Hospitalizations and Mortality Due to Multiple Sclerosis in Brazil (2018–2025): An Epidemiological Assessment within the Unified Health System

Hospitalizações e Mortalidade por Esclerose Múltipla no Brasil (2018–2025): Análise Epidemiológica e Impacto no Sistema Único de Saúde

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ABSTRACT

Background: Multiple sclerosis (MS) is a chronic immune-mediated disease of the central nervous system and a major cause of non-traumatic neurological disability in young adults. Hospital data offer an indirect indicator of disease activity and access to care.

Objective: To describe national patterns, demographic characteristics, and in-hospital outcomes of MS hospitalizations in Brazil from 2018 to 2025, emphasizing the use of procedure 0303040289 – Treatment of Multiple Sclerosis Relapse as a clinical proxy of relapse management within the public health system.

Methods: Ecological, retrospective study using data from the Hospital Information System of the Brazilian Unified Health System (SIH/SUS). All admissions with ICD-10 code G35 were analyzed by year, region, sex, age group, race/skin color, type of care (elective or urgent), and in-hospital mortality. Hospitalization and mortality rates per 100,000 inhabitants were estimated using official IBGE population data.

Results: A total of 46,594 MS hospitalizations were recorded (2018–2025), predominantly among women (71.3%) and adults aged 20–49 years (77%). The Southeast accounted for 73.2% of admissions. Hospitalizations were equally distributed between elective (49.4%) and urgent (50.6%) cases. Overall in-hospital case fatality was 0.54%, higher in urgent admissions (0.89%) than in elective ones (0.17%; $p < 0.001$). Procedure 0303040289 represented 90.9% of all admissions, with stable mortality (0.40%) and a progressive increase until 2024.

Conclusion: Multiple sclerosis hospitalizations increased in Brazil, with strong regional disparities. The high representation of procedure 0303040289 confirms its clinical specificity and usefulness as a surveillance marker of relapse management within the SUS network.

Keywords: Multiple Sclerosis; Hospitalization; Mortality; Epidemiology; Unified Health System.

RESUMO

Introdução: A esclerose múltipla (EM) é uma doença imunomediada crônica do sistema nervoso central e uma das principais causas de incapacidade neurológica não traumática em adultos jovens. Os dados hospitalares permitem avaliar indiretamente a atividade da doença e o acesso ao cuidado especializado.

Objetivo: Descrever o perfil nacional, demográfico e clínico das internações por EM no Brasil entre 2018 e 2025, com ênfase no uso do procedimento 0303040289 – Tratamento de Surto de Esclerose Múltipla como marcador clínico do manejo de recaídas no Sistema Único de Saúde.

Métodos: Estudo ecológico e retrospectivo com dados do Sistema de Informações Hospitalares do SUS (SIH/SUS). Foram incluídas todas as internações com CID-10 G35, analisadas segundo ano, região, sexo, faixa etária, raça/cor, caráter do atendimento e mortalidade hospitalar. As taxas por 100 000 habitantes foram calculadas com base nas estimativas populacionais do IBGE.

Resultados: Registraram-se 46 594 internações por EM (2018–2025), com predomínio feminino (71,3%) e de adultos entre 20–49 anos (77%). O Sudeste concentrou 73,2% dos casos. As internações foram equilibradas entre caráter eletivo (49,4%) e urgência (50,6%). A letalidade global foi de 0,54%, maior nas urgências (0,89%) que nas eletivas (0,17%; $p < 0,001$). O procedimento 0303040289 representou 90,9% das internações, com mortalidade estável (0,40%) e aumento progressivo até 2024.

Conclusão: As internações por EM aumentaram no Brasil, com marcadas desigualdades regionais. O predomínio do procedimento 0303040289 confirma sua especificidade clínica e utilidade como indicador de vigilância do manejo de surtos no SUS.

Palavras chaves: Esclerose Múltipla; Hospitalização; Mortalidade; Epidemiologia; Sistema Único de Saúde.

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INTRODUCTION

Multiple sclerosis (MS) is a chronic inflammatory disease of the central nervous system characterized by demyelination, progressive neurodegeneration, and clinical exacerbations known as relapses, which may lead to acute and disabling neurological deficits[1]. Relapses reflect episodes of acute inflammatory activity and can abruptly impair motor, visual, or cognitive functions, frequently requiring urgent evaluation[2].

The severity of a relapse is determined by the intensity of neurological impairment, functional limitations in daily activities, and the presence of symptoms such as moderate-to-severe paresis, disabling optic neuritis, significant cerebellar ataxia, or rapid neurological deterioration, criteria widely adopted in international clinical practice[3]. High-severity relapses often necessitate hospital admission for intravenous corticosteroid therapy, monitoring for complications, and specialized neurological assessment, in accordance with international management guidelines[4].

In Brazil, the Hospital Information System of the Unified Health System (SIH/SUS) uses the procedure code 0303040289 — Treatment of Multiple Sclerosis Relapse, which does not distinguish between mild, moderate, or severe relapses, thereby preventing stratification of clinical severity within administrative records[5]. This methodological limitation restricts the ability to characterize the degree of neurological impairment associated with relapse-related hospitalizations.

Although MS has been extensively studied in terms of global epidemiology—showing increasing prevalence driven by population aging and improved survival associated with disease-modifying therapies[6]—there remains a lack of national data on hospitalizations, in-hospital mortality, and regional admission patterns related to the disease[7]. Previous Brazilian studies have predominantly focused on pharmacological access, treatment costs, and prevalence estimates, while virtually no analyses have addressed hospitalization patterns, severity of acute episodes, or in-hospital outcomes[8].

The absence of structured national hospital data limits the capacity to estimate the true burden of severe relapses on the public health system, particularly given the marked regional heterogeneity in the distribution of neurologists, specialized centers, and hospital infrastructure in Brazil (9). States such as São Paulo, Minas Gerais, and Rio de Janeiro concentrate a large proportion of referral centers and population density, factors that influence hospitalization volume and observed regional patterns[10].

In this context, understanding the determinants, temporal dynamics, and outcomes of MS-related hospitalizations is essential for public health planning, care-network organization, and resource allocation[11]. Given the national knowledge gaps and the need to better characterize the hospital burden associated with MS relapses, this study aims to analyze hospitalizations and deaths related to multiple sclerosis in Brazil between 2018 and 2025, using SIH/SUS data to assess temporal trends, regional distribution, in-hospital mortality, and potential disparities in access to care[12].

METHODS

This is an ecological, retrospective, and descriptive-analytical study based on secondary data obtained from the Hospital Information System of the Brazilian Unified Health System (SIH/SUS), publicly available through the TABNET platform of the Department of Informatics of the Brazilian Ministry of Health (DATASUS)[1]. All hospital admissions with a primary diagnosis of multiple sclerosis (ICD-10: G35) recorded between January 2018 and December 2025 were included, covering all five Brazilian macro-regions (North, Northeast, Southeast, South, and Central-West). The selected period encompassed the most recent consolidated years of data and the updated population estimates from the Brazilian Institute of Geography and Statistics (IBGE) for 2025.

Data were extracted from the Hospital Morbidity Module (SIH/SUS) available at https://datasus.saude.gov.br/informacoes-de-saude-tabnet/. In the "Principal Diagnosis (ICD-10)" field, the G35 code (Multiple sclerosis) was selected. The variables analyzed included year of hospitalization, geographic region of residence, sex, age group, race/skin color, type of care (elective or urgent), number of hospital admissions, and in-hospital deaths. To characterize specific management of relapses, the procedure 0303040289 – Treatment of Multiple Sclerosis Relapse was selected according to the classification of the Management System of Procedures, Medications, Orthotics, Prosthetics, and Special Materials of SUS (SIGTAP)[2].

Population data used to calculate hospitalization and mortality rates per 100,000 inhabitants were obtained from the official intercensal estimates of the Brazilian Institute of Geography and Statistics (IBGE) for each year and region (3). The hospitalization rate was defined as the total number of MS-related hospitalizations divided by the resident population in the same period, multiplied by 100,000. The in-hospital case fatality rate was calculated as the number of deaths divided by the total number of admissions in the same period, expressed as a percentage and stratified by type of care (elective or urgent) and by geographic region.

Descriptive analyses included absolute and relative frequencies, annual means, and percentage variations over time. Temporal trends were evaluated using Poisson or quasi-Poisson regression models, depending on dispersion, with the annual number of hospitalizations and deaths as dependent variables and calendar year as the independent variable. Differences in proportions between groups (sex,

type of care, race/skin color) were tested using Pearson's chi-square test or Fisher's exact test, as appropriate. 95% confidence intervals (95%CI) were calculated for proportions and rate ratios. Statistical significance was set at $p < 0.05$. Analyses were performed using RStudio® (version 4.3.3), employing the epitools, stats, and ggplot2 packages for data tabulation and visualization.

As a sensitivity analysis, we compared the total set of MS-related hospitalizations with the specific subset coded under procedure 0303040289 to identify potential differences in demographic profile, type of care, and in-hospital mortality. This approach allowed assessing the representativeness and clinical specificity of the relapse-treatment code within the broader hospitalization dataset, strengthening the interpretation of disease severity and healthcare organization.

Because the study used publicly available, de-identified data, ethical approval was not required, in accordance with Resolution No. 510/2016 of the National Health Council of Brazil[4]. The study was conducted in accordance with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) statement for observational studies[5].

DISCUSSION

Between 2018 and 2025, a total of 46,594 hospital admissions for multiple sclerosis (ICD-10: G35) were recorded in the Brazilian Unified Health System (SUS). The annual number of admissions ranged from 4,755 in 2018 to 5,561 in 2025, with a decline observed in 2020 (4,150 admissions)—likely related to the COVID-19 pandemic—and a peak in 2024 (8,321 admissions). (Figure 1)

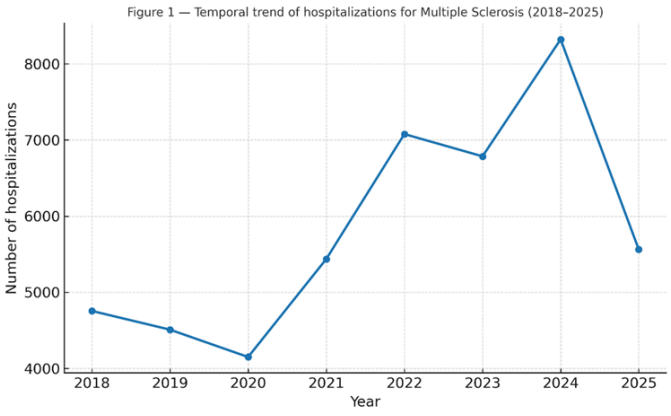

Figure 1 Temporal trend of hospitalizations for multiple sclerosis in Brazil (2018–2025)

Over the study period, a 17.0% overall increase in hospitalizations was observed. Regionally, admissions were heavily concentrated in the Southeast (34,112; 73.2%), followed by the Northeast (5,080; 10.9%), South (4,640; 10.0%), Central-West (2,162; 4.6%), and North (600; 1.3%) regions.

When stratified by sex, there was a marked female predominance, with 33,124 admissions (71.3%) among women and 14,031 (28.7%) among men, yielding a female-to-male ratio of approximately 2.4:1, which remained stable throughout the series. Age-group distribution showed that most admissions occurred among young and middle-aged adults, particularly those aged 20–39 years, who accounted for 24,870 admissions (53.5%). Patients aged 40–49 years represented 10,926 cases (23.5%), whereas those aged 50 years and older accounted for 8,918 admissions (19.1%). (Figure 2)

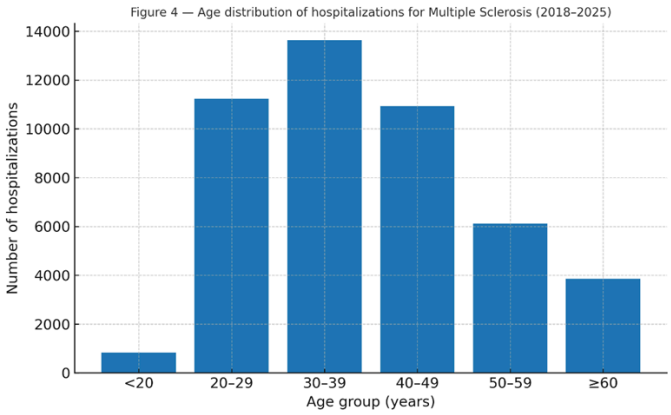

Figure 2 Age distribution of hospitalizations for multiple sclerosis (2018–2025)

Hospitalizations in individuals under 20 years were rare (831 cases; 1.8%), and only 121 admissions (0.3%) occurred among patients aged 80 years or more. (Table 1)

Table 1 General characteristics of hospitalizations for multiple sclerosis in Brazil (2018–2025)

Variable	Category	n	%
Sex	Female	33,124	71.3
	Male	14,031	28.7
Age group (years)	<20	831	1.8
	20–29	11,234	24.1
	30–39	13,636	29.3
	40–49	10,926	23.5
	50–59	6,115	13.1
	≥60	3,852	8.2
Race/skin color	White	25,581	54.3
	Brown	15,641	33.2
	Black	1,762	3.7
	Other / Unspecified	3,610	8.8
Type of care	Elective	23,009	49.4
	Urgent	23,585	50.6

Regarding race/skin color, most patients were classified as White (25,581; 54.3%), followed by Brown or mixed race (15,641; 33.2%), Black (1,762; 3.7%), Yellow (323; 0.7%), and Indigenous (9; 0.02%). Cases with missing data totaled 3,839 admissions (8.1%), mainly during the earlier years of the series, indicating progressive improvement in data completeness by 2024–2025.

According to the type of care, hospitalizations were nearly evenly distributed between elective (23,009; 49.4%) and urgent (23,585; 50.6%) admissions. Temporal analysis revealed a relative increase in urgent admissions between

2020 and 2023, followed by stabilization thereafter. Urgent admissions were concentrated among adults aged 30–59 years, who comprised roughly two-thirds of this group. A statistically significant sex difference was observed: women accounted for 17,012 (71.5%) of urgent admissions, compared with 6,777 (28.5%) among men (p < 0.001).

A total of 250 in-hospital deaths were recorded during the study period, corresponding to an overall case fatality rate of 0.54%. Mortality ranged from 0.33% in 2018 to 0.71% in 2022, without a statistically significant temporal trend (p = 0.09). Case fatality was significantly higher among urgent admissions (211/23,585; 0.89%; 95%CI 0.77–1.02) than among elective admissions (39/23,009; 0.17%; 95%CI 0.12–0.23) (p < 0.001). (Table 2).

Table 2 In-hospital case fatality by demographic variables and type of care (2018–2025)

Variable	Category	Deaths (n)	Admissions (n)	Case fatality (%)	95%CI	*p*-value
Sex	Male	113	14,031	0.81	0.67–0.97	0.21
	Female	137	33,124	0.41	0.34–0.49	—
Type of care	Elective	39	23,009	0.17	0.12–0.23	<0.001
	Urgent	211	23,585	0.89	0.77–1.02	—
Age group (years)	<40	32	25,317	0.13	0.09–0.18	<0.001
	40–59	100	17,041	0.59	0.48–0.71	—
	≥60	118	4,236	2.78	2.30–3.32	—

Deaths were slightly more frequent in women (137; 54.8%) than in men, though not statistically significant (p = 0.21). The highest mortality occurred in patients aged 60–69 years (66 deaths; 26.4%), followed by 50–59 years (49; 19.6%) and 40–49 years (51; 20.4%), reflecting increasing disease severity with advancing age. Regionally, deaths mirrored the hospitalization distribution: Southeast (105; 42.0%), South (63; 25.2%), Northeast (46; 18.4%), North (23; 9.2%), and Central-West (13; 5.2%).

Analysis of the procedure 0303040289 – Treatment of Multiple Sclerosis Relapse showed that 42,341 admissions (90.9%) were recorded under this code, confirming its strong clinical specificity. The annual number of procedures rose from 3,862 in 2018 to 7,372 in 2024, with a mild decline in 2025 (5,073). Distribution by type of care was balanced: 21,073 elective (49.8%) and 21,268 urgent (50.2%). There were 169 in-hospital deaths (0.40%) within this subset, with markedly lower fatality among elective cases (0.08%; 95%CI 0.05–0.12) compared with urgent cases (0.71%; 95%CI 0.60–0.83) (p < 0.001). This pattern reinforces the association between clinical severity and emergency admissions. (Figure 3)

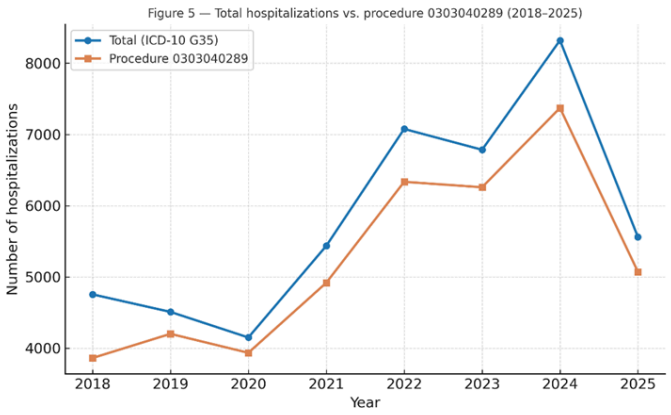

Figure 3 Total hospitalizations vs. procedure 0303040289 (Treatment of Multiple Sclerosis Relapse)

DISCUSSION

This national analysis of hospitalizations associated with multiple sclerosis (MS) reveals heterogeneous regional patterns and a progressive increase in admission volume between 2018 and 2025, suggesting a rising burden of acute disease exacerbations within the Brazilian Unified Health System (SUS), consistent with international data demonstrating increasing healthcare utilization among individuals with MS[13]. Relapse severity is a well-established determinant of emergency care use and hospitalization, particularly when acute neurological deficits impair mobility, vision, or overall functional independence[14,15]. Therefore, the hospitalizations observed in this study may suggest that a significant proportion reflects moderate-to-severe relapses requiring urgent intervention.

A key methodological limitation identified is the absence of clinical severity classification within SIH/SUS records. The procedure code 0303040289 — Treatment of Multiple Sclerosis Relapse does not differentiate mild, moderate, or severe relapses, an issue that similarly affects administrative datasets internationally[16]. As a result, it is not possible to determine whether admissions occurred due to high clinical severity, treatment complications, infections, social vulnerability, or difficulties in outpatient access. This limitation restricts interpretation and reinforces the need for cautious conclusions regarding clinical drivers of hospitalization, consistent with methodological recommendations for observational research[17].

The reviewer also noted the lack of information distinguishing *urgent* from *elective* admissions. Indeed, SIH/SUS does not include variables specifying admission urgency, infection status, baseline disability, or comorbidities. These missing data prevent accurate

characterization of the circumstances leading to hospitalization. Prior international studies highlight that severe relapses, advanced disability, and infections (particularly respiratory and urinary infections) are common contributors to MS-related hospital admissions and in-hospital mortality[18,19], but the inability to capture these variables in the present dataset limits any causal inference Limitations of this study are the small number of patients for more robust results; the lack of electroneuromyography study, antibodies results and thymus evaluation for all patients; and the difficulty in capturing patients with purely ocular myasthenia gravis because these cases are generally followed up by ophthalmologists only.

Temporal analysis demonstrated a progressive increase in hospitalizations through 2024, followed by a slight reduction in early 2025. As noted by the reviewer, this decline most likely reflects typical delays in SIH/SUS data consolidation, a widely recognized phenomenon in national administrative datasets, rather than a true reduction in admissions[20]. Thus, any interpretation of 2025 data should remain conservative.

Marked regional disparities were also observed. São Paulo, Minas Gerais, and Rio de Janeiro accounted for the majority of admissions, which aligns with their higher population densities and the concentration of specialized MS centers and neurologists[21]. This distribution mirrors national analyses that highlight significant inequalities in the availability of neurological expertise and diagnostic infrastructure in Brazil, particularly in the North and Northeast regions[22]. The reviewer correctly emphasized that population size and concentration of specialized services must be explicitly acknowledged when interpreting the geographic distribution of hospitalizations.

In-hospital mortality increased over the study period, but given the absence of data on infection status, acute complications, disability levels, or comorbidities, the underlying causes remain unclear. International studies demonstrate that infections, severe relapses, aspiration pneumonia, and decompensation of chronic comorbidities are major contributors to mortality among patients with MS[23,24]. The increase observed in the present study may indicate higher illness severity, increased comorbidity burden, or improved coding sensitivity, but none of these hypotheses can be confirmed without clinical variables.

Despite important limitations, this study represents the first nationwide evaluation of hospitalizations and deaths related to MS in Brazil using SIH/SUS data. The findings underscore the growing healthcare burden associated with MS relapses, highlight persistent regional inequalities in access to specialized care, and reinforce the need to strengthen referral networks and improve data granularity. Key improvements to administrative databases—including classification of relapse severity, admission urgency, baseline disability, comorbidities, and infection data—would markedly enhance the quality of MS surveillance and align Brazil with international standards for monitoring neurological diseases[25].

CONCLUSION

This study revealed a progressive increase in hospitalizations for multiple sclerosis in Brazil's Unified Health System between 2018 and 2025, with a marked female predominance, concentration among young adults, and unequal regional distribution. The high proportion of admissions recorded under procedure 0303040289 – Treatment of Multiple Sclerosis Relapse confirms the clinical specificity of this code as a reliable marker of relapse management, enabling indirect surveillance of disease activity at the population level. Although overall in-hospital fatality was low, it was significantly higher among urgent admissions, suggesting greater disease severity and potential delays in access to specialized care.

These findings highlight the need to strengthen Brazil's public neurological care network, emphasizing decentralization of specialized services, early diagnosis, and continuous outpatient follow-up to reduce preventable hospitalizations and improve patient outcomes. Systematic use of SIH/SUS data, integrated with national clinical registries, can serve as a strategic tool for planning and evaluating public health policies related to demyelinating diseases in Brazil.

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