

Leprosy-related disability in children and adolescents under 15 years old in Brazil: evaluation of macro-regional disparities from 2001 to 2022

Incapacidades físicas relacionadas à hanseníase em crianças e adolescentes menores de 15 anos no Brasil: avaliação das disparidades macrorregionais entre 2001 e 2022

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Abstract

Objective: to investigate macro-regional disparities in the incidence of leprosy in children and adolescents under 15 years old in Brazil from 2001 to 2022, with a focus on leprosy-related disabilities. **Methods:** an ecological study was carried out using data from the Brazilian Notifiable Diseases Information System (SINAN). The annual number of leprosy cases was normalized to every 100,000 residents in each macro-region (incidence), stratified by leprosy-related disability (grade 0, 1, and 2). The significance level was set at 5%, and Poisson regression adjusted for a robust dispersion was used to estimate the incidence ratio. **Results:** approximately 14% (7,694) of all leprosy cases in this age group were notified with grade 1 (78.9%) or 2 (21.1%) disability. Moreover, in grades 1 and 2, the incidence of leprosy was significantly higher in the North, Northeast, and Central-West macro-regions when compared to the national estimate, as well as significantly lower in the Southeast and South (p-value <0.05). **Conclusion:** macro-regional disparities were observed in the incidence of leprosy in children and adolescents under 15 years old with grade 1 or 2 disability in Brazil from 2001 to 2022.

Keywords: public health; neglected diseases; leprosy; epidemiology; health inequalities.

Resumo

Objetivo: investigar as disparidades macrorregionais na taxa de incidência de hanseníase em crianças e adolescentes com menos de 15 anos no Brasil, de 2001 a 2022, com foco nas incapacidades físicas relacionadas à hanseníase. **Métodos:** foi realizado um estudo ecológico com dados do Sistema de Informação de Agravos de Notificação (SINAN) do Brasil. O número anual de casos de hanseníase foi normalizado para cada 100.000 habitantes em cada macrorregião (incidência), estratificado por incapacidade física relacionada à hanseníase (grau 0, 1 e 2). O nível de significância foi definido em 5%, e a regressão de Poisson, ajustada para uma dispersão robusta, foi utilizada para estimar a razão da taxa de incidência. **Resultados:** aproximadamente 14% (7.694) de todos os casos de hanseníase nesta faixa etária foram notificados com incapacidade física grau 1 (78,9%) ou 2 (21,1%). Além disso, nos graus 1 e 2, a incidência de hanseníase foi significativamente maior nas macrorregiões Norte, Nordeste e Centro-Oeste quando comparadas à estimativa nacional, assim como significativamente menor no Sudeste e Sul (valor de p <0,05). **Conclusão:** foram observadas disparidades macrorregionais na incidência de hanseníase em crianças e adolescentes com menos de 15 anos com incapacidades físicas grau 1 ou 2 no Brasil, de 2001 a 2022.

Palavras-Chave: saúde pública; doenças negligenciadas; hanseníase; epidemiologia; iniquidades em saúde.

INTRODUCTION

Quality of life among people living with leprosy, among other factors, is associated with early diagnosis and treatment, as well as experience with leprosy-related disabilities¹. These disabilities can be observed in physical deformities, reduced functionality, and impairment of activities of daily living, in addition to social stigma². The occurrence of leprosy-related disabilities is a relevant factor in understanding the clinical evolution of leprosy cases, in addition to acting as an indicator for disease control actions, which demonstrates the importance of this outcome in this setting, especially among endemic countries, where leprosy is considered a neglected disease^{3,4}. The notification of new cases of leprosy with leprosy-related disabilities may suggest

that the policies and actions carried out to detect the disease were insufficient in that territory⁵.

From this perspective, it is important to consider that the coverage and resolution of health systems and services can influence leprosy control, increasing or decreasing demographic-related disparities^{2,5}. Moreover, it is also worth highlighting that demographic-related disparities in leprosy control actions involve the organization of healthcare networks, as well as the implementation of effective strategies for timely diagnosis, which suggests the need to monitor the notification of new cases, in addition, to evaluate the grade of leprosy-

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related disability at that moment⁶. In Brazil, a country with endemic regions for leprosy, macro-regional disparities have already been observed, such as in the skin smear exams, as a diagnosis-related example of differences in leprosy control^{7,8}.

At last, the interface between leprosy, disability, and demographic-related disparities must be added to cases among children and adolescents under 15 years old in Brazil. Previous evidence points to the risk of this age group in relation to household contact with other people with untreated leprosy, often in endemic regions (portraying prolonged exposure from a young age)^{9,10}. Moreover, between 2013 and 2017, there was an increase in the frequency of leprosy with grade 2 disability in Brazil, ranging from 2.9% to 4.1% of new cases in this age group¹¹. However, as far as it was possible to verify, there is no comprehensive national investigation that evaluated macro-regional disparities in the incidence of leprosy according to the grade of disability in this age group.

Therefore, the objective of this study was to investigate macro-regional disparities in the incidence of leprosy in children and adolescents under 15 years old in Brazil from 2001 to 2022, with a focus on leprosy-related disability. The null hypothesis was tested, and there is no difference in the incidence of leprosy among children and adolescents under 15 years old between the national estimate (Brazil) and the macro-regions, considering all grades of leprosy-related disability.

METHODS

Setting

An ecological study was conducted using a quantitative, longitudinal, and retrospective approach designed in a time series¹². The period evaluated covers 22 years, from 2001 to 2022. The territory evaluated was Brazil, considering the national estimate and its five macro-regions (North, Northeast, Southeast, South, and Central-West).

Ethics

There was no ethical appreciation of this study, considering that data available in open access (public domain) were used, which does not require ethical approval, according to current legislation in Brazil. No information allows the identification or localization of children and adolescents diagnosed with leprosy during the period evaluated¹³.

Data source

The data source was the National System of Notifiable Diseases (SINAN) since leprosy is part of the national list of compulsory notification diseases, and all cases must be reported to the Ministry of Health in Brazil¹⁴. SINAN data is made available by the Department of Informatics of the Brazilian Unified Health System (DATASUS) and accessible by the TabNet tool^{15,16}.

Variables

The primary variable of the study was the incidence of leprosy cases (new cases, relapses, and other entrances) among children and adolescents under 15 years old in Brazil and its five macro-regions, considering the World Health Organization (WHO) grading system of leprosy-related disability: grade 0 (absence of disability), grade 1 (loss of protective sensibility in the eyes, hands or feet, but no visible damage or deformities) and grade 2 (presence of deformities or visible damage to the eyes, hands or feet), as described previously¹⁷.

The incidence was obtained by the annual number of leprosy notifications in SINAN in this age group, normalized to every 100,000 residents in each macro-region (proxy measure). The population size was estimated in intercensal projections from the Brazilian Institute of Geography and Statistics (IBGE), also retrieved in the TabNet tool¹⁵. The classification of the leprosy endemicity of each macro-region was carried out according to the criteria of the Brazilian Ministry of Health for children and adolescents under 15 years old, also described in Santos et al. (2019)¹⁸: low-endemic (<0.50 cases per 100,000 residents), medium-endemic (0.50–2.49), high-endemic (2.50–4.99), very high-endemic (5.00–9.99) and hyperendemic (≥ 10.00).

Data collection

The data was collected by the same researcher after qualitative training of the TabNet tool in January 2024. On the website, the options "*Epidemiological and Morbidity*" and "*Leprosy cases - SINAN*" were selected. The geographic coverage was adjusted to "Brazil by region". The period was adjusted in the specific tab from 2001 to 2022. Leprosy cases (annual numbers) were recovered according to the year of notification, stratified by macro-region and grade of disability at diagnosis.

Data analysis

After collection, the data were tabulated in spreadsheets for descriptive and inferential statistical analysis. The significance level was set at 5% ($\alpha = 0.05$) in all operations. The descriptive approach was based on the overall incidence (from 2001 to 2022) and the median of annual incidence, including the interquartile range (IQR) and minimum and maximum values. In addition, absolute (number of cases) and relative (%) frequencies were reported. The inferential analysis was based on the incidence ratio (IR), estimated in generalized linear models (Poisson regression), applying an adjustment for robust dispersion (quasi-Poisson distribution), considering the maximum likelihood in the logarithmic link function (Log-likelihood ratio)¹⁹. In this analysis, the JAMOV statistical package (version 2.3.15, Sydney, Australia) was used.

In addition, the time trend was estimated by the Annual Percent Change (APC), considering the Prais-Winsten regression analysis to estimate the angular coefficients (β_1) after logarithmic

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transformation (\log_{10}) of the dependent variable (leprosy annual incidence per 100,00 residents). The APC (percentage) was established by the expression: $[(-1 + 10^{\beta_1}) \times 100]$. For a 95% confidence interval, β_1 limits (upper and lower) were established by the expression: $[(\beta_1) \pm (t\text{-critical value} \times \beta_1\text{-standard error})]$. Then, the time trend was determined as stationary when the p-value was equal to or higher than 0.05, as increasing when the p-value was less than 0.05 and a positive β_1 value, and as decreasing when the p-value was less than 0.05 and the negative β_1 value²⁰. In this analysis, the PAST statistical package (version 4.03, Oslo, Norway) was used.

RESULTS

Table 1 shows the leprosy cases according to the grade of disability in children and adolescents under 15 years old in Brazil and its macro-regions. It was possible to observe that almost 14% (7,694) of leprosy cases were notified with disabilities in individuals in this age group in Brazil. Among these cases, grade

I was observed in the majority (78.9%), followed by grade II (21.1%). The Northeast macro-region had the highest frequency of cases in all grades, and the South region had the lowest (without considering the correction for demographic density). Table 2 shows the incidence of leprosy according to the grade of disability in children and adolescents under 15 years old in Brazil and its macro-regions, and Table 3 shows the incidence ratio. In grade 0, it was observed that the North macro-region had the highest incidence for the period, followed by the Central-West and Northeast. Otherwise, South and Southeast had the lowest incidence for the period. When compared to the national estimate, the incidence of leprosy in the North macro-region was 164% higher (IC95% = 112%, 330%), in the Central-West it was 70% higher (IC95% = 34%, 115%), and in the Northeast, it was 48% higher (IC95% = 17%, 90%). Nonetheless, the incidence of leprosy in the South macro-region was 90% lower (IC95% = 83%, 95%), and in the Southeast was 67% lower (IC95% = 52%, 78%).

Table 1. Leprosy cases according to the grade of disability in children and adolescents under 15 years old in Brazil and its macro-regions between 2001 and 2022 (2024).

Grade	Brazil		North	Northeast	Southeast	South	Central-West
	n	%			%		
Grade 0	47,808	86.1	27.9	45.1	13.0	1.3	12.7
Grade 1	6,067	10.9	28.7	45.1	11.2	1.2	13.8
Grade 2	1,627	2.9	31.6	46.0	11.2	0.9	10.3

n: number of cases (absolute frequency). %: proportional relative frequency.

Table 2. Incidence of leprosy according to the grade of disability in children and adolescents under 15 years old in Brazil and its macro-regions between 2001 and 2022 (2024).

Macrorregion	Overall (per 100,000)	Median (per 100,000)	IQR	Minimum	Maximum
Grade 0					
Brazil	101	4.55	2.20	1.56	7.01
North	259	11.4	8.22	2.98	20.5
Northeast	150	7.10	2.00	2.45	10.0
Southeast	34.5	1.35	1.35	0.42	2.87
South	10.3	0.30	0.27	0.09	2.00
Central-West	170	7.50	4.02	2.67	11.9
Grade 1					
Brazil	12.9	0.58	0.09	0.29	1.20
North	33.9	1.51	0.35	0.63	3.48
Northeast	19.1	0.83	0.22	0.45	1.83
Southeast	3.75	0.17	0.11	0.07	0.31
South	1.20	0.05	0.05	<0.00	0.12

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Macrorregion	Overall (per 100,000)	Median (per 100,000)	IQR	Minimum	Maximum
Central-West	23.5	0.92	0.46	0.44	2.01
Grade 2					
Brazil	3.45	0.16	0.03	0.08	0.20
North	10.0	0.49	0.11	0.26	0.58
Northeast	5.22	0.23	0.09	0.12	0.35
Southeast	1.01	0.04	0.04	0.01	0.09
South	0.23	<0.00	0.02	<0.00	0.05
Central-West	4.68	0.20	0.14	0.08	0.48

IQR: interquartile range (Q3 - Q1).

Table 3. Incidence ratio of leprosy in children and adolescents under 15 years old between Brazil and its macro-regions from 2008 to 2022 (2024).

Macrorregion	D	IR	Limits		p-value
			Lower	Upper	
Grade 0					
Intercept		3.48	3.05	3.92	<0.001*
Brazil			<i>ref</i>		
North		2.64	2.12	3.30	<0.001*
Northeast	qPO	1.48	1.17	1.90	0.002*
Southeast		0.33	0.22	0.48	<0.001*
South		0.10	0.05	0.17	<0.001*
Central-West		1.70	1.34	2.15	<0.001*
Grade 1					
Intercept		0.44	0.39	0.49	<0.001*
Brazil			<i>ref</i>		
North		2.69	2.23	3.28	<0.001*
Northeast	qPO	1.48	1.20	2.84	<0.001*
Southeast		0.29	0.20	0.40	<0.001*
South		0.09	0.05	0.16	<0.001*
Central-West		1.84	1.50	2.26	<0.001*
Grade 2					
Intercept		0.11	0.09	0.12	<0.001*
Brazil			<i>ref</i>		
North		2.97	2.48	3.57	<0.001*
Northeast	qPO	1.52	1.24	1.86	<0.001*
Southeast		0.29	0.20	0.40	<0.001*
South		0.06	0.03	0.17	<0.001*
Central-West		1.36	1.11	1.68	0.004*

D: distribution. IR: incidence ratio. *: p-value <0.05 (statistically significant). ref: reference level. qPO: quasi-Poisson distribution (robust dispersion).

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In grade 1 and 2, a similar pattern to grade 0 was observed. However, in grade 1, when compared to the national estimate, the incidence of leprosy in the North macro-region was 169% higher (IC95% = 123%, 228%), in the Central-West it was 36% higher (IC95% = 11%, 68%) and in the Northeast it was 52% higher (IC95% = 24%, 86%). Likewise, the incidence of leprosy in the South macro-region was 94% lower (IC95% = 83%, 97%), and in the Southeast was 71% lower (IC95% = 60%, 80%). At last, in grade 2, the incidence of leprosy in the North macro-region was 197% higher (IC95% = 148%, 257%), in the Central-West was 70% higher (IC95% = 50%, 126%), and in the Northeast, it was 48% higher (IC95% = 20%, 184%). Likewise, the incidence of leprosy in the South macro-region was 91% lower (IC95% = 84%,

95%), and in the Southeast was 71% lower (IC95% = 60%, 80%).

Table 4 shows the time trend analysis of the incidence of leprosy according to the grade of disability in children and adolescents under 15 years old in Brazil and its macro-regions. In grade 0, it was possible to observe that the national estimate and five macro-regions of Brazil presented a decreasing temporal trend from 2001 to 2022. In grade 1, the national estimate and the North, Northeast, and Southeast macro-regions remained decreasing, while the South and Central-West were stationary. At last, in grade 2, the national estimate and the North and Southeast macro-regions remained decreasing, while the Northeast, South, and Central-West were stationary.

Table 4. Time trend analysis of the incidence rate of leprosy according to the grade of disability in children and adolescents under 15 years old in Brazil and its macro-regions between 2001 and 2022 (2024).

Macrorregion	β_1	R ²	p-value	Trend	APC (%)
Grade 0					
Brazil	-0.027 [-0.020, -0.035]	0.818	<0.001*	Decreasing	-6.03 [-4.50, -7.74]
North	-0.036 [-0.028, -0.042]	0.864	<0.001*	Decreasing	-7.96 [-6.24, -9.22]
Northeast	-0.021 [-0.013, -0.032]	0.681	<0.001*	Decreasing	-4.72 [-2.95, -7.10]
Southeast	-0.039 [-0.033, -0.044]	0.940	<0.001*	Decreasing	-8.59 [-7.32, -9.64]
South	-0.036 [-0.019, -0.049]	0.649	<0.001*	Decreasing	-7.96 [-4.28, -10.7]
Central-West	-0.024 [-0.018, -0.033]	0.773	<0.001*	Decreasing	-5.38 [-4.06, -7.32]
Grade 1					
Brazil	-0.009 [-0.001, -0.016]	0.255	0.015*	Decreasing	-2.05 [-0.23, -3.62]
North	-0.010 [-0.002, -0.018]	0.220	0.026*	Decreasing	-2.28 [-0.46, -4.06]
Northeast	-0.008 [-0.001, -0.016]	0.215	0.027*	Decreasing	-1.83 [-0.23, -3.62]
Southeast	-0.026 [-0.020, -0.032]	0.809	<0.001*	Decreasing	-5.81 [-4.50, -7.10]
South	0.027 [-0.003, 0.059]	0.135	0.095	Stationary	6.41 [-0.68, 14.6]
Central-West	-0.002 [-0.013, 0.011]	0.001	0.896	Stationary	-0.46 [-2.95, 2.57]
Grade 2					
Brazil	-0.009 [-0.003, -0.015]	0.404	0.001*	Decreasing	-2.05 [-0.69, -3.39]
North	-0.014 [-0.008, -0.020]	0.612	<0.001*	Decreasing	-3.17 [-1.83, -4.50]
Northeast	-0.007 [-0.016, 0.001]	0.166	0.057	Stationary	-1.60 [-3.62, 0.23]
Southeast	-0.032 [-0.012, -0.045]	0.417	0.002*	Decreasing	-7.10 [-2.73, -9.84]
South	0.015 [-0.038, 0.079]	0.015	0.574	Stationary	3.51 [-8.38, 19.9]
Central-West	0.009 [-0.003, 0.021]	0.087	0.177	Stationary	2.09 [-0.69, 4.95]

β_1 : angular coefficient. R²: coefficient of determination. APC: Annual Percent Change. N/A: not applicable. *: p-value <0.05 (statistically significant). []: 95% confidence interval.

Comparing the first and last years of the time series, in leprosy-related grade 0 disability among children and adolescents under 15 years old, the North macroregion was classified as hyperendemic (18.6/100,000) in 2001 and as high-endemic (2.98/100,000) in 2022, the Northeast was classified as very high-endemic (7.24/100,000) in 2001 and as high-endemic (2.65/100,000) in 2022, the Central-West was classified as hyperendemic (10.0/100,000) in 2001 and as high-endemic (3.26/100,000) in 2022, the Southeast was classified as medium-endemic (2.30/100,000) in 2001 and as low-endemic

(0.47/100,000) in 2022, and the South was classified as low-endemic (0.37/100,000) in 2001 and as low-endemic (0.19/100,000) in 2022.

In grade 1 of leprosy-related disability, the North macroregion was classified as medium-endemic (1.54/100,000) in 2001 and as medium-endemic (1.03/100,000) in 2022, the Northeast was classified as medium-endemic (0.73/100,000) in 2001 and as medium-endemic (0.72/100,000) in 2022, the Central-West was classified as medium-endemic (0.96/100,000) in 2001 and

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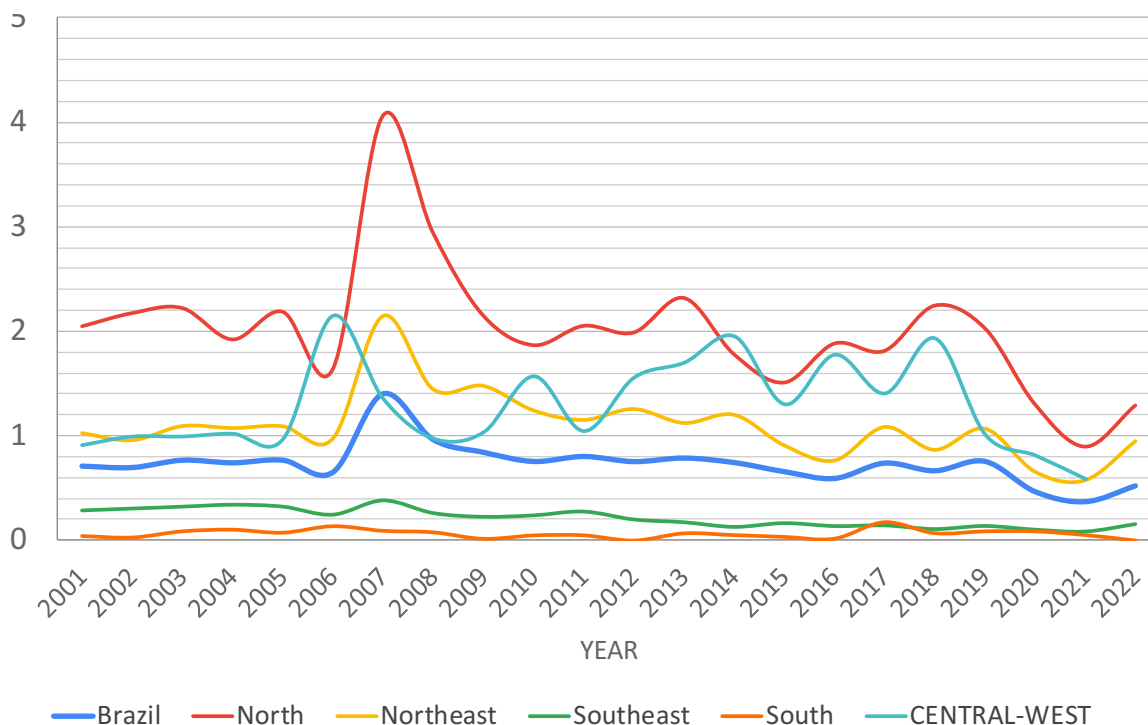
as low-endemic (0.44/100,000) in 2022, the Southeast was classified as low-endemic (0.22/100,000) in 2001 and as low-endemic (0.09/100,000) in 2022, and the South was classified as low-endemic (0.03/100,000) in 2001 and as low-endemic (0.00/100,000) in 2022.

In grade 2, of leprosy-related disability, the North macroregion was classified as medium-endemic (0.51/100,000) in 2001 and as low-endemic (0.27/100,000) in 2022, the Northeast was classified as low-endemic (0.29/100,000) in 2001 and as low-endemic (0.22/100,000) in 2022, the Central-West

was classified as low-endemic (0.11/100,000) in 2001 and as low-endemic (0.14/100,000) in 2022, the Southeast was classified as low-endemic (0.06/100,000) in 2001 and as low-endemic (0.06/100,000) in 2022, and the South was classified as low-endemic (0.01/100,000) in 2001 and as low-endemic (0.00/100,000) in 2022.

Figure 1 shows the temporal variation of leprosy cases with disabilities grade 1 or 2 in all Brazilian macro-regions and in the national estimate.

Figure 1. Temporal variation of leprosy cases with disabilities grade 1 or 2 in all Brazilian macro-regions and in the national estimate



DISCUSSION

This study investigated macro-regional disparities in the incidence of leprosy in children and adolescents under 15 years old, with a focus on leprosy-related disability. The alternative hypothesis was rejected since there were statistically significant differences between the national estimate and the macro-regions in all grades of disability.

Comparing the literature, Miguel et al. (2021)²¹, evaluating data from 2008 to 2018 (all age groups), demonstrated that mortality was significantly lower in the Southeast and South macro-regions compared to the North, Northeast, and Central-West. However, the Southeast and South regions had the highest rates of physical disability in relation to the other macro-regions of Brazil, which differs from the panorama among children and adolescents under 15 years old observed here. In fact, there are clusters of high leprosy mortality in the North, Northeast, and Central-West macro-regions, as demonstrated by other spatio-

temporal investigations. On the other hand, it is known that the distribution of cases in Brazilian territory is heterogeneous, and local variables can influence the leprosy-related outcomes²², although no investigation with a similar approach was found to directly compare outcomes.

Without macro-regional comparisons, investigations in Brazilian endemic and non-endemic territories indicate that the diagnosis of new cases of leprosy in children and adolescents under 15 years old with some grade of disability is a relevant concern in local contexts. A higher incidence of cases diagnosed with leprosy-related disability in this age group is an indicator of transmission from undiagnosed or unreported cases, which suggests a failure in disease control actions, such as active search and evaluation of household contacts (which is directly associated with the transmission of the disease in this age group)^{10,18}.

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Then, it is possible to hypothesize, in a first analysis, that greater efficiency of leprosy control actions in the Southeast and South macro-regions favors early diagnosis, preventing the occurrence of disabilities. As discussed by Miguel et al. (2021)²¹, beyond the context of disabilities addressed here, better leprosy-related outcomes in the Southeast and South macro-regions are associated, in part, with the better organization of healthcare networks, in addition to the implementation of actions to prevent and control the disease in that territory, leading to better early detection rates and timely treatment provision.

On the other hand, it is also possible to hypothesize that more diagnoses will be carried out in the North, Northeast, and Central-West macro-regions, as they are considered high-risk territories. Since more actions are carried out on demand, a higher number of cases are diagnosed (justifying the higher incidence in all grades of leprosy-related disability). This perspective is similar to what was hypothesized by Barbosa-Lima et al. (2023)⁸, considering that the Southeast and South macro-regions performed fewer skin smear exams for leprosy in comparison to the other macro-regions. However, as demonstrated by Miguel et al. (2021)²¹, both presented a higher incidence of cases with some grade of leprosy-related disability despite the lower incidence and mortality. However, both hypotheses require further studies.

Furthermore, it was observed in this study that the incidence of leprosy in children and adolescents under 15 years old decreased in all macro-regions in grade 0 disability, corroborating the improvement in the endemicity classification in all macro-regions. However, in grade 1 and 2, the South and Central-West macro-regions did not show the same outcome. In part, it is possible that variations within the time series justify this outcome: the South macro-region presented very low rates, and the Central-West fluctuated more sharply from 2015 onwards (Figure 1). This outcome is related to the significant reduction in the incidence of leprosy in Brazil in all age groups between 2001 and 2020, with an APC estimated at -5.20%, as reported by Paz et al. (2023)²³. In children and adolescents under 15 years old, disregarding leprosy-related disability, there

was a significant reduction in the incidence between 2001 and 2016 in Brazil, with an APC estimated at -5.00%, as reported by Schneider and Freitas (2018)²⁴.

In Brazil, it is worth considering that, despite advances in the development and implementation of public policies to control leprosy, the panorama of children and adolescents under 15 years of age is challenging since the incidence of new cases with some grade of disability indicates that the actions have been insufficient. There is a strong association between leprosy and poverty in this age group, and advances in recent decades have not been sufficient to interfere with community transmissions, especially in the North, Northeast, and Central-West macro-regions^{11,25}. Therefore, it is reasonable to state that macro-regional disparities in the incidence of grade 1 or 2 leprosy cases fit into this context.

At last, it is important to mention the most relevant limitations of the study: (1) associations at the population level (ecological approach) may not reflect local settings in all macro-regions, which requires specific investigations (2) in Brazil, between 2001 and 2022, 6,306 cases of leprosy in children and adolescents did not receive the WHO leprosy-related disability classification and were not considered and (3) underreporting and delays in the notifications may, at some level, interfere with temporal variation and underestimate the inferences. New studies can explore perspectives and factors that determine the incidence of leprosy with some grade of disability among children and adolescents, also considering other spatio-temporal dynamics, in addition to investigating the impact of public health policies and actions to control the disease in this age group.

CONCLUSION

Between 2001 and 2022, macro-regional disparities were observed in the incidence of leprosy in children and adolescents under 15 years old with grade 1 or 2 disability in Brazil. The North, Northeast, and Central-West macro-regions were above the national estimate, while the Southeast and South were below.

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