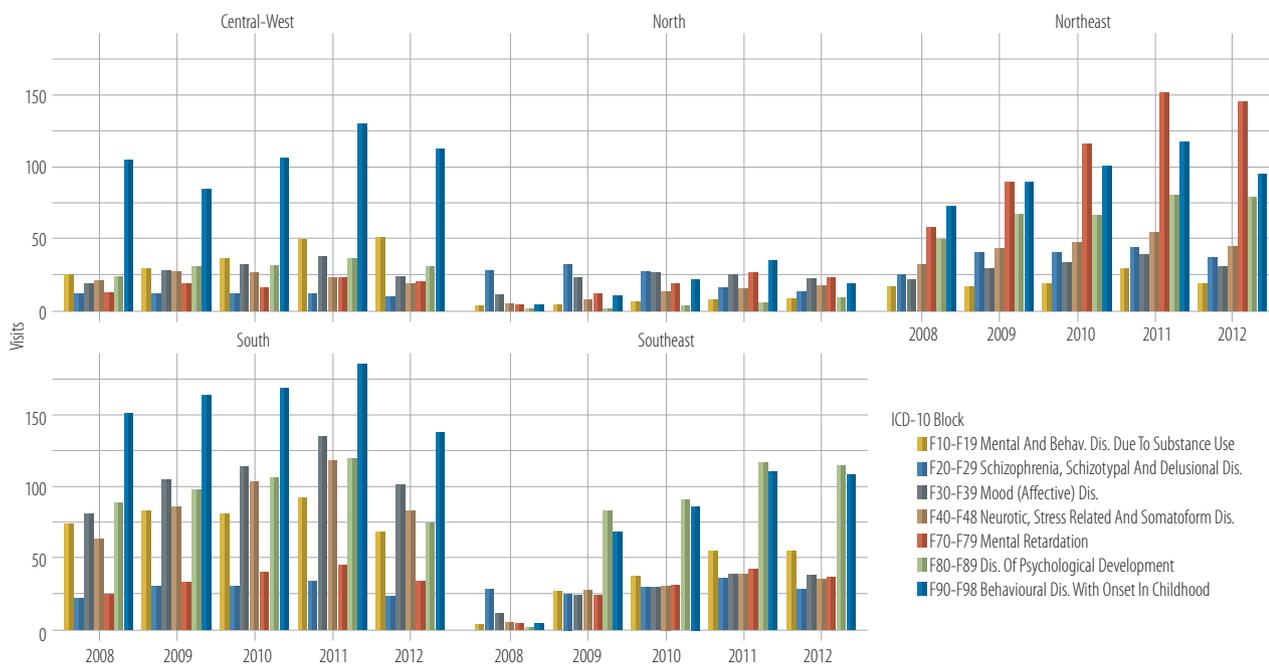


Figure 2. Main mental disorders as ICD-10 blocks with visits per each one hundred thousand inhabitants, from 2008 to 2012.

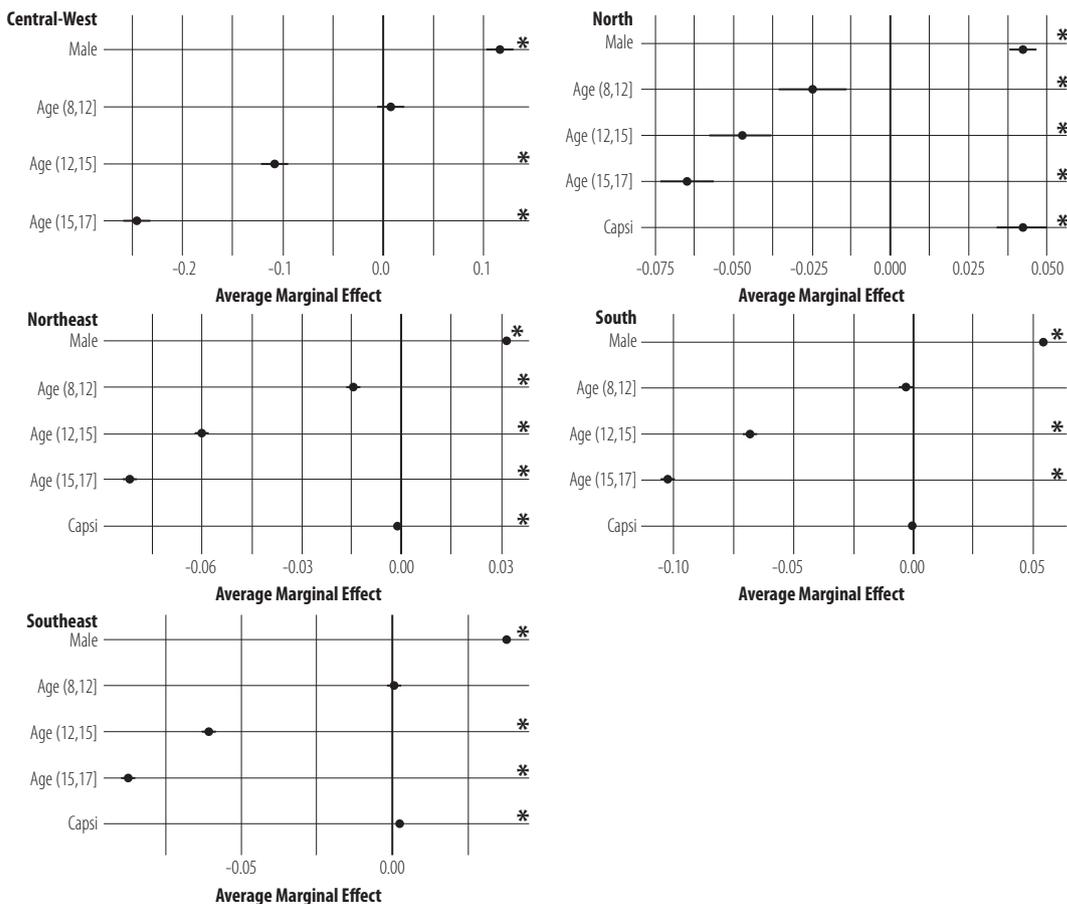
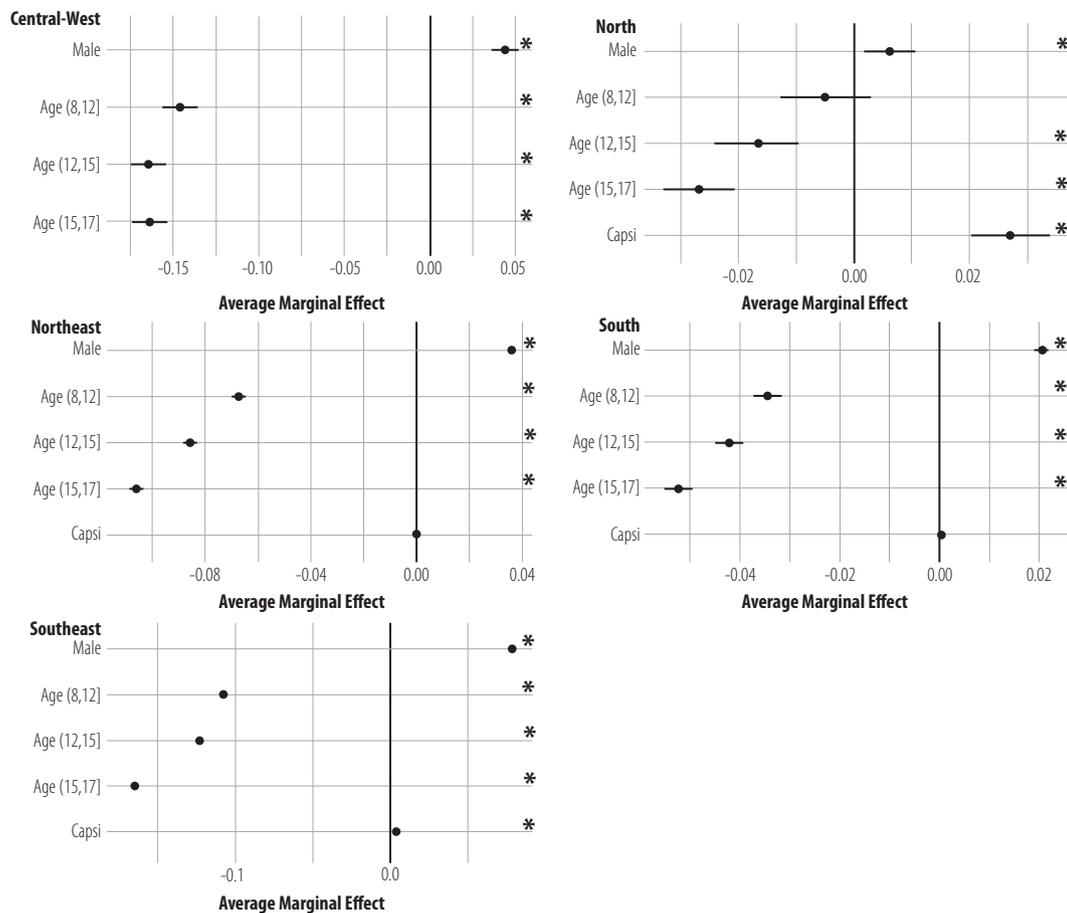


Figure 3. Average marginal effects of the regression model for Disturbance of activity and attention (F90.0). \* p < 0.05. Capsi, number of new child outpatient mental health services over the entire period of the study.



**Figure 4.** Average marginal effects of the regression model for Pervasive Developmental Disorders (F84.0-F84.9). \*  $p < 0.05$ . Capsi, number of new child outpatient mental health services over the entire period of the study.

## DISCUSSION

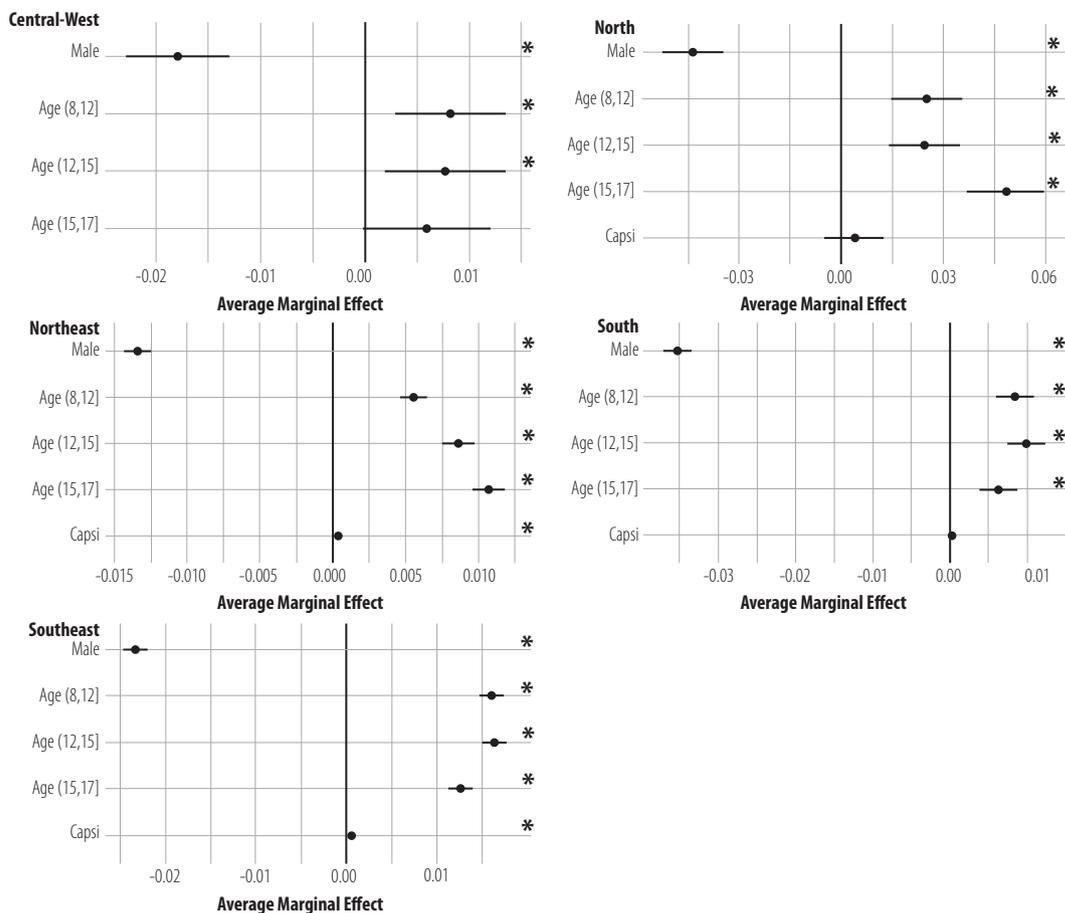
We assessed the epidemiology of mental health conditions of Brazilian young people from 2008 to 2012 using administrative data. We found that males used the service more frequently than females. This finding confirms what was found previously<sup>10,16</sup>. There were important regional differences in rates of visits per 100,000 inhabitants. Mental retardation was higher in the Northeast region and visits due to this increased until 2011; visits for mood disorders were more frequent in the South region; and males are more affected than females in by ADHD and by pervasive developmental disorders.

There were striking regional differences in our findings. The most notable was the rising levels of visits due to mental retardation per 100,000 inhabitants in the Northeast region. These levels seem to peak in 2011 at almost 150 per 100,000 inhabitants, see figure 2. Higher frequencies of mental retardation in this region were reported previously<sup>10,16</sup>, however, growth in rates of visits had never been reported before. In Brazil, until the 1980s, subjects with mental retardation were

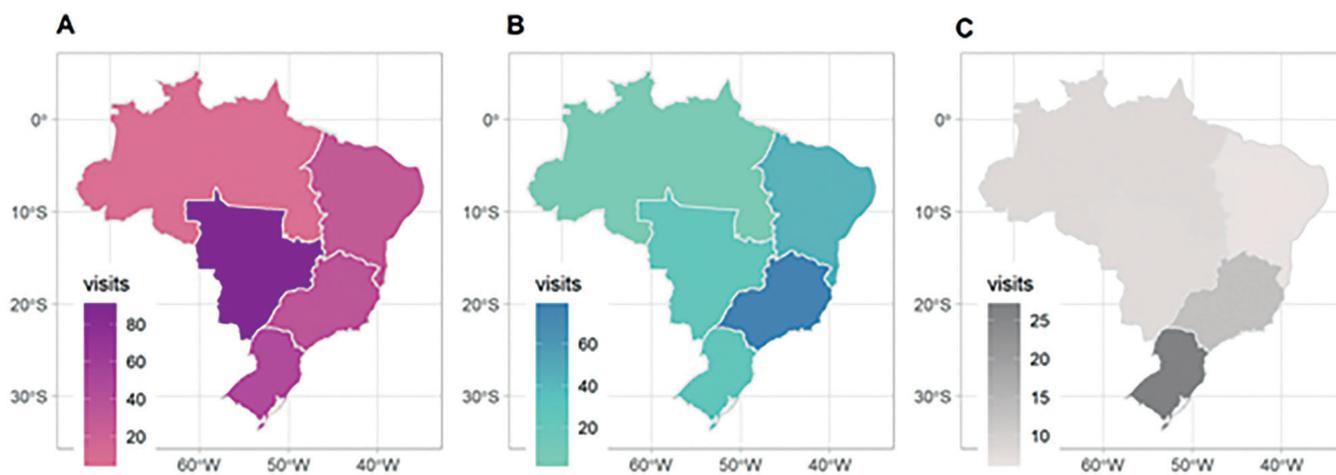
treated in hospices<sup>17</sup>. This population was gradually moved from inpatients to community-based treatments at CAPS, it is possible that this transition explains our findings.

Another finding worth highlighting is the high rate of visits due to Mood Disorders in the South region. The diagnoses which drove this rise were Hypomania (1.42/100,000), Bipolar affective disorder, current hypomanic episode (7.76/100,000), and Mild depressive episode (28.01/100,000). We expected high rates of depression as per previous findings using the DATASUS information on other age strata<sup>12</sup>. Further investigation is needed to evaluate these differences in more depth.

Regression analysis with the ADHD diagnosis (F90.0) as outcome revealed a pattern which is expected for this condition. Younger children are at the highest probability of receiving this diagnosis, which is a known demographic characteristic for this disorder. Furthermore, males had an increased probability of presenting the disorder. This is in line with what is known about this disorder, which has a prevalence of 2%-18% in the United States, with males being three times more likely to experience the condition<sup>18</sup>.



**Figure 5.** Average marginal effects of the regression model for mild depressive episode (F32.0). \* p < 0.05. Capsi, number of new child outpatient mental health services over the entire period of the study.



**Figure 6.** Geographic differences in rates for visits due to Disturbance of activity and attention (A), Childhood autism (B) and Mild depressive episode (C) in 2012. Rates are calculated per one hundred thousand inhabitants using census projection for 2012.

Attention-deficit hyperactivity disorder was the most common condition in this study. Previous studies suggest that at least 0.9% of Brazilian youth are affected by this disorder, but only 16.2%-19.9% of individuals received first-line treatment<sup>2</sup>. Although it is not possible to rule out supply/demand dynamics, we speculate that the higher rates of ADHD are due to it being easily identifiable at the school environment, leading to more referrals.

We decided to analyse the entire block of Pervasive Developmental Disorders due to the dimensional nature of autism<sup>14-16</sup>. The regressions estimates showed marked regional trend differences with regard to age. In most regions (Central-West, Southeast, and Northeast) it was found that there was a lower probability of younger subjects presenting with this disorder to outpatient services (Figure 4). This is a worrying finding, as it could indicate that early detection of such conditions is not happening in those areas, and most cases are still being referred for diagnosis and treatment later in life. Early treatment is crucial for autism spectrum outcomes<sup>19</sup>.

In terms of sex, there was a slight increase in the probability of males presenting with the disorder. This is in line with what is known of this condition<sup>20</sup>. Sex and autism are a somewhat controversial subject due to the theory of the extreme male brain put forward by Baron-Cohen (2002). Testing of this theory<sup>21</sup> has since generated conflicting results<sup>22,23</sup>. Nevertheless, both autism and autism spectrum disorder are more common in males across the globe<sup>24</sup>.

The number of visits for childhood autism in the Southeast region was higher than in other regions. We suspect that this is related to more intensive efforts in training of mental health staff and educators on recognizing early signs and prompt diagnosis in that region, the wealthiest in the country<sup>19</sup>. Additionally, the Southeast region is the region with more CAPSi in Brazil, with 52.9% of these centres located in this region in 2014. This facilitates the access of patients in the autism spectrum<sup>16</sup>.

Depressive disorders among young people are a growing concern, due to the recent surge in suicide in this age group<sup>25</sup>. The prevalence of a major depressive disorder among North American adolescents is between 7.5% and 11.0%<sup>26</sup>. Therefore, knowledge of the patterns of visits to outpatient mental health services is fundamental to improve outcomes. Ceballos *et al.* (2019) reported frequencies of depressive episodes of 50% in the same region, but a frequency of 73.3% in the North in the same period (2008-2012). However, the calculated rates per 100,000 inhabitants in this work revealed that the South presented the highest levels.

Access to treatment is crucial to reduce the recurrence of episodes and development of comorbid conditions such as substance use<sup>25</sup>. For example, Avenevoli *et al.* (2015) reported that 30% of the subjects with major depressive disorders presented some form of suicidality and that preventive

methods are more effective when done outside the school<sup>27</sup>. Knowing the regions where visits due to depressive disorders are more frequent allows the proper training of staff on these conditions, where they are more needed, thus reducing severe co-occurring conditions such as substance use and suicidality.

There are limitations worth noting in this work. The publicly available APACs data does not allow the identification of subjects who are visiting the services for the first time, or whether that visit is a returning one. This arguably inflates results from the regressions. Furthermore, we only had access to the limited set of variables within the APACs and could not test for numerous interactions that are certainly happening. We reported the race/color variable, but the large number of missing data (50.4%) should be noted. We caution against interpreting the regressions as causal relationships, these were included as a way to identify age and sex trends within the data set. Only the model for the North region presented a good fit.

## CONCLUSION

Using routine health records to evaluate demand is of immediate use to policymakers. It can inform decisions on resource use, training of staff and educators, and heighten awareness in the community of the needs of each region.

In the last 20 years, there has been a growing interest in child psychiatric disorders. This is due to the social and financial burden of these conditions and increased awareness of the need for early detection and treatment. The Brazilian Psychosocial Centers for Children and Adolescents (CAPSi) are fundamental in this context because of their ability to reach the country's poorest citizens. The number of CAPSis in Brazil is below the needs of the population<sup>2,16</sup> and is distributed unequally between the States<sup>16</sup>. There are a number of possible reasons for this. The CAPSi were implemented later than the CAPS (adults) in the Brazilian Psychiatric Reform, and were initially restricted to wealthier cities and to regions where child and adolescent psychiatrists and other qualified staff were available. Underfunding of mental health services for children and adolescents is a worldwide issue, but in low-middle income countries is even a greater problem. Our study showed important differences in the main diagnosis in the Brazilian regions.

## INDIVIDUAL CONTRIBUTIONS

JAPA was responsible for the original idea and design. ESR and LFSCA performed the analyses. LFSCA and DBM were responsible for the writing and proofreading. MB provided help in writing and theoretical guidance.

## CONFLICTS OF INTEREST

The authors report no conflict of interests.

## FUNDING

**Luis Fernando Silva Castro-de-Araujo, Elisângela da Silva Rodrigues, Maurício L. Barreto and Daiane Borges Machado** were funded by the Medical Research Council – UK, Grant no. MR/T03355X/1 during the study.

**Luis Fernando Silva Castro-de-Araujo, Jacyra Azevedo Paiva de Araujo, Elisângela da Silva Rodrigues, Maurício L. Barreto and Daiane Borges Machado** were also funded by the National Institute of Mental Health, from the NIH, Grant no. R01MH128911.

## REFERENCES

- Polanczyk GV, Salum GA, Sugaya LS, Caye A, Rohde LA. Annual Research Review: A meta-analysis of the worldwide prevalence of mental disorders in children and adolescents. *J Child Psychol Psychiatry*. 2015;56(3):345–65.
- Paula CS, Bordin IAS, Mari JJ, Velasque L, Rohde LA, Coutinho ESF. The Mental Health Care Gap among Children and Adolescents: Data from an Epidemiological Survey from Four Brazilian Regions. *PLoS One*. 2014;9(2):e88241.
- Zechmeister I, Kilian R, McDaid D; MHEEN group. Is it worth investing in mental health promotion and prevention of mental illness? A systematic review of the evidence from economic evaluations. *BMC Public Health*. 2008;8:20.
- de Almeida Filho N. Estudo de prevalência de desordens mentais na infância em uma zona urbana de Salvador-Bahia. *J Bras Psiquiatr*. 1982;31(4):225–36.
- de Almeida-Filho N. Development and assessment of the QMPI: A Brazilian children's behaviour questionnaire for completion by parents. *Soc Psychiatry*. 1981;16(4):205–11.
- Bordin IAS, de Paula CS. Estudos populacionais sobre saúde mental de crianças e adolescentes brasileiros. In: Mello MF de, Mello A de AF de, Kohn R, eds. *Epidemiologia da Saúde Mental no Brasil*. São Paulo, SP: Artmed; 2007. p. 101–7.
- Cury CR, Golfeto JH. Strengths and difficulties questionnaire (SDQ): a study of school children in Ribeirão Preto. *Braz J Psychiatry*. 2003;25(3):139–45.
- Fleitlich-Bilyk B, Goodman R. Prevalence of child and adolescent psychiatric disorders in southeast Brazil. *J Am Acad Child Adolesc Psychiatry*. 2004;43(6):727–34.
- Benvegnú LA, Fassa AG, Facchini LA, Wegman DH, Dall'Agnol MM. Work and behavioural problems in children and adolescents. *Int J Epidemiol*. 2005;34(6):1417–24.
- Ceballos GY, Paula CS, Ribeiro EL, Santos DN. Child and Adolescent Psychosocial Care Center service use profile in Brazil: 2008 to 2012. *Braz J Psychiatry*. 2019;41(2):138–47.
- Fatori D, Salum GA, Rohde LA, Pan PM, Bressan R, Evans-Lacko S, et al. Use of Mental Health Services by Children With Mental Disorders in Two Major Cities in Brazil. *Psychiatr Serv*. 2019;70(4):337–41.
- Castro-de-Araujo LF, Machado DB, Barreto ML. Care-seeking as a proxy indicator of the mental health of elderly Brazilians. *Braz J Psychiatry*. 2020;42(6):591–8.
- World Health Organization. *International Statistical Classification of Diseases and Related Health Problems: 10th Revision ICD-10*. 2016th ed. Geneva: World Health Organization; 1992.
- Wing L, Gould J, Gillberg C. Autism spectrum disorders in the DSM-V: better or worse than the DSM-IV? *Res Dev Disabil*. 2011;32(2):768–73.
- Conceição DS, Andreoli SB, Esperidião MA, Santos DND. Attendance of children and adolescents with psychoactive substance use disorders performed by Psychosocial Care Centers in Brazil, 2008–2012. *Epidemiol Serv Saude*. 2018;27(2):e2017206.
- Castro-de-Araujo LF, Levy N, Kanaan RA. RDoC and shift of reference. *Australas Psychiatry*. 2016;24(5):470–2.
- Surjus LT, Campos RT. Interface between Intellectual Disability and Mental Health: hermeneutic review. *Rev Saude Publica*. 2014;48(3):532–40.
- Sharma A, Couture J. A review of the pathophysiology, etiology, and treatment of attention-deficit hyperactivity disorder (ADHD). *Ann Pharmacother*. 2014;48(2):209–25.
- Bordini D, Gadelha A, Paula CS, Bressan RA. School referrals of children and adolescents to CAPSi: the burden of incorrect referrals. *Braz J Psychiatry*. 2012;34(4):493–4.
- Zahn-Waxler C, Shirtcliff EA, Marceau K. Disorders of Childhood and Adolescence: Gender and Psychopathology. *Annu Rev Clin Psychol*. 2008;4(1):275–303.
- Baron-Cohen S. The extreme male brain theory of autism. *Trends Cogn Sci*. 2002;6(6):248–54.
- Lai M-C, Lerch JP, Floris DL, Ruigrok AN, Pohl A, Lombardo MV, et al. Imaging sex/gender and autism in the brain: Etiological implications. *J Neurosci Res*. 2017;95(1–2):380–97.
- Crespi B, Read S, Ly A, Hurd P. AMBRA1, Autophagy, and the Extreme Male Brain Theory of Autism. *Autism Res Treat*. 2019;2019:1968580.
- Craig F, De Giacomo A, Savino R, et al. The Empathizing-Systemizing Theory and 'Extreme Male Brain' (EMB) Theory in Parents of Children with Autism Spectrum Disorders (ASD): An Exploratory, Cross-Sectional Study. *J Autism Dev Disord*. 2019;49(10):4067–78.
- Global Research on Developmental Disabilities Collaborators. Developmental disabilities among children younger than 5 years in 195 countries and territories, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet Glob Health*. 2018;6(10):e1100–21.
- Mendelson T, Tandon SD. Prevention of Depression in Childhood and Adolescence. *Child Adolesc Psychiatr Clin N Am*. 2016;25(2):201–18.
- Avenevoli S, Swendsen J, He JP, Burstein M, Merikangas KR. Major Depression in the National Comorbidity Survey–Adolescent Supplement: Prevalence, Correlates, and Treatment. *J Am Acad Child Adolesc Psychiatry*. 2015;54(1):37–44.e2.