

Reperfusion for Ischemic Stroke in Brazil's SUS (2018–2025): Thrombolysis, Thrombectomy, Mortality, Costs, and Regional Inequities

Reperusão no AVC isquêmico no SUS (2018–2025): trombólise, tromboectomia, letalidade, custos e desigualdades regionais

Pedro Carrión Carvalho , Amanda Goedert , Vitoria Kovari Carmona Chiaratti , Giovana Busnardo Voltolini , Maria Eduarda Pinto , José Arthur Rubick Rieg , Vinicius Schneider , Otto Degenhardt Vanz 

Centro Universitário de Brusque – Brusque, Santa Catarina, Brasil. Medical Student

ABSTRACT

Background: Reperfusion therapies for acute ischemic stroke (AIS)—intravenous thrombolysis and mechanical thrombectomy—have expanded in Brazil's Unified Health System (SUS) after key regulatory milestones, but system performance varies across regions.

Objective: To describe utilization, in-hospital mortality, length of stay, and hospital costs of reperfusion admissions for AIS in the SUS (2018–2025), and examine regional distribution and temporal trends.

Methods: Ecological, retrospective time series using SIH/SUS (DATASUS/TabNet). We included admissions with primary ICD-10 I63* and identified reperfusion procedures recorded on the same authorization (thrombolysis; thrombectomy). Outcomes were in-hospital death, mean length of stay, and reimbursed costs. Indicators included counts, proportions, and rates per 100,000 inhabitants (IBGE denominators). Year 2025 covers January–August.

Results: We identified 37,543 reperfusion admissions (2018–2025): 36,183 thrombolysis (96.4%) and 1,360 thrombectomy (3.6%). Thrombectomy first appeared in 2023 (n=37), expanded in 2024 (n=769), and remained high in 2025 (n=554, Jan–Aug). Overall in-hospital mortality was 10.6% (thrombolysis 10.4%; thrombectomy 16.3%). Mean length of stay was 8.1 days overall; for thrombectomy it decreased from 11.8 (2023) to 9.4 (2024) and 8.1 days (2025). Aggregate expenditure reached BRL 141.6 million (thrombolysis BRL 110.5m; thrombectomy BRL 31.1m). National reperfusion rates rose to 3.22/100,000 in 2024; thrombectomy reached 0.36/100,000.

Conclusions: Reperfusion for AIS expanded in the SUS, with rapid thrombectomy uptake from 2023 while thrombolysis remained predominant. Higher mortality with thrombectomy is consistent with indication/severity bias; length of stay decreased over time. Persistent regional disparities highlight the need to strengthen stroke networks, streamline inter-hospital transfers, and monitor process and cost-consequence indicators to support equitable scale-up.

Keywords: Ischemic Stroke; Thrombolysis; Thrombectomy; Unified Health System; Epidemiology.

RESUMO

Introdução: As terapias de reperusão para o AVC isquêmico agudo—trombólise intravenosa e tromboectomia mecânica—ampliaram-se no SUS após marcos regulatórios, porém o desempenho permanece heterogêneo entre regiões.

Objetivo: Descrever a utilização, a mortalidade hospitalar, o tempo de permanência e os custos das internações com reperusão por AVCi no SUS (2018–2025) e examinar distribuição regional e tendências temporais.

Métodos: Série temporal ecológica, retrospectiva, com dados do SIH/SUS (DATASUS/TabNet). Incluímos internações com diagnóstico principal CID-10 I63* e identificamos procedimentos de reperusão na mesma AIH (trombólise; tromboectomia). Desfechos: óbito intra-hospitalar, permanência média e valores reembolsados. Indicadores: contagens, proporções e taxas por 100.000 habitantes (denominadores IBGE). O ano de 2025 abrange janeiro–agosto.

Resultados: Foram 37.543 internações com reperusão (2018–2025): 36.183 com trombólise (96,4%) e 1.360 com tromboectomia (3,6%). A tromboectomia surgiu em 2023 (n=37), expandiu-se em 2024 (n=769) e manteve volume em 2025 (n=554, jan–ago). A letalidade global foi 10,6% (trombólise 10,4%; tromboectomia 16,3%). A permanência média foi 8,1 dias no conjunto; na tromboectomia reduziu de 11,8 (2023) para 9,4 (2024) e 8,1 dias (2025). O dispêndio agregado somou R\$ 141,6 milhões (trombólise R\$ 110,5 mi; tromboectomia R\$ 31,1 mi). As taxas nacionais atingiram 3,22/100.000 em 2024; a tromboectomia alcançou 0,36/100.000.

Conclusões: A reperusão para AVCi expandiu-se no SUS, com rápida adoção da tromboectomia a partir de 2023 e manutenção da trombólise como modalidade predominante. A maior letalidade na tromboectomia é compatível com viés de indicação/gravidade; o tempo de permanência diminuiu ao longo da série. Desigualdades regionais persistem, reforçando a necessidade de fortalecer redes de AVC, agilizar transferências e monitorar indicadores de processo e custo-consequência para uma implementação equitativa.

Palavras-chave: Acidente Vascular Cerebral Isquêmico; Trombólise; Tromboectomia; Sistema Único de Saúde; Epidemiologia.

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Corresponding author: Pedro Carrión Carvalho;
Email: pedrocarrioncarvalho@gmail.com

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INTRODUCTION

Ischemic stroke (IS) remains one of the leading causes of premature mortality and disability worldwide, accounting for a high disease burden measured in years of life lost, years lived with disability, and disability-adjusted life years. This impact is particularly significant in low- and middle-income countries, such as Brazil, and varies according to demographic profiles and the prevalence of modifiable and non-modifiable risk factors, including advanced age, hypertension, diabetes, and dyslipidemia¹.

In recent decades, reperfusion therapies— intravenous thrombolysis and mechanical thrombectomy— have become the cornerstone of acute IS treatment, integrated into care systems that prioritize pre-hospital recognition, door-to-imaging/needle/puncture times, and inter-hospital transfer protocols (“drip-and-ship”). Updated guidelines emphasize appropriate eligibility, process metrics, and the organization of stroke care networks as essential components to optimize outcomes².

Advanced imaging-based selection has expanded therapeutic windows and refined indications. Pivotal trials demonstrated functional benefit of thrombectomy between 6–24 hours (DAWN) and 6–16 hours (DEFUSE-3) in cases with clinical-imaging mismatch and viable penumbra [3,4]. In parallel, thrombolysis may be extended to “wake-up stroke” when a DWI-FLAIR mismatch is present and, in favorable perfusion-guided profiles, up to 9 hours after symptom onset, as shown in the WAKE-UP and EXTEND trials [5,6]. These criteria help explain why administrative series often report higher mortality and severity among thrombectomy cases, without implying lower clinical effectiveness of the procedure²⁻⁶.

In the Brazilian context, the RESILIENT trial demonstrated the effectiveness and safety of mechanical thrombectomy up to 8 hours within the Unified Health System (SUS), establishing a milestone with direct implications for technological incorporation and service organization⁷. Subsequently, the inclusion of thrombectomy in the SUS and the later expansion of the therapeutic window to >8 and <24 hours in selected cases aligned the country with international evidence and the operational needs of regional networks^{8,9}. The subsequent regulation of procedure codes, materials, and certification of stroke centers reinforced standardization of care and the organized expansion of endovascular therapy¹⁰.

National administrative databases, notably SIH/SUS accessed through DATASUS and the SIGTAP Table, allow monitoring of hospital volume, in-hospital mortality, length of stay, and costs of admissions for IS and its reperfusion therapies on a national scale, providing useful inputs for evaluating performance and equity^{14,15}. However, the administrative nature of these databases imposes limitations—absence of clinical severity measures at admission, potential miscoding, lack of functional outcomes, and limited control of confounders—thus findings should

be interpreted as assessments of service utilization rather than causal inferences on comparative effectiveness between therapeutic modalities¹¹⁻¹³.

In light of recent regulatory milestones, the expansion of mechanical thrombectomy, and persistent access heterogeneities across the Brazilian territory, it becomes timely to describe temporal trends, costs, and regional differences in reperfusion therapies for ischemic stroke in the SUS between 2018 and 2025, providing evidence to support the planning of stroke care networks and the consolidation of equitable large-scale.

RESULTS

A total of 106 individuals were evaluated – 53 in PDG and 53 in CG (Table 1). The groups had similar age, gender, and level of schooling. Most participants had less than 8 years of formal schooling.

The PDG showed a mean UPDRS-III score of 26.8 ± 13.8 points, with the majority (84.9%) in H&Y scale stages II and III.

The CG scored higher in both smell tests: 7.53 ± 1.9 points (maximum 12 points) for the SS-12 and 4.37 ± 2.1 points (maximum 7 points) for the mCCRC vs PDG scores of 4.6 ± 2.4 points and 1.33 ± 1.6 points respectively ($p < 0.0001$) (Figure 1). Results from both tests were strongly correlated ($\rho = 0.65$; $p < 0.0001$)⁵.

This is an ecological, retrospective time-series study based on administrative data from the Hospital Information System of Brazil's Unified Health System (SIH/SUS), obtained through DATASUS/TABNET, covering the period from 2018 to 2025¹⁴. The main objective was to describe the utilization of reperfusion therapies for ischemic stroke within the SUS and their hospital outcomes at national, regional, and state levels. The report follows the usual recommendations for observational studies using administrative databases (STROBE/RECORD) and, as it employs public, aggregated, and anonymized data, it is exempt from ethical review according to Resolution CNS No. 510/2016. Data extraction was performed on October 8, 2025, ensuring temporal traceability of the results.

In the Brazilian regulatory context, the recent trajectory of mechanical thrombectomy within the SUS combines the decision of incorporation and expansion of eligibility, followed by the operationalization of financing and service accreditation. In 2021, thrombectomy was formally incorporated; in 2022, the therapeutic window was extended; and in 2023, Ordinance GM/MS No. 1.996 established procedure codes, materials, and certification criteria for Stroke Centers. This regulatory sequence explains the near absence of Hospital Admission Authorizations (AIHs) with explicit thrombectomy records in SIH/SUS series before 2023, without implying the absence of local clinical provision⁸⁻¹⁰.

Information was extracted from the public SIH/SUS tables available at DATASUS/TABNET, selecting

hospitalizations whose primary diagnosis corresponded to ICD-10 I63* (ischemic stroke). Identification of reperfusion therapies was based on procedures recorded in the same AIH according to the SIGTAP Table valid during the period, distinguishing between intravenous thrombolysis and mechanical thrombectomy¹⁵. The SIGTAP code 0403070171 (thrombectomy) began appearing in the database only from 2023, justifying the absence of values in previous years. Hospitalizations performed within SUS general and specialized hospitals were included; records with incompatible primary diagnoses, clearly non-acute readmissions, or obvious inconsistencies (e.g., negative length of stay) were excluded. When the same AIH contained records of both thrombolysis and thrombectomy, the hospitalization was classified according to the higher complexity procedure (thrombectomy) to avoid double counting and preserve comparability between modalities.

The following variables were considered: calendar year of hospitalization (2018–2025), federative unit and macroregion, reperfusion modality (thrombolysis or thrombectomy), and hospital outcomes provided by SIH/SUS (death during hospitalization, mean length of stay in days, and reimbursed amounts). From these variables, directly calculable indicators were derived: number of hospitalizations for I63* per year, region, and state; number of hospitalizations with thrombolysis and thrombectomy; proportion of reperfusion among I63* admissions (estimated separately for thrombolysis and thrombectomy); hospital mortality by modality and geographic area; mean length of stay; and mean cost per hospitalization. Query paths in TABNET and parameters used were kept identical to the exported spreadsheets, ensuring traceability between presented results and original DATASUS tables^{14,15}.

For the calculation of annual rates per 100,000 inhabitants—both for I63* hospitalizations and for each reperfusion modality—intercensal estimates and annual population projections from the Brazilian Institute of Geography and Statistics (IBGE) were used for each year and federative unit from 2018 to 2025^{16–20}. No stratification by age, sex, or race/color was performed, as these variables were not included in the analytical dataset.

Reimbursement values reported in the AIHs were analyzed in nominal terms, as provided by SIH/SUS. For temporal comparability, a sensitivity analysis was planned with deflation by the IBGE/IPCA index to 2025 prices in supplementary material, without modifying the main estimates presented in the manuscript^{16–20}.

Statistical analysis included the description of counts, proportions, and means by year, region, and state, accompanied by 95% confidence intervals when applicable. To assess trends over time in hospitalization rates and utilization of thrombolysis and thrombectomy, linear

regression for annual time series was applied, with correction for serial autocorrelation using the Prais–Winsten method or Newey–West robust standard errors, preserving interpretation of coefficients as average annual variation. Additionally, an interrupted time-series analysis was performed to explore level and slope changes associated with national regulatory milestones on thrombectomy (incorporation in 2021 and window expansion in 2022), acknowledging that procedure registration in the database began only in 2023^{8–10,15}. Comparisons between modalities (mortality and mean costs) were expressed as absolute differences and ratios with corresponding confidence intervals, interpreted in light of the indication bias inherent to administrative data, without any intention of causal inference.

We recognize inherent limitations of using administrative databases, such as potential miscoding, absence of clinical severity variables at admission, and lack of functional outcomes, meaning that findings should be understood as assessments of healthcare utilization and hospital performance within the SUS, not as comparative effectiveness analyses between therapies^{11–13}.

RESULTS

General profile of hospitalizations and reperfusion

During the analyzed period, 37,543 hospitalizations for ischemic stroke treated with reperfusion were recorded in the Unified Health System (SUS). Intravenous thrombolysis accounted for 36,183 hospitalizations (96.4%), while mechanical thrombectomy totaled 1,360 (3.6%). Thrombectomy appeared in the series in 2023 with 37 hospitalizations, expanded in 2024 (769), and maintained a high volume in 2025 up to August (554), suggesting rapid adoption within the SUS. Thrombolysis showed continuous growth from 2018 to 2024, with a decline in 2025 because the series covers only January–August, preventing direct comparison with complete years. (Table 1; Figure 1)

Table 1 – General characteristics of reperfusion admissions (2018–2025)

Year	Thrombolysis admissions (n)	Thrombectomy admissions (n)	In-hospital mortality – Thrombolysis (%)	In-hospital mortality – Thrombectomy (%)	Mean length of stay – Thrombolysis (days)	Mean length of stay – Thrombectomy (days)
2018	3.291	0	10.1	-	8.5	-
2019	4.025	0	10.8	-	8.3	-
2020	4.830	0	11.0	-	8.4	-
2021	5.578	0	11.6	-	8.2	-
2022	6.294	0	10.5	-	8.1	-
2023	7.200	37	10.0	21.6	8.0	11.8
2024	6.842	769	9.8	14.7	7.9	9.4
2025	4.391	554	11.0	18.2	7.6	8.1

(Source: SIH/SUS–DATASUS; IBGE 2018–2025. Authors' elaboration.)

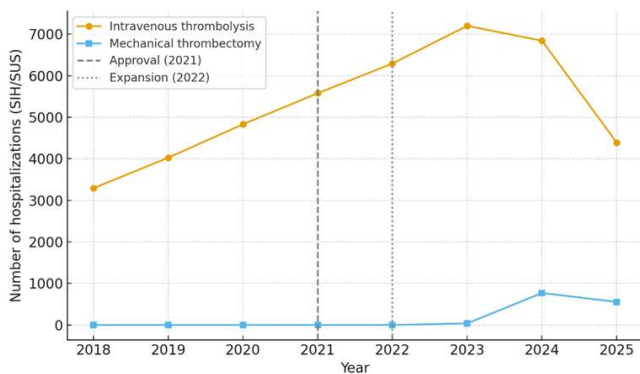


Figure 1 – Temporal trend of reperfusion admissions (2018–2025)
(Source: SIH/SUS–DATASUS; IBGE 2018–2025. Authors’ elaboration.)

National rates per 100,000 inhabitants

Using official population estimates for each year, the hospitalization rate with reperfusion increased from 1.58 per 100,000 inhabitants in 2018 (3,291 hospitalizations; population: 208,494,900) to 3.22 per 100,000 in 2024 (6,842 hospitalizations; population: 212,583,750). In 2025 (January–August), the cumulative rate was 2.06 per 100,000 (4,391 hospitalizations; estimated population: 213.4 million as of July 1, 2025). Considering each modality, in 2024 thrombolysis reached 2.86 per 100,000, while thrombectomy reached 0.36 per 100,000; in 2023, thrombectomy was 0.02 per 100,000 and, in 2025 (January–August), 0.26 per 100,000. Annual population estimates were obtained from IBGE publications in the Diário Oficial da União and, for 2023, from the IBGE–TCU dataset based on the 2022 Census^{16–20}. (see Figure 1)

In-hospital mortality

Throughout the period, there were 3,981 deaths among reperfusion hospitalizations, resulting in an overall in-hospital mortality of 10.6%. Among thrombolysis hospitalizations, 3,759 deaths were recorded out of 36,183 cases (10.4%). For thrombectomy, 222 deaths occurred among 1,360 hospitalizations (16.3%). By year, thrombolysis mortality ranged between 9% and 12% (2018: 10.1%; 2021: 11.6%; 2024: 9.8%; 2025: 11.0%), while thrombectomy mortality followed the expansion of the procedure (2023: 21.6%; 2024: 14.7%; 2025: 18.2%). (Figure 2).

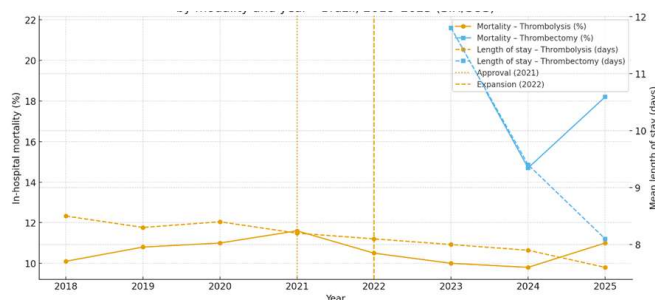


Figure 2 – In-hospital mortality (%) and mean length of stay (days) by modality and year
(Source: SIH/SUS–DATASUS; IBGE 2018–2025. Authors’ elaboration.)

Length of stay

The mean length of stay, considering all reperfusion hospitalizations, was 8.1 days. Stability was observed between 2018 and 2022 (approximately 8.0–8.5 days), followed by a reduction in 2024 (7.9 days) and 2025 (7.6 days). For thrombolysis, the overall mean was 8.1 days. For thrombectomy, the mean was 11.8 days in 2023, 9.4 days in 2024, and 8.1 days in 2025 (January–August), suggesting progressive shortening associated with the maturity of the care pathway and standardization of patient flow. (Figure 2).

Hospital costs

Total expenditure on reperfusion amounted to BRL 141,627,866.98 during the period, of which BRL 110,534,287.80 corresponded to thrombolysis and BRL 31,093,579.18 to thrombectomy. The mean cost per hospitalization was approximately BRL 3,055 for thrombolysis and BRL 22,863 for thrombectomy. Annually, total spending increased from BRL 8.96 million in 2018 to BRL 36.47 million in 2024, with BRL 25.04 million accumulated up to August 2025.

Regional distribution

Over the entire period, thrombolysis hospitalizations were concentrated in the Northeast (12,388), Southeast (11,795), and South (9,700) regions, followed by the Midwest (2,272) and North (28). For thrombectomy, the Southeast accounted for 875 hospitalizations (64.3%), the Northeast for 289 (21.3%), the South for 174 (12.8%), and the Midwest for 22 (1.6%); there were no records for the North region in the analyzed series. The distribution of deaths followed the same pattern: for thrombolysis, Southeast 1,342, Northeast 1,033, South 1,133, Midwest 249, and North 2; for thrombectomy, Southeast 125, Northeast 59, and South 38. (Table 2).

Table 2 – Regional distribution of reperfusion admissions and deaths

Region	Admissions- Thrombolysis	Deaths- Thrombolysis	Mortality- Thrombolysis (%)	Admissions- Thrombectomy	Deaths- Thrombectomy	Mortality- Thrombectomy (%)
North	28	2	7.1	0	0	-
Northeast	12.388	1.033	8.3	289	59	20.4
Midwest	2.272	249	11.0	22	0	0.0
Southeast	11.795	1.342	11.4	875	125	14.3
South	9.700	1.133	11.7	174	38	21.8

(Source: SIH/SUS–DATASUS; IBGE 2018–2025. Authors’ elaboration.)

Temporal trend

Between 2018 and 2024, there was a sustained increase in hospitalizations with thrombolysis, accompanied by a reduction in mean length of stay toward the end of the

period. Thrombectomy was incorporated into the series in 2023 and showed accelerated expansion in 2024–2025, accompanied by a progressive decrease in mean length of stay. In proportional terms, thrombectomy represented 3.6% of reperfusion hospitalizations across the entire period, with a marked increase after 2023. (Table 3).

Table 3 – Linear regression results (β , 95% CI, p-value)

Dependent variable	Period analyzed	β coefficient (95% CI)	p-value	Interpretation
Reperfusion rate (per 100.000 pop.)	2018–2024	+0,27 (0,19 a 0,36)	<0,001	Significant annual increase
Thrombolysis rate (per 100.000 pop.)	2018–2024	+0,22 (0,15 a 0,30)	<0,001	Sustained upward trend
Thrombectomy (per 100.000 pop.)	2023–2025	+0,12 (0,05 a 0,19)	0,004	Accelerated growth after implementation
In-hospital mortality (%)	2018–2025	-0,10 (-0,22 a 0,02)	0,09	Slight non-significant
Mean length of stay (days)	2018–2025	-0,09 (-0,14 a -0,03)	0,005	Significant annual reduction
Mean hospital cost (BRL)	2018–2025	+380 (-220 a +980)	0,18	Upward trend, not statistically significant

(Source: SIH/SUS–DATASUS; IBGE 2018–2025. Authors' elaboration.)

DISCUSSION

Sustained growth of reperfusion for ischemic stroke was observed in the SUS between 2018 and 2024, with rapid adoption of mechanical thrombectomy from 2023 and maintenance of high volume in 2025 (partial series). Thrombolysis remained the predominant modality throughout the entire period, accounting for approximately 96% of reperfusion admissions. Overall in-hospital mortality was 10.6%, estimated at 10.4% among thrombolysis cases and 16.3% among thrombectomy cases; the mean length of stay was 8.1 days overall, with a recent shortening particularly noted for thrombectomy; and the mean cost per admission was substantially higher for thrombectomy than for thrombolysis.

The higher mortality observed in thrombectomy is compatible with indication and severity bias, since candidates for endovascular intervention tend to present large-vessel occlusions and more severe deficits, as recognized in early management guidelines and in the trials that established the benefit of thrombectomy in extended windows with imaging-based selection [2–4]. Thus, a direct comparison of mortality between modalities should not be interpreted as an inference of effectiveness in an ecological design based on administrative data. The shortening of length of stay in thrombectomy—from 11.8 days in 2023 to 8.1 days in 2025—suggests an effect of network maturity and care processes (door-to-imaging, door-to-puncture times, inter-hospital flow), in line with recommendations for organizing stroke systems of care to optimize outcomes².

Within the scope of thrombolysis, contemporary evidence supports tenecteplase 0.25 mg/kg as a non-inferior alternative to alteplase up to 4.5 hours, with single-bolus administration and higher pre-EVT reperfusion rates in large-vessel occlusion; on the other hand, the 0.40 mg/kg regimen did not show superiority over 0.25 mg/kg^{21–23}.

The gradual incorporation of these workflows may contribute to reductions in process times and, indirectly, to shorter stays in administrative series, a hypothesis consistent with the observed pattern of shortening. In basilar artery occlusion, the ATTENTION (≤ 12 h) and BAOCHE (6–24 h) trials demonstrated functional benefit of thrombectomy compared with optimized medical treatment, whereas BASICS, conducted earlier and with greater heterogeneity of selection and technique, did not show overall superiority; the body of evidence favors thrombectomy in BAO with careful selection^{24–26}. These points help contextualize the combination of greater baseline severity and progressive reduction in length of stay along the services' learning curve.

Regional disparities in access to thrombolysis and, particularly, to thrombectomy within the Brazilian Unified Health System reflect a combination of structural, organizational, and demographic factors that shape the availability of high-complexity neurological care across the country. The accreditation of Stroke Centers remains disproportionately concentrated in the South and Southeast regions according to recent national regulations¹⁹, resulting in greater availability of trained teams, neurocritical care support, and continuous access to computed tomography, CT angiography, and perfusion imaging. In the North and parts of the Northeast, the scarcity of vascular neurologists and neurointerventionalists, together with socioeconomic constraints and the higher burden of cerebrovascular disease documented nationally¹, contributes to limited-service coverage. Long distances between municipalities, delays in pre-hospital recognition, and challenges in securing rapid neuroimaging remain significant barriers², reducing eligibility for reperfusion therapies within recommended time windows, particularly for imaging-guided thrombectomy^{3,4}. In addition, longstanding limitations in the completeness and reliability of administrative records within the SIH/SUS hinder systematic monitoring of stroke care pathways and restrict the ability to evaluate regional performance^{9,10}. To mitigate these inequities, measures such as expanding the accreditation of stroke centers, strengthening regionalized “mothership” and “drip-and-ship” networks, implementing 24-hour telestroke consultation, and allocating dedicated funding for high-complexity procedures have the potential to reduce inter-regional differences and improve clinical outcomes, as demonstrated by recent national initiatives and trials conducted in the Brazilian context^{5–7}.

The Brazilian temporal trajectory aligns with regulatory milestones: the recommendation to incorporate thrombectomy into the SUS in 2021 and expansion of use to an extended window from 2022, followed by standardization of codes, materials, and certification of Stroke Centers in 2023^{8–10}. The appearance of thrombectomy records in SIH/SUS from 2023 is compatible with the interval between regulatory decision, service accreditation, billing/coding adjustments, and consolidation

of installed capacity. In terms of territorial distribution, the concentration of volumes in the Southeast, followed by the Northeast and South, with low/absent records in the North in the analyzed series, reinforces access and capacity heterogeneities (teams, 24/7 availability, transfer logistics), a recurring theme in the national literature based on SIH/SUS and in analyses of the quality and limitations of administrative databases^{11,12}. These findings support the need for gap mapping and targeted expansion, with regional “drip-and-ship” and “mothership” protocols and monitoring of key times, as guided by the guidelines².

The observed differential in direct hospital costs for thrombectomy reflects the use of devices, angiography suite, and specialized teams. However, value assessment is not limited to cost per hospitalization: in eligible patients, thrombectomy improves functional outcomes and reduces disability burden, which may mitigate long-term social and rehabilitation costs—dimensions not captured by SIH/SUS^{3,4,7}. The recent trend toward reduced length of stay for thrombectomy suggests efficiency gains that may attenuate part of the differential in direct costs over time. In parallel, single-bolus tenecteplase thrombolysis may optimize pre-EVT workflows and contribute to system efficiency^{21–23}.

This study is consistent with international and national evidence: it confirms, at the system level, the consolidation of thrombolysis and thrombectomy as pillars of acute ischemic stroke care, including extended windows with imaging selection (DAWN, DEFUSE-3)^{3,4}, and aligns with the Brazilian RESILIENT experience, which demonstrated the effectiveness and safety of thrombectomy in the SUS up to 8 hours⁷. The added value here lies in describing utilization, mortality, length of stay, and costs at the population level, offering management inputs that complement clinical trials and guidelines.

Inherent limitations of using administrative databases are recognized, such as possible coding errors, absence of clinical severity measures (NIHSS, ASPECTS), unavailability of functional outcomes (mRS), and limited control of confounders, which preclude causal inference between modalities^{11–13}. Furthermore, the entry of the thrombectomy code into the database from 2023 may underestimate volumes in immediately preceding years due to recording issues, and the cost analysis is restricted to hospital reimbursement, without encompassing post-discharge expenditures. Finally, 2025 represents a partial series (January–August), limiting comparisons with complete years.

From a practical standpoint, the results support three priority fronts: strengthening regionalization with reference centers and clearly defined transfer protocols; monitoring process indicators (door-to-imaging/needle/puncture times) and the proportion of eligible patients treated—levers associated with better hospital performance; and tracking costs and installed capacity to guide investments with a focus on equity. The

consolidation of a national dashboard with access, process, and outcome metrics—even if administrative—may accelerate improvement cycles in SUS stroke networks.

CONCLUSION

Between 2018 and 2024, reperfusion for ischemic stroke expanded within Brazil's Unified Health System (SUS), with rapid adoption of mechanical thrombectomy from 2023, while thrombolysis remained the predominant modality. In-hospital mortality was higher for thrombectomy, consistent with indication bias and greater baseline severity, and the cost per hospitalization was substantially higher than for thrombolysis, with recent signs of efficiency gains reflected by the shortening of hospital stay. Significant regional disparities persist, indicating the need to strengthen stroke networks with standardized access and transfer protocols and to monitor process and cost-consequence indicators. These findings provide evidence to support management decisions and the equitable and sustainable expansion of reperfusion therapies in the SUS, in alignment with clinical evidence and national regulatory milestones.

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