

A Cross-Sectional Study of Stroke Hospitalization Costs in Secondary Care: Evidence From Southern Thailand (2019-2023)

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Abstract

Background: Stroke represents a significant global health burden with escalating incidence rates and healthcare costs. This study analyzes hospitalization costs for stroke patients from both healthcare provider and payer perspectives to inform resource allocation and enhance system efficiency.

Methods: This cross-sectional study examined data from 7,932 stroke patients (ICD-10 codes I60-I69) treated at Songkhla Hospital, Thailand (2019-2023). Analysis included inpatient costs across stroke types, readmission rates, and costs under different Universal Health Coverage schemes using SPSS version 17.

Results: The cohort comprised predominantly males (57.07%), with mean age 64.70 years and median hospital stay of 3 days (IQR: 2–5 days). Ischemic stroke constituted 79.84% of cases, with Universal Coverage Scheme covering 75.57% of patients. Patient volume increased by 23.04% over the study period, with 5.14% one-year readmission rate. Total treatment costs reached USD 6.09 million (THB 198,230,040), with a mean of USD 725 (THB 23,624) per year. Hemorrhagic stroke costs exceeded ischemic stroke by USD 454 (THB 14,802) annually. First-time median costs were USD 342 (THB 11,152) for ischemic and USD 658 (THB 21,451) for hemorrhagic strokes. Diagnosis-Related Groups (DRG) reimbursements were consistently lower than accounting costs, particularly for extended hospitalizations.

Conclusion: Findings demonstrate substantial cost variations between stroke types and payment mechanisms, highlighting the need for DRG system refinement to better reflect actual care costs.

Keywords: hospitalization costs, stroke, Thailand, health economics

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Introduction

Stroke is a condition in which the brain is deprived of blood supply due to the rupture, narrowing, or blockage of blood vessels, resulting in the death of brain cells (Kuriakose & Xiao, 2020; Sacco et al., 2013). It is a major public health issue worldwide, with increasing trends in both morbidity and mortality rates each year (Feigin et al., 2025; Xu et al., 2024). Stroke survivors often suffer from residual disabilities and are at high risk of recurrence and hospital readmission (Bjerkreim et al., 2019; Lin et al., 2011; Zhou et al., 2023). Additionally, stroke care imposes a substantial economic burden due to the long recovery periods and the need for close and continuous patient care (Kuptniratsaikul et al., 2013; Lucas-Noll et al., 2023; Ma et al., 2024; Rochmah et al., 2021).

Songkhla Hospital is a secondary care facility that serves as a referral center for stroke and neurological care for eight community hospitals within its network: Ranot Hospital, Krasae Sin Hospital, Sathing Phra Hospital, Singhanakhon Hospital, Mueang Songkhla Hospital, Thepha Hospital, Chana Hospital, and Saba Yoi Hospital. The hospital provides comprehensive, standardized care throughout the patient journey before arrival at the hospital, during inpatient treatment, and after discharge. Treatment is tailored to each patient's health condition and stroke severity.

This study was aimed to examine the inpatient (IPD) hospitalization costs of stroke patients admitted to Songkhla Hospital from walked-in or referred from community hospitals in its network. The findings will be valuable for planning and managing resources for stroke care and will contribute to optimizing healthcare resource utilization.

Method

This study employed a cross-sectional descriptive design using inpatient medical records of stroke patients documented in the hospital information system of Songkhla Hospital and referred from eight community hospitals between 2019 and 2023. Inclusion criteria comprised patients diagnosed with stroke (ICD-10 codes I60–I69) by a physician and admitted to Songkhla Hospital. Records with incomplete or missing data were excluded. A total of 7,932 cases were included (Figure 1). Data were obtained through a retrospective review of inpatient medical records and was used for comparing healthcare costs between initial hospitalizations and subsequent readmissions.

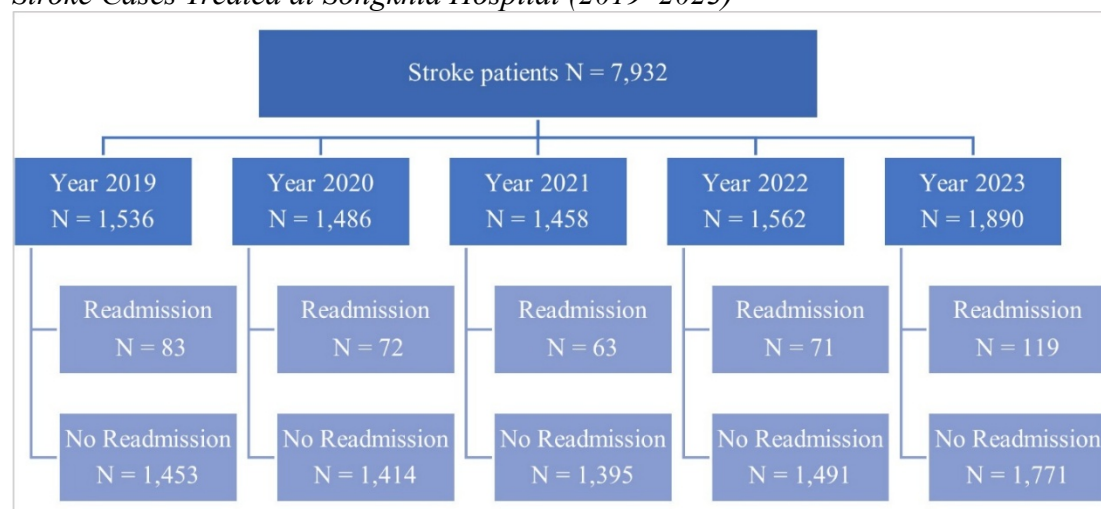
The analysis examined initial hospitalization cost (first admission) and repeated hospitalization cost (subsequent admissions), categorized by stroke type (ischemic or hemorrhagic). Costs were described from healthcare provider and healthcare payer perspectives. Two cost perspectives were assessed (1) accounting costs (actual expenses incurred by the hospital) and (2) Diagnosis Related Group (DRG) costs (reimbursements received under different insurance schemes). Cost data were further analyzed by length of stay and type of healthcare coverage under Thailand's Universal Health Coverage (UHC) system, three main schemes (1) Civil Servant Medical Benefit Scheme (CSMBS), (2) Social Security Scheme (SSS), and (3) Universal Coverage Scheme (UCS).

Descriptive statistics were used to analyze demographic and clinical characteristics, including gender, mean age, average length of stay, marital status, religion, stroke type, insurance coverage, and hospitalization details. Data analysis was performed using SPSS version 17, and results were presented as frequencies, percentages, means, and standard deviations.

Ethical approval for the study was obtained from the Human Research Ethics Committees of Thaksin University (COA No. TSU 2024_134, REC No. 0346) and Songkhla Hospital (SKH IRB 2024-Edu-On3-1077).

Figure 1

Stroke Cases Treated at Songkhla Hospital (2019–2023)



Between 2019 and 2023, a total of 7,932 stroke patients were admitted to Songkhla Hospital (Figure 1). Among these, 408 patients (5.14%) experienced hospital readmission for stroke treatment, whereas 7,524 patients (94.86%) had no readmission.

Result

Table 1

Characteristics of Stroke Patients at Songkhla Hospital (2019–2023)

Variable	Number of patient	Percentage
Gender		
Male	4,527	57.07
Female	3,405	42.93
Marital status		
Single	1,092	13.77
Married	6,488	81.80
Widowed	135	1.70
Divorced	190	2.40
Other	27	0.34
Religion		
Buddhism	6,111	77.04
Islam	1,817	22.91
Christianity	4	0.05
Patient type		
Ischemic stroke	6,333	79.84
Hemorrhagic stroke	1,599	20.16

Health benefit scheme and payment methods

Universal Coverage Scheme (UCS)	5,994	75.57
Social Security Scheme (SSS)	404	5.09
Civil Servant Medical Benefit Scheme (CSMBS)	1,384	17.45
Out-of-pocket payment	129	1.63
Health Insurance for Foreign Workers	21	0.26
Type of hospital admission		
Walked-in	3,746	47.23
Referral (within network)	3,976	50.12
Referral (outside network)	210	2.65

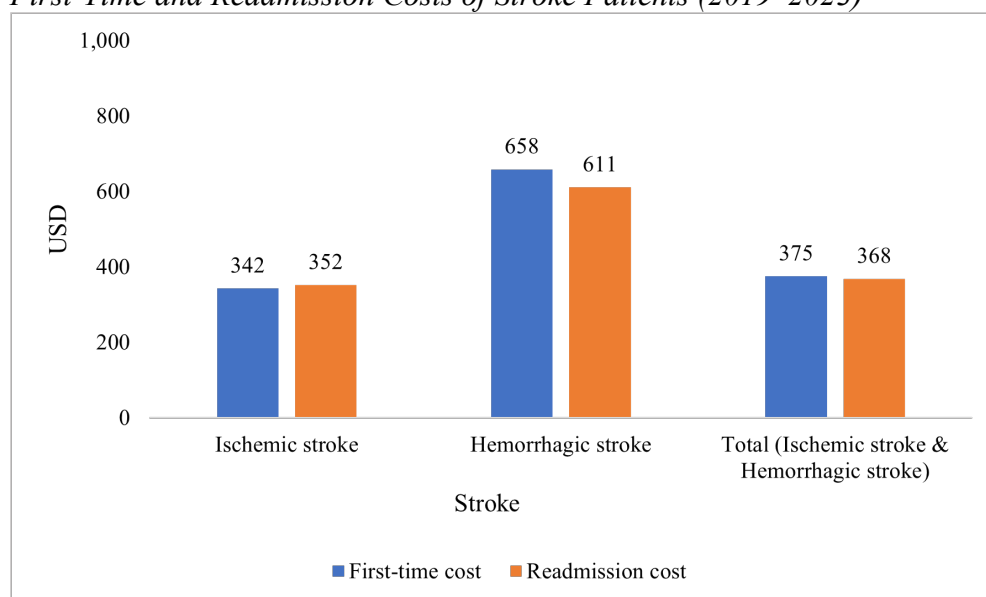
The mean age of patients was 64.70 years (SD = 14.33).

The median length of hospital stay among stroke patients was 3 days (IQR: 2–5 days).

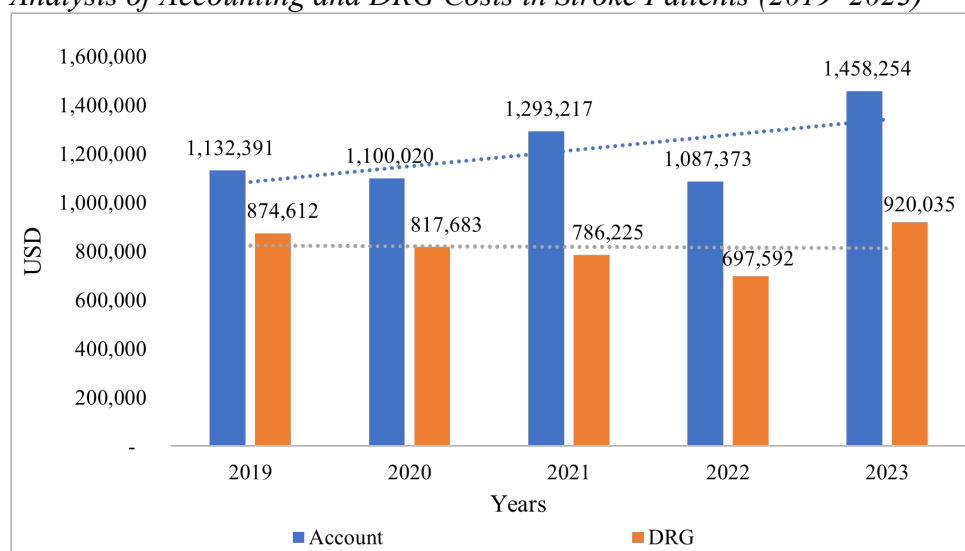
Based on the data presented in Table 1, the majority of stroke patients were male (4,527 cases, 57.07%), Buddhist (6,111 cases, 77.04%), and married (6,488 cases, 81.80%). Most patients were diagnosed with ischemic stroke (6,333 cases, 79.84%), with a mean age of 64.70 years (SD = 14.33). The median length of hospital stay was 3 days (IQR: 2–5 days). Approximately half of the patients (3,976 cases, 50.12%) were referred from affiliated community hospitals, and most were covered by the Universal Coverage Scheme (UCS) (5,994 cases, 75.57%).

Figure 2

First-Time and Readmission Costs of Stroke Patients (2019–2023)



As shown in Figure 2, there was no statistically significant difference in treatment costs between patients admitted for their first stroke episode and those readmitted for subsequent care. On average, the cost of treating hemorrhagic stroke was USD 454 (THB 14,802) higher than that of ischemic stroke. The mean initial treatment cost for hemorrhagic stroke was USD 658 (THB 21,451), compared to USD 342 (THB 11,152) for ischemic stroke.

Figure 3*Analysis of Accounting and DRG Costs in Stroke Patients (2019–2023)*

As illustrated in Figure 3, over the five-year period from 2019 to 2023, Songkhla Hospital spent approximately USD 6.09 million (THB 198,230,040) on stroke patient care. However, the hospital received only about USD 4.09 million (THB 133,295,779) in reimbursements under the Diagnosis Related Groups (DRG) system. This resulted in a cost deficit of approximately USD 1.99 million (THB 64,934,262). It represented financial shortfall of around 32.76%.

Furthermore, the cost gap has shown a consistent upward trend. In 2019, the deficit was USD 257,778 (THB 7,936,149), which increased to USD 538,218 (THB 18,593,930) by 2023 (Figure 3). This trend reflects the hospital's growing financial burden, which may be attributed to rising treatment costs or to DRG reimbursement rates that do not align with actual expenditures.

These findings (2019-2023) highlight a persistent imbalance between actual accounting costs and DRG-based reimbursement. Without targeted reforms or additional financial support, such discrepancies could threaten the long-term financial sustainability of secondary care hospitals.

Table 2*Comparison of Accounting Cost and DRG by Length of Stay (≤ 5 vs. ≥ 6 days) in Stroke Patients*

Los	Accounting cost (USD)		DRG (USD)	
	Median	IQR	Median	IQR
≤ 5 Days	327	262–469	293	290–403
Ischemic stroke	317	258–431	293	290–379
Hemorrhagic stroke	455	317–673	428	290–554
≥ 6 Days	1,215	711–2,129	581	381–1,286
Ischemic stroke	1,127	630–2,001	571	302–1,286
Hemorrhagic stroke	1,288	827–2,422	767	532–1,343

As presented in Table 2, accounting costs exceeded DRG-based reimbursements across all categories of stroke patients, with particularly pronounced differences observed among those with hospital stays longer than six days. The disparity between actual costs and reimbursement amounts tended to increase with the length of hospitalization. Specifically, stroke patients who were hospitalized for more than six days incurred a median accounting cost of USD 1,215 (THB 39,572), while the corresponding DRG reimbursement was only USD 581 (THB 18,939). This finding highlights a structural imbalance in the reimbursement system, particularly for cases requiring prolonged and complex care.

Additionally, patients with hemorrhagic stroke consistently incurred higher treatment costs than those with ischemic stroke, in terms of both accounting costs and DRG reimbursements (Table 2). This pattern was observed regardless of the length of stay (≤ 5 days or ≥ 6 days), reflecting the increased cost burden faced by hospitals in managing patients with more severe clinical presentations.

Table 3

Comparison of Accounting and DRG Costs by Health Scheme (2019–2023)

Health benefit scheme	Patient Stroke N (%)	Accounting (USD)	DRG (USD)	% Different*
Universal Coverage Scheme (UCS)	5,994 (75.57%)	375	293	-21.92%
Social Security Scheme (SSS)	404 (5.09%)	360	23	-93.64%
Civil Servant Medical Benefit Scheme (CSMBS)	1,384 (17.45%)	378	459	+21.38%
Out-of-pocket payment	129 (1.63%)	376	-	0.00%
Health Insurance for Foreign Workers	21 (0.26%)	390	293	-24.97%

Note * Loss (-) and profit (+)

As shown in Table 3, the average accounting cost of stroke care was relatively consistent across Thailand's major health insurance schemes (USD 360-390 or THB 11,730-12,706), reflecting a uniform standard of care. However, DRG-based reimbursements varied considerably.

Only the Civil Servant Medical Benefit Scheme (CSMBS) provided reimbursements exceeding actual costs, with a 21.38% surplus (USD 81 or THB 2,631). In contrast, the Social Security Scheme (SSS) had the largest deficit, covering only 6.36% of actual costs (USD 23 or THB 746), resulting in a shortfall of 93.64% (USD 337 or THB 10,984). Similarly, the Universal Coverage Scheme (UCS) and migrant worker insurance schemes also provided reimbursements below actual costs, with UCS patients facing an average deficit of 21.92% (USD 82 or THB 2,677).

Uninsured patients received no DRG-based reimbursement and were responsible for the full cost of care (Out-of-pocket).

These findings underscore structural disparities in the reimbursement systems, which destabilized the financial sustainability of public hospitals-particularly those operating under tight budget constraints.

Discussion

This study assessed the economic burden of stroke care at a secondary-level hospital in Southern Thailand by analyzing actual accounting costs, Diagnosis Related Group (DRG)-based reimbursements, and variations across different health insurance schemes using data from 2019 to 2023.

The findings revealed no significant difference in treatment costs between initial admissions and readmissions for stroke care. However, hemorrhagic stroke cases consistently incurred significantly higher costs than ischemic stroke cases, reflecting the greater resource requirements associated with more severe clinical presentations.

Over the five-year period, the hospital spent approximately USD 6.09 million on stroke patient care but received only USD 4.09 million in DRG-based reimbursements-resulting in a cumulative shortfall of around USD 1.99 million, or 32.76% of total costs. This deficit exhibited a rising trend each year, highlighting the increasing financial strain on secondary care hospitals.

This study found that reimbursement discrepancies across health insurance schemes. The Civil Servant Medical Benefit Scheme (CSMBS) was the only scheme that provided reimbursements exceeding actual costs (a 21.38% surplus), while the Social Security Scheme (SSS) offered the lowest coverage-only 6.36% of costs (USD 23 per case), resulted in 93.64% shortfall. Patients under the Universal Coverage Scheme (UCS) also faced reimbursement gaps, while uninsured patients bore the full cost out of pocket.

Cost disparities were more pronounced in cases involving extended hospital stays. Patients hospitalized for six days or more incurred median costs of USD 1,215, while corresponding DRG reimbursements averaged just USD 581. The gap was especially substantial in hemorrhagic stroke cases, indicating a structural imbalance in the reimbursement model for complex or prolonged hospitalizations.

Limitations

This study was conducted using retrospective data from one secondary hospital, which may limit the generalizability of the findings to other healthcare settings. Additionally, the analysis focused exclusively on direct accounting costs and did not capture indirect costs such as loss of productivity among caregivers or long-term disability-related expenses, which are also relevant when evaluating the broader economic impact of stroke.

Policy Implications and Recommendations

The findings suggest that current DRG reimbursement rates do not adequately reflect the actual costs incurred in stroke care, particularly in secondary-level hospitals operating under budget constraints. To address this, policymakers should consider revising the DRG payment structure to more accurately represent real treatment expenses for each type of health benefit scheme especially SSS and UCS. Furthermore, public hospitals that provide care for complex

or prolonged stroke cases should be supported through additional budget allocations or targeted financial mechanisms to maintain service quality and institutional sustainability. Broader research involving multiple hospitals and levels of care is also recommended to capture national trends and guide more equitable health financing policies.

Conclusion

This study highlights significant structural imbalances in Thailand's hospital reimbursement system for stroke care. The persistent gap between actual treatment costs and DRG-based reimbursements-particularly among patients with severe conditions, longer hospital stays, or underfunded insurance schemes-may threaten the financial sustainability of secondary public hospitals. Without targeted policy reforms or financial support mechanisms, these discrepancies could compromise equitable and sustainable access to essential stroke care services.

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