







Temporal and spatial analysis of notifications of sexual violence against male children and adolescents in Brazil, 2013 to 2022: an ecological study

Análise temporal e espacial das notificações de violência sexual contra crianças e adolescentes do sexo masculino no Brasil, 2013 a 2022: estudo ecológico

Análisis temporal y espacial de las notificaciones de violencia sexual en contra de niños y adolescentes varones en Brasil, 2013 a 2022: estudio ecológico

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ABSTRACT

Objective: To analyze the temporal trend and the spatial distribution of reported cases of sexual violence against male children and adolescents, and their relationship with municipal development in Brazil. **Methods:** This is an ecological study with data from the Notifiable Health Conditions Information System and the Municipal Human Development Indexes (MHDIs), from 2013-2022. Prais-Winsten regression was used for temporal analysis and the Moran Index for spatial analysis. **Results:** There were 39,967 reports of sexual violence against male children and adolescents. An increasing trend was found for Brazil as a whole (annual percentage change = 6.8; 95%CI 3.8;10.0). Spatial distribution showed direct correlation between high rates of violence and low MHDIs ($p < 0.001$). **Conclusion:** We found a rising temporal trend in Brazil and spatial dependence of the rates of reported sexual violence in the municipalities.

Keywords: Sex Offenses; Child Abuse, Sexual; Ecological Studies; Times Series Studies; Spatial Analysis.

INTRODUCTION

Global prevalence of sexual violence is heterogeneous and does not show a significant decrease, which requires effective coping strategies.¹ One in 13 men reports having been sexually abused between the ages of zero and 17.² Sexual violence against children and adolescents is underestimated for males, due to less understanding or recognition of cases against males.¹

In Brazil, from 2015 to 2021, 202,948 cases of sexual violence against children and adolescents were recorded on the Notifiable Health Conditions Information System (*Sistema de Informação de Agravos de Notificação - SINAN*). Males had the lowest proportion of cases (13.8%) – following the global trend –, a percentage that could be even higher due to underreporting.^{3,4} This fact is due to the existence of sociocultural barriers, such as *machismo* and discrediting of victims.⁴

The COVID-19 pandemic also contributed to underreporting, with a reduction in reports of this form of violence against children and adolescents in 2020 in the Brazilian state of Rio Grande do Sul.⁵ This trend was also found in North America, Europe, Asia and Africa, even with the exacerbation of sexual abuse.⁶

Tackling sexual violence against male children and adolescents requires understanding the scale of the problem. Trend and spatial analysis studies help services understand the magnitude of a public health problem, in addition to comparisons of exceptional periods, such as the COVID-19 pandemic.^{7,8}

Male children and adolescents have been little studied in these analyses. Observing the trend of sexual violence among this population and identifying priority areas is strategic for planning public prevention and coping policies, especially in exceptional periods, such as the pandemic. The objective of this study was to analyze the temporal trend and the spatial distribution of reported cases of sexual violence against male children and adolescents and

Study contributions	
Main results	The trend of reported cases of sexual violence against male children and adolescents was rising in Brazil. The spatial analysis showed a direct correlation between high rates of violence and low human development indexes.
Implications for services	The identification of underreported areas requires the structuring of health surveillance services. Territories with the highest number of reports require prevention and coping strategies to attend to these victims.
Perspectives	Strategies for prevention, coping and improvement of the surveillance process must be adopted. These include: reception, psychosocial support, comprehensive health care and training of health professionals to notify and report the problem.

their relationship with municipal development in Brazil, from 2013 to 2022.

METHODS

Design and background

This is an ecological study of time series and spatial analysis. The temporal analysis unit was made up of years and the spatial analysis units were the Brazilian municipalities.

We used reports of sexual violence against male children and adolescents in Brazil, from 2013 to 2022. This period was chosen because it represents the most recent decade with data on the problem made available by the Information Technology Department of the Brazilian National Health System (*Departamento de Informática do Sistema Único de Saúde - DATASUS*).⁹

In 2022, the male population corresponded to 49% of the Brazilian population, and people up to 19 years old corresponded to 14% of this population.¹⁰

Participants

We analyzed reported cases of sexual violence against male children and adolescents aged zero to 19 held on the SINAN. We used World Health Organization (WHO) criteria to define the age range of the study, whereby individuals aged zero to 9 are considered

children, and individuals aged 10 to 19 are considered adolescents.¹¹

Variables

The study variables were: male sex, age group (in years: < 1, 1-4, 5-9, 10-14, 15-19), region, municipality, year reported, relationship with the aggressor (family member, affective, acquaintance, stranger, person with an institutional relationship, police officer/law enforcement officer, other relationships), place of occurrence (residence, collective housing,

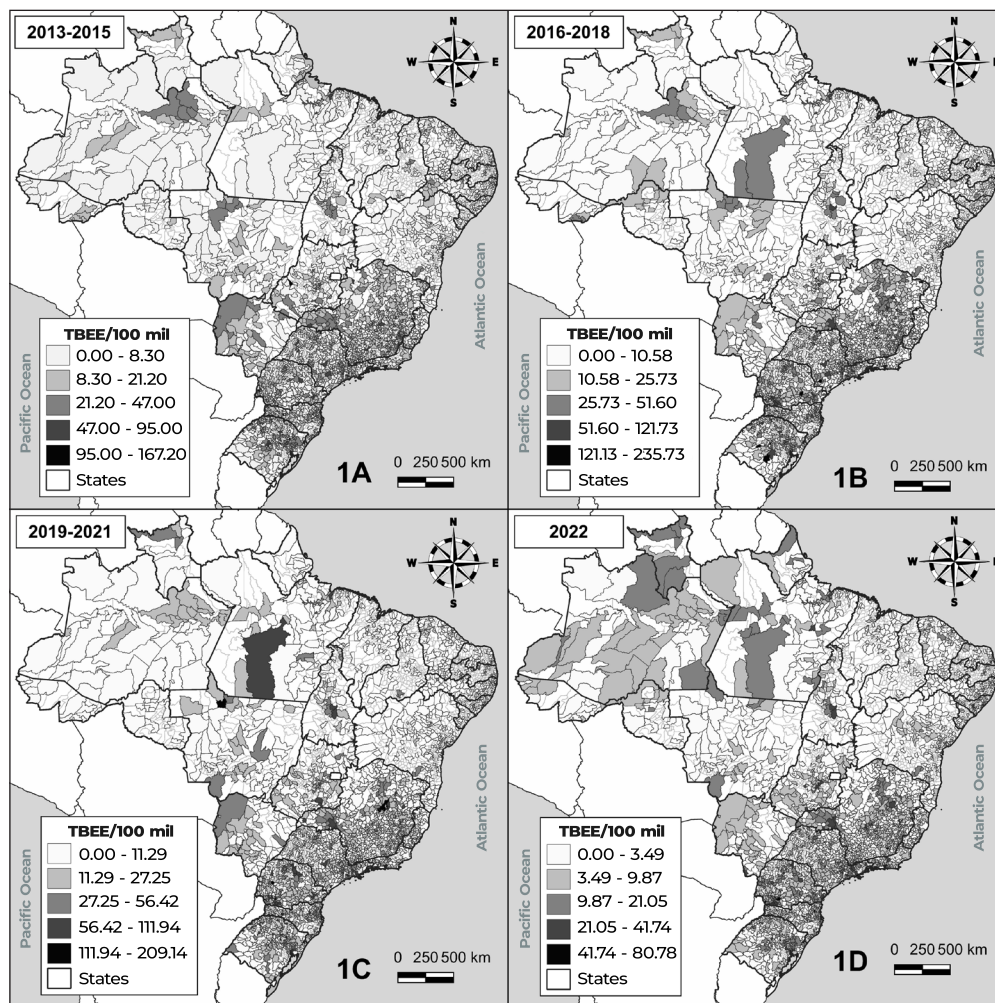


Figure 1 – Distribution of reported sexual violence against male child and adolescents in the Brazilian municipalities, 2013-2022

school, sports facility, bar or similar, public thoroughfare and commerce/services, industry/construction, other).

Data source and measurement

The number of cases of sexual violence against male children and adolescents was obtained from the SINAN database, and population estimates were obtained from the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística* - IBGE), available, respectively, on the DATASUS

Tabnet platform (<https://datasus.saude.gov.br/>) and on the 2022 Census website (<https://censo2022.ibge.gov.br/>), obtained on 11/16/2023.⁹

In the case of the “aggressor relationship” variable, the data were aggregated as follows: father, mother, stepfather, stepmother, son, daughter, brother and sister were aggregated as a “Family member” relationship. Spouse, ex-spouse, boyfriend, ex-boyfriend, girlfriend and ex-girlfriend were aggregated as an “Affective” relationship. Friends/acquaintances, carers and bosses were aggregated as an “Acquaintance” relationship.

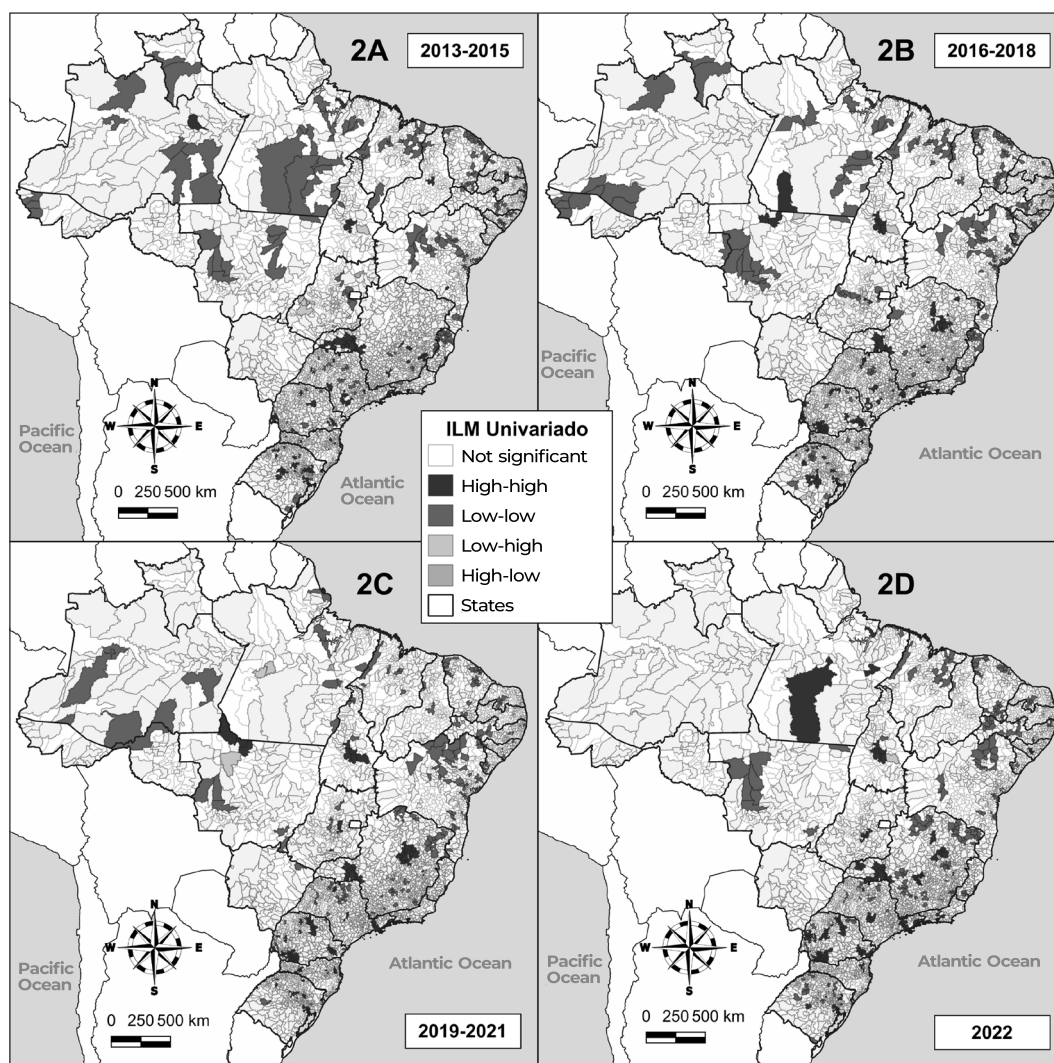


Figure 2 – Spatial dependence of reported sexual violence against male child and adolescents in the Brazilian municipalities, 2013-2022

The mapping data source (territorial grids) used to generate the maps was the IBGE 2021 version.¹² We used the 2010 Census¹³ for the Human Development Index (HDI) estimates, given the unavailability of estimates in the 2022 Census.

To calculate the rates of sexual violence against male children and adolescents, the total number of cases per year was divided by the resident population in the respective age groups of each region and of Brazil as a whole in the same year, and multiplied by 100,000.

Statistical methods

We calculated annual percentage change (APC) in rates of sexual violence against male children and adolescents, based on the Prais-Winsten generalized linear analysis model, using Stata version 14.0.⁸

Initially, we performed log base 10 transformation of the sexual violence rates, with the aim of minimizing the heterogeneity of the variance of the residuals of the regression model, in addition to favoring the calculation of the time series annual growth ratio.⁸ The Prais-Winsten model was used to estimate 95% confidence intervals (95%CI).

The spatial analyses were performed using GeoDa and QGIS. Spatial empirical Bayesian rates were calculated for data analysis and representation in maps.¹⁴ The maps were divided into three-year periods, using natural breaks as a matrix representation.

The spatial autocorrelation analysis was performed using the univariate and bivariate versions of the global and local Moran index.¹⁵ The univariate models used Bayesian rates of sexual violence against male children and adolescents in isolation, while in the bivariate model, possible spatial correlations between the rates and Municipal Human Development Indexes (MHDIs) were tested.

To estimate the statistical significance of the indices, the pseudo-significance test

was adopted using 99999 permutations.¹⁶ Cartographic representation was achieved by using the map of local spatial association indicators, which categorizes municipalities based on the local Moran index into direct autocorrelation clusters (high-high and low-low) and inverse correlation clusters (high-low and low-high).

The Universal Transverse Mercator system was used for the map projections, employing the Geocentric Reference System for the Americas 2000 model. The Moran index calculation were performed using GeoDa version 1.20; QGIS versão 3.64 was used for final map layout and creation.

Ethical aspects

Secondary and aggregated publicly accessible data were used, making it impossible to identify individual records, which exempted the study from being assessed by a research ethics committee.

RESULTS

A total of 39,967 cases of sexual violence against male children and adolescents were reported on the SINAN in Brazil during the period studied. Among the reported cases, 16,497 (41.3%) were aged between 5 and 9 years; 14,021 (35.1%) were committed by acquaintances and 11,385 (28.5%) by family members; 24,948 (62.4%) occurred at home; and 17,658 (44.2%) occurred in the Southeast region of Brazil (Table 1). The "repeated violence" variable could not be analyzed due to high incompleteness (31.1%).

A statistically significant rising trend (APC: 6.8; 95%CI 3.8;10.0; p-value < 0.001) was found for Brazil as a whole (Table 2). APC was higher in the Southeast region (APC: 9.5; 95%CI 5.3;13.9; p-value: 0.001) and Northeast region (APC: 6.8; 95%CI 2.8;11.0) regions ; p-value: 0.004), and among those between 15 and 19 years old (APC: 11.6; 95%CI 7.7;15.6; p-value: < 0.001) and < 1 year old (APC: 10.4; 95%CI 3.8;17.6; p-value: 0.006).

Table 1 – Characterization of reports of sexual violence against male children and adolescents, Brazil, 2013-2022 (n = 39,967)

Variables	N	%
Age group (years)		
<1	724	1.8
1-4	10,277	25.7
5-9	16,497	41.3
10-14	9,224	23.1
15-19	3,245	8.1
Relationship		
Family member	11,385	28.7
Affective	346	0.9
Acquaintance	14,021	35.3
Stranger	3,842	9.7
Person with institutional relationship	786	2.0
Police officer/law enforcement officer	71	0.2
Other relationships	9,239	23.3
Unknown	277	0.7
Place of occurrence		
Residence	24,948	62.4
Collective housing	619	1.5
School	2,299	5.8
Sports facility	274	0.7
Bar or similar	211	0.5
Public thoroughfare	2,188	5.5
Commerce/services	334	0.8
Industry/construction	105	0.3
Other	4,290	10.7
Unknown	4,699	11.8
Regions		
North	4,519	11.3
Northeast	4,549	11.4
Southeast	17,658	44.2
South	9,353	23.4
Midwest	3,888	9.7

Table 2 – Annual percentage change (APC) in sexual violence among male children and adolescents (per 100,000 inhabitants), by age group and regions, Brazil, 2013-2022

Age group (years)	APC ^a (95%CI) ^b	p-value	Trend
North			
< 1	13.6 (6.6;21.1)	0.002	rising
1-4	0.8 (-2.3;3.9)	0.586	stationary
5-9	0.9 (-1.3;3.1)	0.370	stationary
10-14	2.6 (0.3;5.0)	0.034	rising
15-19	5.1 (-0.4;11.0)	0.066	stationary
< 1-19	1.8 (-0.2;3.8)	0.070	stationary
Northeast			
< 1	12.0 (-3.1;29.4)	0.109	stationary
1-4	7.3 (2.5;12.3)	0.007	rising
5-9	5.4 (1.9;8.9)	0.007	rising
10-14	5.9 (-0.2;12.4)	0.058	stationary
15-19	12.0 (8.3;15.8)	< 0.001	rising
< 1-19	6.8 (2.8;11.0)	0.004	rising
Southeast			
< 1	10.7 (1.4;21.0)	0.029	rising
1-4	9.3 (5.9;12.9)	< 0.001	rising
5-9	7.0 (2.2;12.0)	0.010	rising
10-14	10.8 (7.0;14.6)	< 0.001	rising
15-19	13.7 (7.2;20.6)	0.001	rising
< 1-19	9.5 (5.3;13.9)	0.001	rising
South			
< 1	14.0 (6.9;21.6)	0.002	rising
1-4	5.1 (1.3;9.0)	0.014	rising
5-9	2.6 (-10.9;6.5)	0.150	stationary
10-14	7.2 (2.3;12.4)	0.009	rising
15-19	10.5 (5.6;15.7)	0.001	rising
< 1-19	5.6 (1.8;9.5)	0.009	rising
Midwest			
< 1	7.5 (-4.5;1.9)	0.195	stationary
1-4	4.3 (-1.8;10.7)	0.147	stationary
5-9	1.9 (-2.1;6.1)	0.315	stationary
10-14	7.7 (3.7;11.8)	0.002	rising
15-19	13.5 (5.2;22.4)	0.005	rising
< 1-19	4.9 (0.8;9.1)	0.024	rising
Brazil			
< 1	10.4 (3.8;17.6)	0.006	rising
1-4	6.8 (3.8;10.0)	< 0.001	rising
5-9	4.5 (1.3;7.9)	0.012	rising
10-14	8.0 (4.8;11.2)	< 0.001	rising
15-19	11.6 (7.7;15.6)	< 0.001	rising
< 1-19	6.8 (3.8;10.0)	< 0.001	rising

a) APC: Annual percentage change; b) 95%CI: 95% confidence interval.

In the 2013-2015 three-year period, higher rates were concentrated in municipalities in the South and Southeast of Brazil. In the 2016-2018 and 2019-2021 three-year periods, violence rates remained concentrated in the municipalities of the South and Southeast and also in the Northern region state of Pará. In 2022, a differentiated spatial distribution was found in the three-year periods, especially in the municipalities of the Northern region states of Amazonas, Roraima and Amapá, where the rate of sexual violence varied up to 21.05 per 100,000 inhabitants.

There was direct correlation in all years analyzed: 2013-2015 (I: 0.371 $p < 0.001$), 2016-2018 (I: 0.330 $p < 0.001$), 2019-2021 (I: 0.391 $p < 0.001$) and 2022 (I: 0.405 $p < 0.001$). Clusters of municipalities with high rates of sexual violence were found in the South and Southeast regions and in the Northern region states of Tocantins, from 2013 to 2021 and in 2022, and Pará, from 2013 to 2018 and in 2022.

In Figure 3 it can be seen that the bivariate model showed direct global dependence for the four periods analyzed: 2013-2015 (I: 0.196 $p < 0.001$), 2016-2018 (I: 0.169 $p < 0.001$),

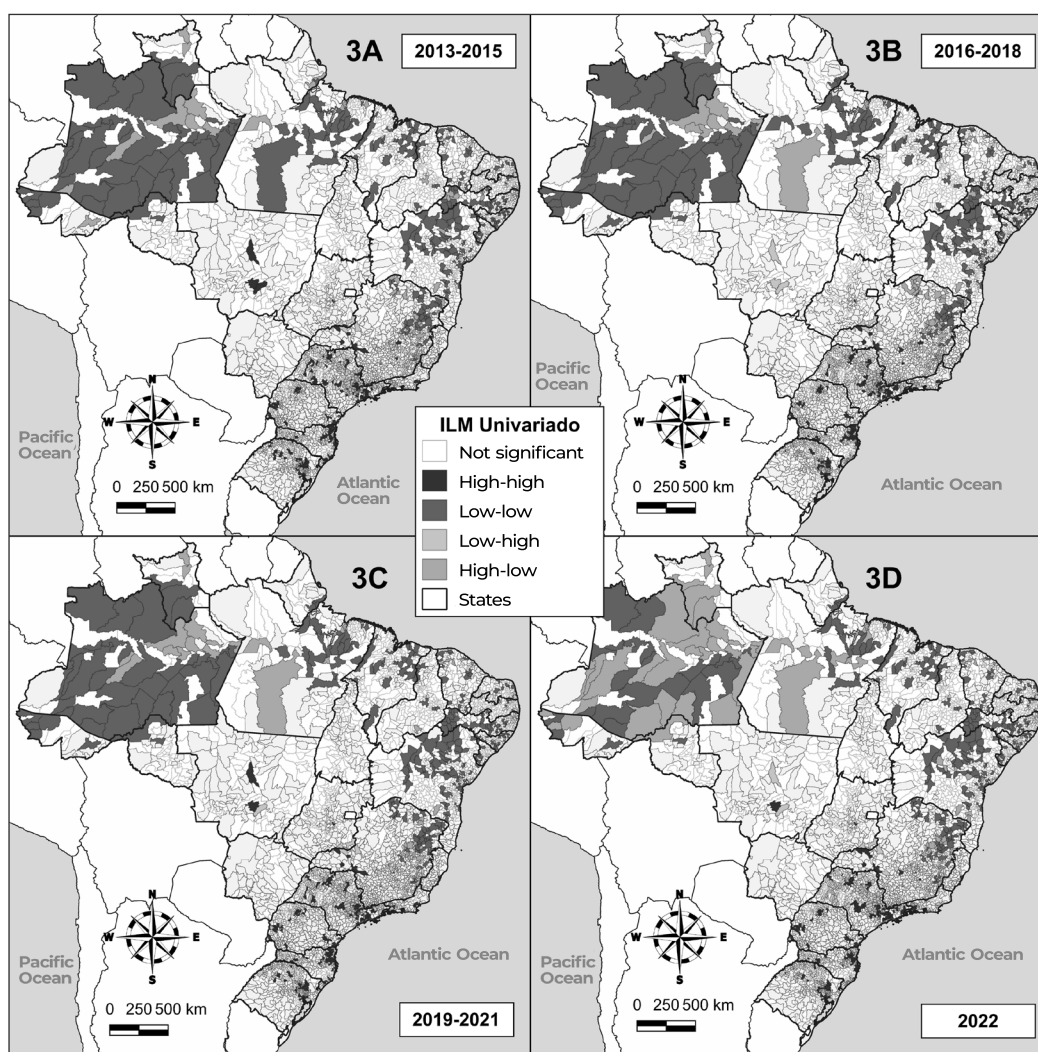


Figure 3 – Correlation of reported sexual violence against male children and adolescents according to the human development index in the Brazilian municipalities, 2013-2022

2019-2021 (I: 0.176 $p < 0.001$) and 2022 (I: 0.162 $p < 0.001$). Between 2013 and 2021, there was a predominance of clusters with low rates of sexual violence with low MHDIs. In the South and Southeast regions, especially São Paulo, prevalence of low-high and high-high clusters can be seen. In 2022, the Northern region states of Amazonas, Roraima and Pará concentrated the largest number of municipalities with high rates of sexual violence and low MHDIs.

DISCUSSION

Reported cases of violence against male children and adolescents were predominant in children aged 5 to 9 years. The most frequent relationships with the cases were acquaintances or family members. The home was the most frequent place of occurrence. With the exception of the Northern region, the trend was rising throughout Brazil, mainly in the Southeast region. Cases were concentrated in the South and Southeast, while the lowest rates were recorded in the Northeast. Spatial distribution showed correlation with the MHDIs, with emphasis on the states of Amazonas, Roraima and Pará.

A study carried out in the municipality of Rio das Ostras, Rio de Janeiro, revealed that, among cases reported between 2009 and 2018, half were related to children aged 5 to 9 years of both sexes.¹⁷ In Envigado, Colombia, among 807 cases of sexual violence between 2011 and 2020, 63% occurred in individuals aged 1 to 17.¹⁸ Due to physical and psychological immaturity, the younger the child, the greater the risk of suffering violence and damage to their health, as they do not have the physical or emotional capacity to defend themselves from such violence.¹⁸

Acquaintance and family member aggressors were predominant in this study. In Belém, between 2014 and 2016, of 4,870 cases of sexual violence against male children and adolescents, the aggressors of 59% of them were people known to the victims.¹⁹

The study conducted in Envigado, cited above, revealed that the main aggressors have a family member relationship with the victim, this being a circumstance that makes it difficult to seek help.¹⁸ Violent experiences, child abuse, mental disorders, drug use, family member dysfunction and limited supervision of children contribute to aggressors having easier access to the victim, especially when they are family members.¹⁸

The home was the main place of occurrence, which can be associated with the aggressor's relationship to the victim, since, in most cases, the aggressor is a member of the family or an acquaintance, exercising power over the victim and persisting with sexual abuse. Home should be a welcoming environment for children and adolescents, however, ease of access contributes to the occurrence of sexual violence, mostly in the victim's home.^{17,20}

The Southeast had a greater number of cases, trend and spatial concentration, a result similar to that found by a study characterizing child sexual abuse, from 2011 to 2017, in Brazil.²¹ Greater surveillance present in the country's large urban centers, through encouragement of reporting and increase in protection services, as in the Southeast region, may influence the number of reports.²¹ In turn, the absence or reduction of case reporting, health services and population adherence to services may explain why the North and Northeast regions had lower rates of sexual violence against male children and adolescents in our study.^{21,22}

Between 2013 and 2022, sexual violence against male children and adolescents increased in Brazil and was related to low development. A concentration of municipalities with high rates of violence and low levels of human development was found in Amazonas, Roraima and Pará. Sexual exploitation was closely linked to precarious socioeconomic conditions in empirical research carried out in Manaus, capital of the state of Amazonas, between 2018 and 2019.²³ Children and

adolescents in situations of socioeconomic vulnerability may be sexually exploited as a means of sustenance.²³ Although violence is not restricted to individuals in vulnerable situations, there is a relationship between sexual abuse and socioeconomic and cultural aspects.²⁴

The study has limitations, such as underreporting and incomplete data, which

suggest failures in health services to adequately report on the SINAN. Actions such as training health professionals to manage sexual violence and raising community awareness about reporting can help monitor cases. This study contributes to a better understanding of the phenomenon of sexual violence and the development of interventions in line with needs.

AUTHOR CONTRIBUTIONS

Lima BCL, Miranda CES, Rodrigues MTP and Borges JWP contributed to the study design and concept, analysis and interpretation of the results, drafting and critically reviewing the contents of the manuscript. Nascimento FF and Andrade JX contributed to data analysis and interpretation, drafting and critically reviewing the contents of the manuscript. All the authors have approved the final version of the manuscript and are responsible for all aspects thereof, including the guarantee of its accuracy and integrity.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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RESUMO

Objetivo: Analisar a tendência temporal e a distribuição espacial dos casos notificados de violência sexual contra crianças e adolescentes do sexo masculino, e sua relação com o desenvolvimento municipal no Brasil. **Métodos:** Trata-se de estudo ecológico empregando dados do Sistema de Informação de Agravos de Notificação e os Índices de Desenvolvimento Humano Municipal (IDHMs), de 2013-2022. Utilizou-se a regressão de Prais-Winsten para a análise temporal e o índice de Moran para a análise espacial. **Resultados:** Houve 39.967 notificações de violência sexual contra crianças e adolescentes do sexo masculino. Verificou-se tendência crescente no Brasil (variação percentual anual = 6,8; IC_{95%} 3,8;10,0). A distribuição espacial apresentou correlação direta entre altas taxas de violência e baixos IDHMs ($p < 0,001$). **Conclusão:** Observou-se tendência temporal de crescimento no Brasil e dependência espacial das taxas de notificação de violência sexual nos municípios.

Palavras-chave: Violência Sexual; Abuso Sexual de Crianças e Adolescentes; Estudos Ecológicos; Estudos de Séries Temporais; Análise Espacial.

RESUMEN

Objetivo: Analizar la tendencia temporal y la distribución espacial de los casos reportados por violencia sexual en niños y adolescentes varones y su relación con el desarrollo municipal en Brasil. **Métodos:** Se trata de un estudio ecológico que utiliza datos del Sistema de Información de Enfermedades de Declaración Obligatoria y de Índices de Desarrollo Humano Municipal (IDHM), en el período 2013-2022. Se utilizó la regresión de Prais-Winsten para el análisis temporal y el índice de Moran para el análisis espacial. **Resultados:** Hubo 39.967 denuncias de violencia sexual contra niños y adolescentes varones. En Brasil hubo una tendencia creciente (variación porcentual anual = 6,8; IC_{95%} 3,8;10,0). La distribución espacial mostró una correlación directa entre altas tasas de violencia y bajos IDHM ($p < 0,001$). **Conclusión:** Se observó una tendencia de crecimiento temporal en Brasil y una dependencia espacial de las tasas de notificación de violencia sexual en los municipios.

Palabras clave: Violencia Sexual; Abuso Sexual de Niños y Adolescentes; Estudios Ecológicos; Estudios de Series Temporales; Análisis Espacial.