



ANALYSIS OF THE DIFFERENCE BETWEEN ACTUAL COSTS AND INDONESIAN CASE-BASED GROUP (INA-CBG) RATES FOR INPATIENTS WITH STROKE

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ABSTRACT

The implementation of the INA-CBGs prospective payment system requires hospitals to ensure that reimbursement tariffs adequately cover actual treatment costs, particularly for stroke, which is a high-cost catastrophic disease. Differences between INA-CBGs tariffs and actual hospital costs may affect hospital financial sustainability. This study aimed to analyse the differences between actual hospital costs and INA-CBGs tariffs in inpatient stroke cases and to identify the effects of length of stay, stroke severity, stroke type, complications, and Cost Recovery Rate (CRR) on these cost differences. This quantitative retrospective study used secondary data from medical records and BPJS claims of 101 inpatient stroke cases selected using total sampling, including all eligible stroke inpatients treated at RSUD dr. Abdul Aziz Singkawang in 2024. Data were analysed using descriptive analysis, t-tests, logistic regression, and CRR calculations. Total actual hospital costs exceeded INA-CBGs reimbursement, resulting in a financial deficit and an overall CRR of 93%. Stroke severity and stroke type significantly influenced cost differences, while length of stay and complications showed indirect effects through increased resource utilisation and prolonged hospitalisation. Severe haemorrhagic stroke cases generated the largest financial losses. Differences between actual costs and INA-CBGs tariffs are influenced by multiple interrelated factors. Severe stroke cases, particularly haemorrhagic stroke, create the greatest financial burden. Tariff evaluation and improved hospital cost management are required to enhance financial efficiency.

Keywords: actual cost; cost recovery rate; hospital financing; INA-CBGs; stroke; stroke severity

INTRODUCTION

Hospitals are essential institutions that play a significant role in improving public health by providing comprehensive healthcare services, including outpatient, inpatient, and emergency care. In addition, hospitals function as centers for education and research for healthcare professionals. Achieving these roles effectively, efficiently, and sustainably depends on various factors, one of the most important being a well-managed healthcare financing system. According to Hidayati and Sari (2021), healthcare financing is a significant factor influencing the quality of a country's health system.

In Indonesia, hospital reimbursement is predominantly based on the Indonesian Case-Based Groups (INA-CBGs) payment system. INA-CBGs is a case-based reimbursement application used for submitting claims by hospitals, primary healthcare centers (Puskesmas), and other healthcare providers (PPKs) participating in the National Health Insurance (JKN) program. Under this system, reimbursement is determined according to Case-Based Groups (CBGs), in which patients with similar diagnoses or clinical conditions are grouped together. Hospitals receive predetermined payments based on the average cost of treating patients within each diagnosis-related group rather than on the actual costs incurred for individual patients (Wijayanti & Sugiasi, 2013).

According to the Regulation of the Indonesian Ministry of Health (Kemenkes R.I., 2014), the INA-CBGs grouping system is based on the coding of the final diagnosis and medical procedures performed during patient care. Disease classification follows the International Classification of Diseases, Tenth Revision (ICD-10) for diagnoses and the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) for medical procedures. The grouping process is conducted using an information technology-based INA-CBGs application, which generates 1,077

case groups, consisting of 789 inpatient case groups and 288 outpatient case groups.

Addition to the INA-CBGs reimbursement system, hospital financing can also be assessed based on actual treatment costs. Actual treatment cost refers to the total of all direct medical cost components incurred during an individual patient's hospitalization period (Indahsari, Winarno, & Rosmi, 2024). Currently, stroke is one of the most common disease groups managed under both the INA-CBGs reimbursement system and actual cost calculations in hospitals. Despite advances in modern medical care, approximately 60% of stroke patients either die or experience permanent disability (WHO, 2020). In Indonesia, stroke is the leading cause of disability and the second leading cause of death worldwide. National data indicate that stroke accounts for 11.2% of all disabilities and 18.5% of all deaths, with a prevalence of 8.3 cases per 1,000 population (Ministry of Health of the Republic of Indonesia, 2024). Furthermore, stroke is classified as one of the country's catastrophic diseases, ranking third in healthcare expenditure after cardiovascular disease and cancer, with total treatment costs reaching IDR 5.2 trillion in 2023.

Given the substantial costs associated with stroke management, hospitals are likely to experience financial discrepancies between the actual costs incurred and the reimbursement provided through the INA-CBGs system. Mahardika, Nita, and Priyandani (2024) reported that intracerebral hemorrhagic stroke and unspecified stroke diagnoses consistently resulted in negative reimbursement differences ranging from IDR 110,659 to IDR 8,184,007 per patient episode. Medications and medical devices were identified as the largest contributors to stroke treatment costs. The study also found that length of stay (LOS), National Health Insurance (JKN) class, and patient age were significant determinants of direct medical costs. Similarly, Munawaroh, Sulistiadi, and Rachmad (2019) demonstrated that both length of hospital stay and stroke severity were significantly associated with reimbursement differences. The financial deficit attributable to length of stay reached IDR 125,844,628, while the deficit associated with stroke severity amounted to IDR 21,786,653. These findings indicate that INA-CBGs tariffs remain insufficient to fully cover the actual costs of ischemic stroke treatment.

The findings of the aforementioned study also demonstrated a substantial discrepancy between the actual treatment costs of patients with non-hemorrhagic stroke and the reimbursement provided under the INA-CBGs payment system. INA-CBGs tariffs are determined based on diagnosis codes, disease severity, and inpatient class. For Class I patients, the hospital incurred actual treatment costs of IDR 477,972,000, whereas the INA-CBGs reimbursement amounted to only IDR 212,232,087, resulting in a deficit of IDR 264,739,913. A similar pattern was observed for Class II patients, where actual costs reached IDR 533,407,410, exceeding the INA-CBGs reimbursement of IDR 193,701,293 by IDR 339,706,117. Although Class III patients incurred slightly lower actual costs (IDR 520,634,295), they experienced the largest reimbursement gap, amounting to IDR 395,786,957. Overall, the total discrepancy across all three inpatient classes reached IDR 1,000,232,987, highlighting a substantial financial burden on hospitals (Mubarok, Suryawati, & Harto, 2024).

Another study reported different findings regarding outpatient and inpatient reimbursement. Patient characteristics in outpatient care were not significantly associated with direct medical costs. In contrast, patient age, length of hospital stay, and inpatient class were significantly associated with direct medical costs among hospitalized patients. The comparison between INA-CBGs reimbursement and actual costs also revealed contrasting patterns between outpatient and inpatient services. For outpatient care, the average INA-CBGs reimbursement was lower than the actual treatment costs, indicating that reimbursement was insufficient to cover hospital expenditures. Conversely, for inpatient care, the average INA-CBGs reimbursement exceeded the actual treatment costs, suggesting that the reimbursement was generally adequate to finance inpatient services, except for patients with mild stroke, where reimbursement remained insufficient (Fuad, Jayanti, & Maharani, 2022).

However, several studies have reported different findings regarding the adequacy of INA-CBGs reimbursement. Mazidah, Yasin, and Kristina (2019) concluded that INA-CBGs tariffs were insufficient to cover the treatment costs of hospitalized patients with hemorrhagic stroke, resulting in a financial deficit of IDR 89,165,865. In contrast, reimbursement for ischemic stroke generated a positive balance of IDR 154,789,069. Similarly, Indahsari et al. (2024) reported that, for non-hemorrhagic stroke inpatients, the overall INA-CBGs reimbursement exceeded the actual hospital costs, yielding a positive difference of IDR 32,355,523 across 28 patient cases.

Analyzing the discrepancy between actual hospital costs and INA-CBGs reimbursement is essential for hospitals to identify opportunities for optimizing resource allocation, improving operational efficiency, and ensuring long-term financial sustainability. This issue is particularly relevant for RSUD dr. Abdul Aziz Singkawang, where a substantial proportion of patients are covered under the INA-CBGs payment system. A heavy dependence on INA-CBGs reimbursement may reduce the financial contribution from non-INA-CBGs patients, thereby increasing the hospital's exposure to reimbursement deficits. Although a Cost Recovery Rate (CRR) exceeding 100% indicates that reimbursement exceeds treatment costs, this surplus should be carefully evaluated to ensure that all cost components, including indirect overhead expenses, are adequately covered to maintain the hospital's financial sustainability (Mubarok et al., 2024). Consequently, reimbursement tariffs should be periodically evaluated and aligned with actual treatment costs, while hospital resources and clinical care pathways should be optimized to improve both financial sustainability and the quality of healthcare services (Sunayya, 2024).

Another important determinant of hospital expenditure is the length of stay (LOS), defined as the number of days a patient is hospitalized from admission until discharge. A longer LOS generally requires greater resource utilization and increases direct medical costs. Mahardika et al. (2024) identified LOS as the most influential factor affecting direct medical costs for stroke patients. Similarly, Marwan, Prapanca, Himawati, and Widiyaningsih (2024) reported that prolonged hospitalization substantially increases unit costs and may exceed the allocated unit cost budget. In contrast, Utami and Fanny (2021) found that while different LOS categories were significantly associated with the magnitude of negative reimbursement differences between actual hospital costs and INA-CBGs tariffs, no significant differences were observed according to inpatient class, severity level, or the number of complication diagnoses.

RSUD dr. Abdul Aziz serves as the primary referral hospital for Singkawang City and the surrounding regions, including Sambas Regency, Bengkayang Regency, and Mempawah Regency. The hospital plays a strategic role in managing stroke cases because patients often require advanced medical services that are not available at lower-level healthcare facilities, making RSUD dr. Abdul Aziz the nearest referral center for these areas. Hospital records from 2024 showed a total of 101 hospitalized stroke cases at RSUD dr. Abdul Aziz. The total INA-CBGs reimbursement for these cases was IDR 690,420,500, whereas the total actual treatment cost reached IDR 916,677,167, resulting in a financial deficit of IDR 226,256,667. This substantial reimbursement gap underscores the need to evaluate the adequacy of INA-CBGs tariffs and to identify the factors contributing to the discrepancy between actual hospital costs and reimbursement for inpatient stroke care.

In addition, RSUD dr. Abdul Aziz operates under the Regional Public Service Agency Financial Management System (Pola Pengelolaan Keuangan Badan Layanan Umum Daerah, PPK-BLUD), which emphasizes efficiency, productivity, and financial sustainability in the delivery of public healthcare services. Evaluating the relationship between actual treatment costs and INA-CBGs reimbursement at this hospital can provide an important benchmark for assessing the financial sustainability of regional public hospitals. Based on hospital service statistics, stroke is among the most frequently treated conditions at RSUD dr. Abdul Aziz, making the evaluation of stroke-related

treatment costs highly relevant for improving healthcare efficiency and optimizing resource utilization for the population of Singkawang and surrounding regions. Within the PPK-BLUD framework, the Cost Recovery Rate (CRR) is not merely a financial indicator but also a measure of fiscal sustainability that reflects the hospital's ability to maintain service quality, invest in medical equipment, and meet long-term operational expenditures (Government of Singkawang City, 2024).

Previous analyses of the differences between actual hospital costs and Indonesian Case-Based Groups (INA-CBGs) reimbursement for hospitalized stroke patients at RSUD dr. Abdul Aziz Singkawang have been limited to descriptive comparisons of cost differences, without comprehensively evaluating the adequacy of reimbursement or its implications for the hospital's financial sustainability. Cost comparisons alone do not adequately reflect the hospital's capacity to recover treatment expenditures under a case-based payment system. In this context, the Cost Recovery Rate (CRR) serves as a critical indicator of financial performance by measuring the proportion of actual treatment costs covered by INA-CBGs reimbursement. A CRR consistently below 100% indicates that reimbursement is insufficient to cover the actual costs of care, thereby posing a potential threat to the long-term sustainability of inpatient stroke services and increasing the risk of financial instability.

A low CRR in inpatient stroke services has implications that extend beyond financial losses at the individual patient level. Persistent reimbursement deficits may limit the hospital's ability to procure essential medicines and medical equipment, constrain investments in healthcare resources, increase pressure to improve service efficiency, and potentially compromise the quality of patient care. These consequences are particularly important for regional referral hospitals, which are responsible for delivering specialized healthcare services to a large catchment population. Therefore, the CRR can function as an early warning indicator of reimbursement inadequacy and financial vulnerability within the hospital. Accordingly, this study aims not only to analyze the differences between actual hospital costs and INA-CBGs reimbursement for hospitalized stroke patients at RSUD dr. Abdul Aziz Singkawang but also to establish the Cost Recovery Rate (CRR) as a key indicator for comprehensively evaluating hospital financial performance. By incorporating CRR into the analysis, this study integrates clinical, operational, and financial perspectives to provide a more comprehensive assessment of hospital financing. The findings are expected to provide robust empirical evidence for developing policies on reimbursement evaluation, cost control, resource optimization, and the long-term sustainability of healthcare services in regional public hospitals.

METHOD

This study employs a quantitative method with descriptive and analytical approaches. The quantitative approach is used to objectively measure the difference between INA-CBG rates and actual hospital costs using numerical data. The descriptive approach aims to illustrate patterns of cost differences and the Cost Recovery Rate (CRR), while the analytical approach is used to analyze factors influencing these differences, such as length of stay, severity level, stroke type, and complications. A retrospective design is used, utilizing existing data—specifically INA-CBG claim data and actual patient costs. This design was selected to evaluate the adequacy of INA-CBG rates in covering stroke patient care costs and to assess the hospital's financial strain via the Cost Recovery Rate (CRR) indicator.

The study population consists of all JKN-enrolled patients diagnosed with ischemic or hemorrhagic stroke who were hospitalized at RSUD dr. Abdul Aziz, Singkawang City, between January and December 2024. A total sampling technique was applied, resulting in a sample of 101 patients who met the inclusion criteria. Inclusion criteria comprised BPJS patients with ischemic or hemorrhagic stroke INA-CBG codes, while patients treated in the ICU were excluded. The study utilizes secondary data in the form of verified BPJS claims from 2024. Supporting data were obtained from the medical records department, the hospital information system, and the casemix unit of RSUD dr. Abdul Aziz, Singkawang City. Data collection was conducted through the review of documentation from the

hospital's finance, medical records, and casemix departments.

The sampling technique employed was total sampling, drawing from a population of hospitalized BPJS-covered patients diagnosed with ischemic and hemorrhagic stroke; based on the established sampling criteria, the study included a total of 574 cases. Microsoft Excel was used to collect and present quantitative data and to prepare the data for processing in SPSS software. Additionally, EViews software was utilized to conduct regression analyses—including N-Way ANOVA, Binary Logistic Regression, model selection, and panel data regression modeling—as well as hypothesis testing.

RESULT AND DISCUSSION

Table 1.

Demographic Data of Stroke Case Research Based on Age, Gender, Inpatient Class, Severity, and Complications (n=574)

Group	Category	f	%	CRR	Average CRR
Patient Age	< 45 years	52	9	80%	90.3%
	45-60 years	229	40	98%	
	>60 years	293	51	93%	
Gender	Male	300	52%	97%	92.5%
	Female	274	48%	88%	
Inpatient Class	Class 1	149	26%	102%	97.3%
	Class 2	61	11%	102%	
	Class 3	364	63%	88%	
Severity	Ischemic				101%
	Mild	178	31%	102%	
	Moderate	121	21%	109%	
	Severe	161	28%	91%	
	Subtotal (n)	460	80%		
	Hemorrhagic				73%
	Mild	11	2%	65%	
	Moderate	52	9%	70%	
	Severe	51	9%	85%	
	Subtotal (n)	114	20%		
Complications	Yes	548	95%	94%	94%
	No	26	5%	93%	

Source: BPJS Claim Data, RSUD dr. Abdul Aziz; processed by the Researcher (2025)

Based on the data presented in Table 4.10, the majority of hospitalized stroke patients at RSUD dr. Abdul Aziz Singkawang were aged over 60 years, accounting for 293 patients (51%). This finding indicates that stroke predominantly affects older adults, who are physiologically at greater risk of cerebrovascular disorders due to age-related degenerative changes. Patients aged >60 years had a Cost Recovery Rate (CRR) of 93%, indicating that the revenue generated from this age group covered 93% of the actual cost of care, reflecting relatively efficient service delivery although it was still insufficient to fully offset hospital costs.

Patients aged 45–60 years also represented a substantial proportion of cases, with 229 patients (40%). This age group achieved the highest financial performance, with a CRR of 98%, indicating the most efficient cost recovery among all age groups, although the reimbursement still did not completely cover the actual treatment costs. Meanwhile, patients aged below 45 years accounted for only 52 cases (9%), suggesting that stroke incidence among the productive-age population remains relatively low but is still important to monitor because of the increasing trend of early-onset stroke. This group had the lowest CRR (80%), making it the most vulnerable to financial deficits.

Regarding sex distribution, male patients constituted a slightly higher proportion (52%) than female patients (48%). Male patients achieved a CRR of 97%, demonstrating better financial performance than female patients, whose CRR was 88%. This indicates that hospital reimbursement for male patients nearly covered the actual cost of care, whereas female patients were associated with a greater risk of financial loss.

In terms of hospitalization class, most patients were treated in Class III wards (63%), followed by Class I (26%) and Class II (11%). The predominance of Class III patients reflects that most stroke patients at RSUD dr. Abdul Aziz were beneficiaries of Indonesia's National Health Insurance (BPJS Kesehatan). Class I and Class II patients demonstrated the best financial performance, each with a CRR of 102%, indicating that reimbursement exceeded the actual treatment costs and generated a financial surplus. In contrast, although Class III accounted for the largest proportion of patients (63%), it had the lowest CRR (88%), making it the group with the highest risk of financial deficits.

The analysis of stroke characteristics showed that ischemic stroke was the predominant diagnosis, accounting for 460 cases (80%), whereas hemorrhagic stroke comprised only 114 cases (20%). Among ischemic stroke patients, mild severity was the most common (31%), followed by severe (28%) and moderate (21%) cases. In contrast, among hemorrhagic stroke patients, the highest proportions were observed in the severe (9%) and moderate (9%) categories, while mild cases accounted for only 2%. These findings indicate that hemorrhagic stroke is generally associated with greater clinical severity, which may lead to longer hospital stays, increased medication use, and higher actual treatment costs.

Stroke Ischemic stroke patients had an average Cost Recovery Rate (CRR) of 101%, whereas hemorrhagic stroke patients had a substantially lower average CRR of 73%. Patients with mild and moderate ischemic stroke demonstrated the best financial performance, with CRR values exceeding 100%, indicating that reimbursement was sufficient to cover the actual treatment costs. In contrast, hemorrhagic stroke patients, particularly those with mild to moderate severity, exhibited the lowest CRR, reflecting a greater financial deficit for the hospital.

Regarding complications, 548 patients (95%) experienced one or more additional medical complications, while only 26 patients (5%) had no recorded complications. This finding suggests that the majority of stroke patients presented with comorbid conditions that potentially prolonged the length of hospital stay and increased the actual cost of treatment. The difference in financial performance between patients with and without complications was relatively small, with CRRs of 94% and 93%, respectively. These findings indicate that the presence of complications had only a limited impact on financial efficiency, although reimbursement remained insufficient to fully cover the actual costs of care.

Based on the 2024 financing data, the total INA-CBGs reimbursement claimed from BPJS Kesehatan for hospitalized stroke cases amounted to IDR 4,386,707,300, whereas the hospital's actual expenditure for providing stroke care reached IDR 4,700,230,197. This resulted in a negative difference of IDR 313,522,897, indicating that RSUD dr. Abdul Aziz incurred an operational financial loss in managing hospitalized stroke patients under the prospective INA-CBGs payment system. The comparison between reimbursement and actual expenditure yielded an overall Cost Recovery Rate (CRR) of 93% for hospitalized stroke cases. This indicates that the reimbursement covered only 93% of the hospital's actual treatment costs, demonstrating suboptimal financial efficiency (CRR <100%). These findings suggest that the INA-CBGs reimbursement rates do not fully reflect the actual costs of stroke management, particularly among patients with a length of stay exceeding five days and those with severe clinical conditions. This financial deficit may adversely affect the hospital's financial sustainability, especially considering that RSUD dr. Abdul Aziz operates as a Regional Public Service Agency (BLUD), which is expected to maintain financial independence while continuing to provide high-quality public healthcare services.

Although BPJS Kesehatan reimbursement covered approximately 93% of the actual costs incurred in treating hospitalized stroke patients, the remaining deficit indicates that cost recovery has not yet reached an optimal level. This gap between the national standardized reimbursement tariff and the actual cost of care is likely influenced by several factors, including length of stay (LOS), medical complications, the intensity of medication and medical device utilization, and the patient's hospitalization class.

Logistic Regression Analysis

Logistic regression analysis was employed because the dependent variable was categorical rather than continuous. The primary objective of this analysis was to estimate the probability of an outcome occurring based on several independent variables and to evaluate the association between each predictor and the outcome through the odds ratio. Statistical significance was assessed using the *p*-value (Sig.), while the effect size of each predictor was interpreted using the odds ratio, expressed as Exp(B). The logistic regression model included length of stay (LOS), severity level (TKP), stroke type (JS), and complications (COM) as independent variables. The results of the logistic regression analysis are presented in the following table.

Table 2.
Results of the Logistic Regression Analysis for Length of Stay (LOS), Stroke Severity, Stroke Type, and Complications (n=574)

Variable	B	S.E.	Wald	df	Sig.	Exp(B)	95% CI for Exp(B) (Lower–Upper)
Length of Stay (LOS) among hospitalized stroke patients	-2.657	0.240	123.032	1	<0.001	0.070	0.044–0.112
Stroke severity (Severe; dummy variable)	1.022	0.264	14.928	1	<0.001	2.778	1.654–4.664
Stroke severity (Moderate; dummy variable)	1.326	0.294	20.345	1	<0.001	3.766	2.117–6.701
Stroke type (ischemic vs. hemorrhagic) among hospitalized patients	-1.256	0.273	21.194	1	<0.001	0.285	0.167–0.486
Complications among hospitalized stroke patients	-0.116	0.508	0.052	1	0.820	0.891	0.329–2.410
Constant	0.584	0.430	1.844	1	0.174	1.793	—

Model Summary

Nagelkerke R²: 0.378, Hosmer–Lemeshow goodness-of-fit test (Sig.): 0.010, Overall classification accuracy: 75.1%. As shown in Table 2, the Hosmer–Lemeshow goodness-of-fit test yielded a significance value of 0.010 (*p* < 0.05), indicating that the logistic regression model did not demonstrate an adequate statistical fit to the observed data. The Nagelkerke R² value of 0.378 indicates that the logistic regression model explained approximately 37.8% of the variation in the discrepancy between the actual hospital costs and the INA-CBGs reimbursement rates. This suggests that the model has a moderate explanatory ability, while the remaining 62.2% of the variation may be attributable to other factors not included in the model.

The overall classification accuracy of the model was 75.1%, indicating that the logistic regression model correctly classified approximately three-quarters of the observed cases. Despite the unsatisfactory Hosmer–Lemeshow test result, the model demonstrated a relatively good predictive performance in distinguishing the discrepancy between actual costs and INA-CBGs reimbursement. The logistic regression analysis further showed that Length of Stay (LOS), stroke type, and stroke severity were statistically significant predictors of the discrepancy between actual hospital costs and INA-CBGs reimbursement, with significance values of <0.001 (*p* < 0.05). In contrast, the complications variable was not statistically significant (Sig. = 0.820, *p* > 0.05), indicating that complications were not significantly associated with the discrepancy between actual hospital costs and INA-CBGs reimbursement in this study. The Exp(B) value represents the odds ratio (OR), indicating how the odds of the dependent outcome (the discrepancy between actual hospital costs and INA-CBGs reimbursement) change for a one-unit increase in the corresponding independent variable.

Length of Stay (LOS)

The odds ratio for Length of Stay (LOS) was 0.070. Because $\text{Exp}(B)$ was less than 1, a longer hospital stay was associated with lower odds of the outcome. Specifically, each unit increase in LOS was associated with a 93.0% reduction in the odds of the discrepancy outcome ($1 - 0.070 = 0.930$), assuming all other variables remained constant.

Stroke Severity (Severe Dummy Variable)

The odds ratio for severe stroke was 2.778. This indicates that patients with severe stroke had 2.778 times higher odds of experiencing the outcome than patients with mild stroke (the reference category), after adjusting for the other variables in the model.

Stroke Severity (Moderate Dummy Variable)

The odds ratio for moderate stroke was 3.766. This finding indicates that patients with moderate stroke had 3.766 times higher odds of experiencing the outcome than patients with mild stroke. Among all variables included in the model, moderate stroke severity demonstrated the strongest positive association with the outcome.

Stroke Type (Ischemic vs. Hemorrhagic)

The odds ratio for stroke type was 0.285. Since $\text{Exp}(B)$ was less than 1, ischemic stroke patients had 0.285 times the odds—or approximately 71.5% lower odds—of experiencing the outcome compared with patients with hemorrhagic stroke.

Complications

The odds ratio for complications was 0.891. However, this variable was not statistically significant ($\text{Sig.} = 0.820, p > 0.05$). Therefore, there was no statistically significant difference in the odds of the outcome between patients with and without complications. Overall, stroke severity was the strongest predictor of the discrepancy between actual hospital costs and INA-CBGs reimbursement. Patients with moderate stroke had the highest odds of experiencing the outcome ($\text{OR} = 3.766$), followed by those with severe stroke ($\text{OR} = 2.778$). In contrast, longer length of stay (LOS) and ischemic stroke were associated with lower odds of the outcome, whereas complications were not significantly associated with the outcome in this model.

Simple Linear Regression Analysis

A simple linear regression analysis was performed to examine whether the discrepancy between the actual hospital costs and INA-CBGs reimbursement affected the Cost Recovery Rate (CRR). The results are presented in the following table. The coefficient of determination (R^2) indicated that the discrepancy between actual hospital costs and INA-CBGs reimbursement explained 93.1% of the variation in the Cost Recovery Rate (CRR). The overall regression model was statistically significant (F-test, $p < 0.001$), indicating a significant relationship between the discrepancy in costs and the Cost Recovery Rate. Since the significance value was below 0.05, the proposed hypothesis was accepted. The regression coefficient ($B = 0.965$) was positive, indicating a positive linear relationship between the discrepancy in actual hospital costs and INA-CBGs reimbursement and the Cost Recovery Rate. Specifically, a one-unit increase in the discrepancy variable was associated with an increase of 0.965 units in the Cost Recovery Rate (CRR).

Hypothesis Testing

Effect of Length of Stay (LOS)

The effect of Length of Stay (LOS) on the discrepancy between actual hospital costs and INA-CBGs reimbursement was examined using binary logistic regression (Table 4.12). The analysis showed that LOS was a statistically significant predictor ($p < 0.001$), indicating that LOS significantly influenced the discrepancy between actual hospital costs and INA-CBGs reimbursement. Therefore, the first hypothesis was accepted.

Effect of Stroke Severity

The effect of stroke severity on the discrepancy between actual hospital costs and INA-CBGs reimbursement was also analyzed using binary logistic regression (Table 4.12). For patients with moderate stroke severity, the odds ratio was 3.766 ($p < 0.001$), indicating that these patients had 3.766 times higher odds of experiencing the outcome than patients with mild stroke, after controlling for the other variables in the model. Likewise, patients with severe stroke had an odds ratio of 2.778 ($p < 0.001$), indicating significantly higher odds of the outcome than the mild stroke group. These findings suggest that increasing stroke severity was significantly associated with greater odds of the discrepancy between actual hospital costs and INA-CBGs reimbursement. Therefore, the second hypothesis was accepted.

Effect of Stroke Type

The effect of stroke type (ischemic versus hemorrhagic) on the discrepancy between actual hospital costs and INA-CBGs reimbursement was evaluated using binary logistic regression (Table 4.12). The analysis demonstrated a statistically significant association ($p < 0.001$). The odds ratio of 0.285 indicates that patients with ischemic stroke had significantly lower odds of experiencing the outcome than those with hemorrhagic stroke. Accordingly, stroke type was identified as a significant predictor of the discrepancy between actual hospital costs and INA-CBGs reimbursement, and the third hypothesis was accepted.

Effect of Complications

The effect of complications among hospitalized stroke patients on the discrepancy between actual hospital costs and INA-CBGs reimbursement was examined using binary logistic regression (Table 4.12). The analysis showed that the complications variable was not statistically significant ($p = 0.820 > 0.05$), indicating that complications were not significantly associated with the discrepancy between actual hospital costs and INA-CBGs reimbursement. The odds ratio of 0.891 suggests slightly lower odds of the outcome among patients with complications; however, because the association was not statistically significant, this finding should be interpreted with caution. Therefore, complications were not identified as a significant predictor of the discrepancy between actual hospital costs and INA-CBGs reimbursement, and the fourth hypothesis was rejected.

Effect on Cost Recovery Rate (CRR)

The effect of the discrepancy between actual hospital costs and INA-CBGs reimbursement on the Cost Recovery Rate (CRR) was evaluated using simple linear regression (Table 4.13). The analysis yielded a statistically significant result ($p < 0.001$), indicating a significant relationship between the discrepancy in costs and the Cost Recovery Rate. Since the significance value was below 0.05, the discrepancy between actual hospital costs and INA-CBGs reimbursement was found to have a statistically significant effect on the Cost Recovery Rate. Therefore, the fifth hypothesis was accepted.

Effect of Length of Stay (LOS) on the Discrepancy Between Actual Hospital Costs and INA-CBGs Reimbursement for Hospitalized Stroke Patients

The findings of this study indicate that Length of Stay (LOS) significantly influences the discrepancy between actual hospital costs and INA-CBGs reimbursement among hospitalized stroke patients. According to Purwadi, Latief, and Nurlita (2018), the longer a patient remains hospitalized, the greater the financial loss incurred by the hospital. Under the INA-CBGs case-based payment system, reimbursement is predetermined and remains fixed regardless of the patient's length of stay. Consequently, extending hospitalization does not increase the reimbursement received by the hospital, even though the actual cost of care continues to rise. Similarly, Lilissurian, Saputra, and Ruby (2017) reported that LOS affects only the actual hospital costs, whereas INA-CBGs reimbursement remains unchanged regardless of whether the patient experiences a short or prolonged hospitalization. As a result, longer hospital stays increase the discrepancy between actual treatment costs and the fixed reimbursement provided under the INA-CBGs system.

Monica et al. (2021) further explained that the strong influence of LOS on the discrepancy in actual costs is attributable to the accumulation of daily hospitalization expenses. During hospitalization, patients continuously consume healthcare resources, including nursing care, medications, laboratory examinations, diagnostic procedures, medical supplies, and hospital facilities, all of which contribute to increasing the actual treatment costs. In contrast, the INA-CBGs payment system reimburses hospitals using a fixed prospective payment based on diagnosis and medical procedures rather than the duration of hospitalization. Consequently, prolonged hospitalization increases actual hospital expenditures without a corresponding increase in reimbursement.

However, Firman (2024) reported a different perspective, suggesting that as the duration of hospitalization increases, the financial margin obtained by hospitals tends to decline because total service costs continue to accumulate over time. Likewise, Cahyani, Yuswar, and Nurmainah (2019) found that prolonged hospitalization among stroke patients substantially increases the actual cost of treatment. This condition ultimately leads to a financing deficit because the increase in actual hospital costs associated with longer hospitalization is not accompanied by a corresponding increase in INA-CBGs reimbursement, which remains fixed. Consequently, the gap between actual treatment costs and reimbursement becomes progressively wider as the length of stay increases.

As a consequence, the hospital's financial margin gradually declines and may eventually result in a deficit when the actual cost of providing healthcare services exceeds the fixed reimbursement received through the INA-CBGs payment system. A shorter length of stay (LOS) generally requires fewer medications and healthcare resources, whereas patients with prolonged hospitalization receive a greater number of medications and medical interventions. This directly increases the overall cost of patient care (Agustina, Palu, & Muchlis, 2020). These findings are consistent with previous studies by Satibi et al. (2019), Wijayanti and Sugiarsi (2013), Utami and Fanny (2021), Munawaroh et al. (2019), Baroroh and Oktarinda (2021), Hisyam (2022), Rahmadani, Supadmi, and Sudibyo (2023), and Rahayuningrum, Tamtomo, and Suryono (2016), all of which reported a significant association between length of stay and the actual hospital costs.

Yu et al. (2025) further demonstrated, using bootstrap mediation analysis, that payment method, employment status, patients' place of residence, hypertension, intensive care unit (ICU) admission, and mortality had significant indirect effects on total hospitalization costs through their influence on LOS ($p < 0.05$). These findings suggest that such factors increase healthcare costs indirectly by prolonging hospitalization. The cumulative utilization of medications, medical devices, and ancillary healthcare services during extended hospital stays substantially increases the hospital's variable costs, thereby widening the financing deficit because the INA-CBGs reimbursement system does not adjust payments according to the intensity or duration of services provided.

Therefore, strategies to improve the efficiency of inpatient care are essential to minimize unnecessary prolongation of hospitalization and reduce excessive LOS-related expenditures, thereby improving hospital cost efficiency. This finding is consistent with the study conducted by Kriswanti and Sugeng (2017), which examined the relationship between LOS, patient characteristics, and treatment costs among BPJS patients with acute myocardial infarction. Their study found that an appropriate LOS increased the likelihood of accurate treatment cost allocation by 4.78 times compared with an inappropriate LOS. In summary, Length of Stay (LOS) influences the discrepancy between actual hospital costs and INA-CBGs reimbursement indirectly rather than directly. LOS acts as an important contributing factor through several mechanisms, including payment method, employment status, patients' place of residence, hypertension, ICU admission, medication utilization, mortality, and the intensity of healthcare services delivered. Although LOS does not directly affect the INA-CBGs reimbursement rate, it substantially contributes to hospital financing deficits by increasing the actual cost of care. Because INA-CBGs is a prospective case-based payment system with predetermined

fixed reimbursement, hospitals must absorb the additional costs incurred when prolonged hospitalization results from greater clinical complexity and more intensive healthcare utilization.

Effect of Stroke Severity (Mild, Moderate, and Severe) on the Discrepancy Between Actual Hospital Costs and INA-CBGs Reimbursement Among Hospitalized Stroke Patients

The findings of this study demonstrate that stroke severity (mild, moderate, and severe) significantly influences the discrepancy between actual hospital costs and INA-CBGs reimbursement among hospitalized stroke patients. These findings are consistent with Kang, Lim, Suh, and Liew (2011), who reported that stroke is a high-cost disease because patients frequently require prolonged hospitalization, comprehensive medical management, and long-term rehabilitation. Similarly, Murti Andayani et al. (2017) stated that stroke severity determines the INA-CBGs reimbursement category, whereby patients with greater clinical severity are assigned higher reimbursement tariffs because of the increased complexity of care.

In addition to clinical severity, the number of secondary diagnoses also contributes to patient severity and healthcare expenditures. Dwidayati, Andayani, and Wiedyaningsih (2016) reported that a greater number of secondary diagnoses increases the severity level, which may prolong the length of stay (LOS), particularly among patients receiving lower-class inpatient care. Consequently, prolonged hospitalization results in higher actual hospital costs and may widen the discrepancy between actual costs and INA-CBGs reimbursement. Chetrine et al. (2022), in their comparison of INA-CBGs reimbursement for hospitalized ischemic stroke patients in public hospitals, found that financial deficits did not occur uniformly across all hospitalization classes and severity levels. Among the various cost components, medical consumables accounted for the largest proportion of treatment expenditures. Likewise, Munawaroh et al. (2019) reported that patients with severe ischemic stroke commonly present with multiple comorbidities and complications, leading to increased medication costs, medical procedures, and diagnostic examinations. Each additional comorbidity requires further therapeutic interventions and diagnostic evaluations, thereby increasing the actual treatment costs incurred by the hospital.

Furthermore, Mulyanti, Saputra, Syukri, Nurjannah, and Lestari (2020) reported that severe stroke cases frequently require intensive care unit (ICU) admission, substantially increasing hospitalization costs. Similarly, Zaqiah et al. (2024) identified stroke severity as one of the principal determinants of increased actual hospital costs among patients with ischemic stroke. For hemorrhagic stroke, hospital financial losses are primarily attributable to the need for expensive diagnostic investigations and intensive medical treatment. Tandah, Mukaddas, Angriani, and Mangoting (2021), in their study entitled *Cost Evaluation of Stroke Therapy Compared with INA-CBGs Among Inpatients at Anutapura Hospital*, reported that hemorrhagic stroke generated considerably larger financial deficits than ischemic stroke, particularly among patients with severe disease. These higher costs were associated with prolonged hospitalization, extensive use of high-cost diagnostic procedures such as computed tomography (CT) scanning, specialized pharmacological therapy, and intensive rehabilitation services, including physiotherapy. Collectively, these factors substantially increased the actual treatment costs while the INA-CBGs reimbursement remained fixed, thereby widening the gap between actual hospital costs and reimbursement.

Effect of Stroke Type (Ischemic and Hemorrhagic) on the Discrepancy Between Actual Hospital Costs and INA-CBGs Reimbursement Among Hospitalized Patients

Stroke type (ischemic and hemorrhagic) is considered an important factor contributing to the discrepancy between actual hospital costs and INA-CBGs reimbursement among hospitalized patients. This is because stroke management is generally associated with substantial treatment costs and prolonged hospitalization. The findings of the present study indicate that stroke type significantly influences the discrepancy between actual hospital costs and INA-CBGs reimbursement. However, the observed effect should be interpreted in the context of the unequal distribution of stroke types

within the study population. As presented in Table 4.10, ischemic stroke accounted for 80% of all cases, whereas hemorrhagic stroke represented only 20%. The average Cost Recovery Rate (CRR) for ischemic stroke was 101%, indicating that reimbursement generally covered the actual treatment costs. In contrast, hemorrhagic stroke had an average CRR of 73%, demonstrating that reimbursement was insufficient to cover the actual costs of care. Patients with mild and moderate ischemic stroke exhibited favorable financial performance (CRR >100%), whereas hemorrhagic stroke patients showed the poorest financial performance (CRR <100%).

These findings are consistent with Mazidah et al. (2019), who reported that INA-CBGs reimbursement was insufficient to cover the treatment costs of hospitalized patients with hemorrhagic stroke, resulting in a financial deficit of IDR 89,165,865. Conversely, reimbursement for ischemic stroke generated a financial surplus of IDR 154,789,069. Similarly, Tandah et al. (2021) found that the mean actual treatment cost for ischemic stroke was IDR 7,360,196.70, while the mean INA-CBGs reimbursement was IDR 7,427,251.65 among 91 hospitalized patients. In contrast, the mean actual treatment cost for hemorrhagic stroke was IDR 10,606,834.34, whereas the corresponding INA-CBGs reimbursement averaged only IDR 4,399,393.02 among 43 patients. These findings indicate that the actual treatment costs for hemorrhagic stroke substantially exceeded the fixed reimbursement provided under the INA-CBGs system, whereas reimbursement for ischemic stroke was generally sufficient to cover the actual costs.

Hemorrhagic stroke typically requires more intensive medical management, more complex therapeutic procedures, prolonged hospitalization, and extensive diagnostic investigations. Consequently, the actual treatment costs frequently exceed the predetermined INA-CBGs reimbursement, resulting in financial losses for hospitals managing hemorrhagic stroke patients. Setiani et al. (2021) further reported that stroke type explained approximately 49.1% of the variation in treatment costs. Their linear regression analysis suggested that hemorrhagic stroke requires more intensive monitoring, more diagnostic procedures, and is associated with a higher frequency of complications than ischemic stroke, thereby increasing healthcare expenditures.

In contrast, several studies have suggested that the primary determinant of hospital financial losses among ischemic stroke patients is not the stroke type itself but the duration of hospitalization. Munawaroh et al. (2019) demonstrated that longer hospitalization was associated with a greater negative discrepancy between actual hospital costs and INA-CBGs reimbursement. Likewise, Cahyani et al. (2019) reported that prolonged hospitalization significantly increased the actual treatment costs of ischemic stroke patients. Darmapadmi et al. (2018) concluded that stroke type does not directly determine the discrepancy between actual hospital costs and INA-CBGs reimbursement. Instead, stroke type exerts an indirect effect through factors such as length of stay, whereby both ischemic and hemorrhagic stroke may generate substantial financial deficits when hospitalization is prolonged.

However, these findings differ from those reported by Hadning, Oktaviani, Mouretha, Viviandhari, and Kusumaningtyas (2025). In their study entitled *Cost Analysis of Inpatient Stroke Treatment at a Regional General Hospital Based on INA-CBGs Tariffs in 2023*, the authors found that the average treatment costs for hospitalized stroke patients did not exceed the updated INA-CBGs reimbursement rates introduced in 2023. Consequently, the hospital successfully aligned its stroke treatment costs with INA-CBGs reimbursement and achieved a financial surplus. The authors suggested that revisions to the INA-CBGs tariff structure in 2023 more accurately reflected actual treatment costs, thereby reducing the reimbursement gap observed in previous years. These findings imply that discrepancies between actual hospital costs and reimbursement may be influenced more by reimbursement policy than by stroke type alone. In conclusion, the relationship between stroke type and the discrepancy between actual hospital costs and INA-CBGs reimbursement is influenced by several interacting factors. Although hemorrhagic stroke is generally associated with higher actual

treatment costs than ischemic stroke, the magnitude of the discrepancy depends largely on stroke severity, length of stay, revisions to the INA-CBGs reimbursement policy, and patient characteristics. Therefore, stroke type should be considered an indirect determinant of the discrepancy between actual hospital costs and INA-CBGs reimbursement rather than an independent determinant.

Effect of Complications Among Hospitalized Stroke Patients on the Discrepancy Between Actual Hospital Costs and INA-CBGs Reimbursement

Complications among hospitalized stroke patients often require additional pharmacological treatment, diagnostic procedures, and prolonged hospitalization, all of which cumulatively increase actual hospital costs and may contribute to the discrepancy between actual costs and INA-CBGs reimbursement. Based on the data presented in Table 4.6, 548 patients (95%) experienced one or more medical complications, whereas only 26 patients (5%) had no recorded complications. The Cost Recovery Rate (CRR) was 94% for patients with complications and 93% for those without complications, indicating that both groups demonstrated suboptimal financial performance (CRR <100%). However, the logistic regression analysis in this study showed that complications were not significantly associated with the discrepancy between actual hospital costs and INA-CBGs reimbursement.

Although no statistically significant association was observed between complications and the discrepancy in treatment costs, complications may still contribute to increased actual hospital expenditures because they require additional medications, medical consumables, and diagnostic procedures. Furthermore, variations in the number and type of comorbidities and complications among patients may contribute to differences in medication use and medical resource utilization during hospitalization. Setyawan, Andayani, and Pinzon (2016) reported that the largest cost components in hospitalized stroke patients were medications, diagnostic procedures, and medical consumables required for stroke management. The number of diagnoses is closely related to the presence of additional complications beyond the primary diagnosis. Differences in the number and type of complications or comorbidities contribute to variations in treatment costs and reimbursement discrepancies. Patients with complications generally require longer hospitalization and greater utilization of healthcare resources. Consequently, increasing clinical severity is associated with higher healthcare expenditures (Munawaroh et al., 2019).

Ogata et al. (2014), in their study entitled *Gastrointestinal Bleeding in Acute Ischemic Stroke: Recent Trends from the Fukuoka Stroke Registry*, reported that gastrointestinal bleeding as a complication resulted in a median hemoglobin reduction of 2.5 g/dL, with 31.5% of affected patients requiring blood transfusions. In addition, interruption of antithrombotic therapy increased the risk of stroke progression. Although this study did not directly evaluate treatment costs, it demonstrated that complications were significantly associated with prolonged hospitalization. Likewise, Limbong Allo et al. (2021) reported that hemorrhagic stroke was the strongest predictor of extended hospital stays. These findings suggest that complications may indirectly increase actual hospital costs by prolonging hospitalization and increasing expenditures for inpatient care, medications, medical consumables, and other clinical services required for stroke management.

The impact of complications on actual hospital costs also depends on the type of stroke and the specific comorbid conditions present. Mulyanti et al. (2020) found that among patients with ischemic stroke, only those with hypertension as a comorbidity incurred significantly higher actual hospital costs than the corresponding INA-CBGs reimbursement, whereas other comorbid conditions were not associated with statistically significant cost differences.

In conclusion, complications may contribute indirectly to the discrepancy between actual hospital costs and INA-CBGs reimbursement by prolonging the length of hospital stay and increasing the intensity of healthcare services. However, the direct impact of complications on actual treatment costs varies according to the type of complication, stroke severity, and the clinical procedures required.

These findings are consistent with the results of the present study, in which complications were not identified as an independent statistically significant predictor of the discrepancy between actual hospital costs and INA-CBGs reimbursement after adjustment for other variables in the logistic regression model.

Operational Implications of Length of Stay (LOS) Under the INA-CBGs Payment System

The findings of this study indicate that Length of Stay (LOS) has important operational and financial implications for RSUD dr. Abdul Aziz Singkawang. Although the INA-CBGs reimbursement system applies a fixed case-based payment that is determined by diagnosis and disease severity rather than the duration of hospitalization, prolonged hospital stays continue to increase the hospital's actual treatment costs. This finding highlights the importance of considering LOS from both statistical and operational perspectives, particularly when evaluating hospital financial performance under a prospective payment system.

The descriptive analysis revealed substantial operational demands associated with prolonged hospitalization. Approximately 56.3% of stroke patients were hospitalized for more than six days, with most patients presenting moderate to severe clinical conditions. Furthermore, more than 95.5% of patients experienced one or more medical complications, resulting in intensive and continuous utilization of hospital resources. Each additional inpatient day generated extra expenditures for healthcare personnel, bed occupancy, medications, medical devices, diagnostic investigations, and other supporting services, while the INA-CBGs reimbursement remained unchanged because it is determined by a fixed payment schedule.

Financially, RSUD dr. Abdul Aziz Singkawang experienced a considerable reimbursement deficit. Approximately 58.9% of stroke cases generated negative reimbursement differences, while 59.1% of cases were classified as having a low Cost Recovery Rate (CRR), indicating that the actual treatment costs exceeded the INA-CBGs reimbursement. These findings demonstrate that prolonged hospitalization contributes substantially to cumulative hospital expenditures and reduces the hospital's ability to recover the full cost of stroke care. Previous studies conducted in Indonesia provide supporting evidence regarding the financial burden of stroke management. At Anutapura Hospital, Mazidah, Yasin, and Kristina (2019) reported substantially larger discrepancies between actual hospital costs and INA-CBGs reimbursement among patients with hemorrhagic stroke than among those with ischemic stroke, demonstrating that hemorrhagic stroke represents a major financial challenge for hospitals operating under the INA-CBGs payment system.

Similarly, Cahyani (2019) reported discrepancies between actual hospital costs and INA-CBGs reimbursement among ischemic stroke patients at RSUD Sultan Syarif Mohamad Alkadrie Pontianak. Several INA-CBGs diagnosis groups generated either financial deficits or surpluses, indicating considerable variability in reimbursement performance across different stroke case categories. These findings suggest that hospital financing for stroke management is influenced not only by the duration of hospitalization but also by the reimbursement structure and variations in actual treatment costs across clinical conditions.

Overall, the findings from RSUD dr. Abdul Aziz Singkawang demonstrate that LOS remains an important determinant of hospital operational efficiency despite the use of a fixed prospective reimbursement system. Although INA-CBGs reimbursement is unaffected by the duration of hospitalization, prolonged LOS substantially increases actual hospital expenditures and widens the discrepancy between actual costs and reimbursement. Therefore, effective management of LOS remains essential for improving operational efficiency, maintaining financial sustainability, and ensuring the delivery of high-quality healthcare services under the INA-CBGs payment system.

Effect of the Discrepancy Between Actual Hospital Costs and INA-CBGs Reimbursement on the Cost Recovery Rate (CRR)

The findings of this study indicate that the discrepancy between actual hospital costs and INA-CBGs reimbursement has a significant effect on the Cost Recovery Rate (CRR) among hospitalized patients. Most stroke cases in this study exhibited a CRR below 100%, indicating that the reimbursement received was insufficient to fully cover the actual costs of treatment. Nevertheless, this financial gap should not be regarded as permanent, as it may be reduced through improvements in hospital management, cost-control strategies, and optimization of reimbursement processes. Mardiah and Rivany (2015) reported that, based on treatment costs calculated using clinical pathways, hospitals achieved a higher CRR than the INA-CBGs reimbursement at Severity Level I, whereas at Severity Level II the hospital CRR was lower than the INA-CBGs CRR. At Severity Level III, INA-CBGs reimbursement exceeded the hospital CRR. These differences demonstrate that the prospective INA-CBGs payment system may create discrepancies between predetermined reimbursement rates and the actual costs incurred by hospitals.

Similarly, Arfiani et al. (2020) found an overall CRR of only 60%, indicating that INA-CBGs reimbursement covered merely 60% of the actual treatment costs. Their study also identified significant differences in reimbursement discrepancies according to patient age, sex, length of stay, and disease severity. These findings suggest that BPJS Kesehatan reimbursement is often insufficient to fully compensate hospitals for the costs of inpatient care. Comparable results were reported by Sulistiyarningsih, Sugiarsi, and Kusumawati (2025), who found significant differences between actual hospital charges and INA-CBGs reimbursement for hemodialysis among patients with chronic kidney disease at Kediri Regional Hospital. Likewise, Ringo, Rosidawati, and Bagenda (2024) demonstrated that actual treatment costs exceeded INA-CBGs reimbursement, emphasizing the need to revise reimbursement rates so that they more accurately reflect actual hospital expenditures while encouraging greater efficiency in healthcare delivery.

Aurelia and Pujiyanti (2017) reported a CRR of 227.98% for self-paying patients compared with only 71.38% for BPJS-insured patients. A CRR below 100% among BPJS patients indicates that hospital revenue from INA-CBGs reimbursement was insufficient to cover the actual costs of treating hospitalized patients with acute coronary syndrome (ACS). These findings suggest that hospital financial performance is substantially influenced by the reimbursement mechanism, with higher cost recovery achieved when reimbursement more closely reflects actual treatment costs. Kasie et al. (2023) reported no significant differences in CRR according to inpatient class. Instead, CRR was primarily influenced by disease type, disease severity, length of stay, and patient age. These findings indicate that clinical characteristics have a greater impact on hospital financial performance than ward classification alone.

The discrepancy between actual hospital costs and INA-CBGs reimbursement further suggests that the current reimbursement structure does not fully capture the actual components of healthcare expenditure, including both direct and indirect overhead costs. Mubarok et al. (2024) also reported that suboptimal implementation of clinical pathways, with compliance levels of only approximately 70%, negatively affected both cost efficiency and quality of care. Accordingly, RSUD dr. Abdul Aziz should strengthen the implementation of evidence-based clinical pathways to standardize patient management and optimize the length of stay. Aurelia and Pujiyanti (2017) additionally recommended increasing the number of permanent physicians dedicated to improving operational cost control.

From a managerial perspective, Margaretna et al. (2022) suggested several practical strategies for improving hospital financial performance, including optimization of logistics management, adjustment of non-BPJS service tariffs, and more efficient utilization of hospital resources. Hafni and Widyaningsih (2025) further recommended strengthening inpatient quality and cost-control programs through optimization of BPJS claims, periodic evaluation of hospital tariff components, and

consistent implementation of clinical pathways. Collectively, these strategies may help hospitals reduce financial losses associated with inpatient services reimbursed under the National Health Insurance (JKN) scheme.

In conclusion, the discrepancy between actual hospital costs and INA-CBGs reimbursement has a significant impact on the Cost Recovery Rate among hospitalized stroke patients. A CRR below 100% reflects inadequate reimbursement relative to actual treatment costs and indicates financial pressure on hospitals operating under the INA-CBGs prospective payment system. However, implementation of effective cost-management strategies—particularly standardized clinical pathways, improved medical documentation, optimization of resource utilization, and regular evaluation of hospital cost structures—has the potential to substantially reduce the reimbursement gap, improve the Cost Recovery Rate, and ultimately enhance the hospital's financial sustainability.

Hemorrhagic Stroke Is Associated with the Greatest Financial Deficit Compared with Other Stroke Types

Hemorrhagic stroke is generally associated with substantially higher treatment costs and greater financial deficits than ischemic stroke, as demonstrated in several studies conducted in Indonesian hospitals. For example, Tandah et al. (2021) reported that the mean actual treatment cost for hospitalized patients with hemorrhagic stroke (IDR 10.6 million) was considerably higher than that for ischemic stroke (IDR 7.36 million). This difference reflects the greater utilization of healthcare resources required for hemorrhagic stroke, including intensive care, advanced diagnostic procedures, and more complex medical interventions. The findings of the present study are consistent with this evidence. Patients with hemorrhagic stroke exhibited substantially poorer financial performance than those with ischemic stroke, as reflected by an average Cost Recovery Rate (CRR) of 73% compared with 101% for ischemic stroke. These findings indicate that INA-CBGs reimbursement generally covered the actual treatment costs of ischemic stroke but remained insufficient for hemorrhagic stroke, resulting in a considerably greater financial deficit for the hospital.

Similar findings have been reported by Mazidah et al. (2019), who demonstrated that INA-CBGs reimbursement was inadequate to cover the actual treatment costs of hospitalized patients with hemorrhagic stroke, whereas reimbursement for ischemic stroke was generally sufficient. These results highlight an imbalance in the current reimbursement system, whereby the considerably higher costs of hemorrhagic stroke are not fully reflected in the fixed INA-CBGs payment structure. From a clinical perspective, hemorrhagic stroke is inherently more resource-intensive because patients frequently require intensive care unit (ICU) admission, neurosurgical intervention when indicated, continuous neurological monitoring, advanced imaging examinations, specialized pharmacological therapy, and prolonged rehabilitation. These requirements substantially increase direct medical expenditures while also extending the length of hospital stay. Consequently, prolonged hospitalization further increases actual treatment costs, thereby widening the discrepancy between hospital expenditures and the fixed reimbursement provided under the INA-CBGs prospective payment system.

Although detailed published cost analyses comparing hemorrhagic and ischemic stroke at RSUD dr. Abdul Aziz Singkawang remain limited, the findings of the present study are consistent with the pattern reported in previous Indonesian studies. The markedly lower CRR observed among patients with hemorrhagic stroke indicates that this patient group imposes a greater financial burden on the hospital than patients with ischemic stroke. These findings suggest that the current INA-CBGs reimbursement structure may not adequately compensate hospitals for the higher resource utilization required in the management of hemorrhagic stroke, emphasizing the need for periodic evaluation of reimbursement policies to better align payments with actual treatment costs.

CONCLUSION

The findings of this study demonstrate that Length of Stay (LOS), stroke severity, and stroke type were significant predictors of the discrepancy between actual hospital costs and INA-CBGs reimbursement, whereas complications were not significantly associated with the discrepancy after adjustment for other variables. Stroke severity emerged as the strongest predictor, indicating that patients with moderate and severe stroke were substantially more likely to experience greater discrepancies between actual treatment costs and INA-CBGs reimbursement than patients with mild stroke. Patients with hemorrhagic stroke and severe clinical conditions generally required more intensive treatment, prolonged hospitalization, and greater healthcare resource utilization, resulting in actual hospital costs that frequently exceeded the fixed reimbursement provided under the INA-CBGs prospective payment system. In contrast, patients with mild ischemic stroke and shorter hospital stays tended to generate more favorable financial outcomes for the hospital. The Cost Recovery Rate (CRR) analysis revealed that most hospitalized stroke cases had CRR values below 100%, indicating that INA-CBGs reimbursement was insufficient to fully recover the actual costs of patient care. These findings demonstrate a persistent gap between the standardized INA-CBGs reimbursement rates and the actual costs incurred by the hospital, particularly among patients requiring complex and resource-intensive treatment. To improve financial sustainability, hospitals should strengthen cost-control strategies through effective implementation of evidence-based clinical pathways, optimization of the length of hospital stay without compromising quality of care, efficient utilization of healthcare resources, and continuous evaluation of hospital cost structures. Periodic review of INA-CBGs reimbursement policies is also recommended to ensure that reimbursement rates more accurately reflect the actual costs of managing hospitalized stroke patients.

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