



Profile of Comorbidities and Length of Hospital Stay Among Stroke Patient at Dr. Gunawan Mangunkusumo Hospital Semarang Regency

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<p>Track Record Article</p> <p>Revised: 05 January 2026 Accepted: 09 March 2026 Published: 31 March 2026</p> <p>How to cite: Sudrisman, S., Widjanarko, B., & Suryoputro, A. (2026). Profile of Comorbidities and Length of Hospital Stay Among Stroke Patient at Dr. Gunawan Mangunkusumo Hospital Semarang Regency. <i>Contagion: Scientific Periodical Journal of Public Health and Coastal Health</i>, 8(1), 337–347.</p>	<p style="text-align: center;">Abstract</p> <p><i>Stroke remains a leading cause of morbidity and hospitalization worldwide. Comorbid conditions can significantly influence the length of stay (LOS) among stroke patients. As a catastrophic disease requiring prolong and costly medical care, stroke demands optimized hospital services through strengthened resource capacity, management and referral systems. This study aims to analyze the comorbidity profile of stroke patients and its association with prolonged LOS. A retrospective analytical design was applied, reviewing medical records of all new stroke inpatients at Dr. Gunawan Mangunkusumo Regional General Hospital between January and June 2025, (n = 404). Data were collected using structured research sheets and analyzed with univariate descriptive statistics, chi-square tests, and multivariate and multivariate logistic regression to identify factors associated with prolonged LOS. Among 404 patients, 26 (6.4%) experienced extended hospitalization. Significant factors associated with prolonged LOS included a history of hypertension (p = 0.038) and coronary heart disease (p = 0.037). Coronary heart disease emerged as the strongest predictor of prolonged LOS (OR = 0.192; 95% CI: 0.068–0.539; p = 0.002), highlighting its impact on inpatient management and discharge processes. These findings suggest that integrated cardiovascular and stroke care may improve hospital efficiency. Future prospective studies incorporating measures of stroke severity are recommended.</i></p> <p>Keywords: <i>Stroke, Length of Hospitalization, Comorbidity, Patients, Indonesia</i></p>
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INTRODUCTION

Stroke is a leading cause of global morbidity and mortality, imposing a substantial burden on public health systems and healthcare costs. It occurs when cerebral blood flow is abruptly disrupted, either by vascular occlusion (ischemic stroke) or bleeding (hemorrhagic stroke). Stroke is frequently accompanied by comorbidities that worsen clinical outcomes. Common conditions such as hypertension, diabetes mellitus, heart failure, and other cardiovascular disorders are highly prevalent among stroke patients and have been shown to prolong hospital length of stay (LOS), increase complications, and elevate healthcare expenditures (Li et al., 2023; Zhang et al., 2022).

A statewide inpatient analysis in the United States reported that over 90% of hospitalized stroke patients had at least two concurrent comorbidities. The most common conditions included hypertension, congestive heart failure, and other neurological disorders. These comorbidities were strongly associated with higher in-hospital mortality, longer length

of stay, and increased treatment costs (Li et al., 2023). Evidence from China similarly revealed a rising comorbidity burden among first-ever stroke patients. Patients with more severe comorbidity profiles experienced significantly longer hospitalizations, with LOS extended by up to 12% compared to those without major comorbidities (Wang et al., 2021). A large multicenter study in China further confirmed that comorbidity burden not only influenced mortality but was also independently linked to prolonged hospitalization and higher overall hospital expenditures among ischemic stroke patients (Chen et al., 2024; Zhang et al., 2022).

At the European level, observational cohort data involving patients with transient ischemic attack (TIA) and mild-to-severe stroke indicated that hospital LOS increased with advancing age and stroke severity, both of which were closely related to underlying comorbidities (Åsberg et al., 2020). The data indicated that comorbidity burden significantly influenced post-stroke recovery trajectories and healthcare utilization.

Machine learning research utilizing stroke audit datasets revealed that extended length of stay (LOS) was affected by a confluence of clinical and systemic characteristics, such as comorbidities, reduced mobility, stroke severity, and the necessity for intensive rehabilitation treatments (Johnson et al., 2025). Among patients with diabetes, increasing comorbidity burden was also associated with adverse stroke outcomes and longer hospital admissions (Rawshani et al., 2024). Overall, these international studies indicated that comorbidities significantly contributed to the complexity and duration of inpatient stroke management.

Stroke remains a major non-communicable disease burden in Indonesia. A retrospective cohort study at the Indonesian National Stroke Center involving 2,804 ischemic stroke patients indicated a mean length of stay of around 5.1 days. Clinical variables including hypertension, diabetes mellitus, and a history of cardiovascular disease were recognized as key drivers of extended hospitalization (Siregar et al., 2025). Other studies have similarly found that hypertension, dyslipidemia, and diabetes mellitus are the most common comorbidities among hospitalized stroke patients, and these conditions are consistently linked to poorer clinical outcomes and extended hospital stays (Hidayati et al., 2024; Pratama et al., 2024).

Evidence consistently shows that the rising prevalence of comorbidities among stroke patients worldwide contributes to greater acute care needs, longer hospital stays, higher healthcare costs, and increased systemic burden (Chen et al., 2024; Wang et al., 2021). With global population aging and the growing impact of cardiometabolic risk factors, understanding how comorbidity profiles influence hospital length of stay and stroke outcomes has become crucial for effective healthcare planning, prevention, and clinical management. Reflecting this priority, recent international guidelines now recommend routine comorbidity assessment

during acute stroke hospitalization to improve patient care and discharge planning (Mead et al., 2023).

The relationships between comorbidity profiles and hospital length of stay in stroke patients have been widely documented in clinical epidemiology. Comorbidities are highly prevalent, with more than 90% of older stroke patients presenting at least two comorbid conditions, and these are strongly associated with prolonged length of stay and increased healthcare costs (Li et al., 2023; Chen et al., 2024; Zhang et al., 2022). Beyond overall burden, specific comorbid conditions such as congestive heart failure and diabetes mellitus were also associated with extended hospitalization periods in stroke cohorts (De Stefano et al., 2021).

Despite growing global evidence, findings from Indonesia on this topic remains limited. A recent analysis of ischemic stroke patients in an Indonesian national stroke center demonstrated that mean length of stay was 5.1 days, with several factors including stroke severity and payment method influencing hospital stay length, yet did not fully elucidate the role of comorbidities (Bustami et al., 2025). Other Indonesian registry-based studies highlighted that stroke patients with concurrent cardiovascular or renal disease experienced worse in-hospital outcomes, suggesting the need for deeper examination of comorbidity profiles and their influence on length of stay (Yamanie et al., 2024). Similarly, a cross-sectional study in a private hospital found that complications related to comorbid conditions were significantly associated with prolonged stays among stroke patients (Allo et al., 2023).

Prior literature has further highlighted several gaps in stroke research that this study aims to address. First, while most international studies have identified comorbidity as an important determinant of hospital outcomes, few have reported detailed comorbidity profiles and their differential impact on length of stay within Southeast Asian healthcare settings, particularly Indonesia (Chen & Li, 2023; Zhang et al., 2021). Second, existing Indonesian stroke studies prioritized mortality outcomes or general descriptive epidemiology without a comprehensive analysis of how specific comorbidities influence hospitalization durations (Allo et al., 2023; Bustami et al., 2025). Additionally, most prior literature lacked sufficient representation of secondary and tertiary care hospitals in Semarang Regency, limiting the contextual relevance of findings to local clinical practice. Moreover, international studies have emphasized that integrating comorbidity profiling into predictive models can improve hospital resource allocation and patient-centered care planning, which remains unexplored in Indonesia (Johnson et al., 2025).

During the three years preceding this study, a total of 2,179 stroke patients were admitted to Dr. Gunawan Mangunkusumo Hospital in Semarang Regency, with a mean age of

70 ± 36 years and an even distribution of male and female patients. The average duration of hospital stay for these patients was 15 ± 5 days, with about 85% exhibiting at least one notable comorbidity, including hypertension, diabetes mellitus, or cardiovascular disease upon admission. In this sample, individuals with numerous comorbidities demonstrated prolonged hospitalization lengths compared to those without such problems, a trend that was consistent across both ischemic and hemorrhagic stroke subtypes.

Collectively, these indicated that the prevalence and distribution of comorbidities among stroke patients at Dr. Gunawan Mangunkusumo Hospital had not been thoroughly delineated. The relationship between comorbidity profiles and hospital length of stay is inadequately comprehended in the Indonesian context. Therefore, the research problems for this study are as follows: What were the profiles of comorbidities in stroke patients, and how did these comorbidities correlate with the duration of hospitalization at Dr. Gunawan Mangunkusumo Hospital in Semarang Regency.

METHODS

This study employed a quantitative, non-experimental design using a retrospective analytic approach to examine the association between comorbidities and the length of hospital stay (LOS) among stroke patients. The study was conducted at RSUD dr. Gunawan Mangunkusumo, Semarang Regency, Indonesia, a secondary referral hospital providing inpatient stroke care services.

The study population included patients diagnosed with stroke who were hospitalized at RSUD Dr. Gunawan Mangunkusumo between January and June 2025. A total sampling technique was applied to minimize selection bias and ensure that all eligible cases were included in the analysis. Medical records that met the eligibility criteria during the study period were reviewed, resulting in a final sample of 404 patients.

Patients were involved in this study if they met the following criteria: (1) aged 18 years old or older, (2) admitted for inpatient stroke treatment during the study period, and (3) had complete medical record information on demographic characteristics, comorbidity status, and length of hospital stay. Patients were not involved if they were referred to another health facility before completing treatment, died within the first 24 hours of hospitalization, or had incomplete data on key study variables.

Data were collected retrospectively between September and October 2025 using a structured data extraction form based on hospital medical records and inpatient registries. The extracted variables included demographic characteristics (gender and age), clinical

characteristics (stroke type), comorbidity profiles, and length of hospital stay. Gender was categorized as male or female. Age was classified into three categories: <40 years, 41–65 years, and >65 years. Comorbidities included physician-diagnosed hypertension, diabetes mellitus, coronary heart disease, and obesity, which were recorded dichotomously (yes/no) based on documentation in the medical records. Obesity status was determined using body mass index (BMI) values recorded in the medical records and classified according to standard clinical guidelines. The dependent variable was length of hospital stay (LOS), defined as the number of days from hospital admission to discharge. LOS was categorized into two groups: <7 days and ≥ 7 days. A hospital stay of ≥ 7 days was defined as prolonged LOS, as hospitalization exceeding one week among stroke patients has been associated with greater disease severity, higher comorbidity burden, and increased risk of in-hospital complications (Li et al., 2023; Chen et al., 2024; Zhang et al., 2022).

Data analysis was carried out using statistical software. Descriptive statistics were applied to summarize respondent characteristics and were presented as frequencies and percentages. Bivariate analysis using cross-tabulation was conducted to examine the distribution of prolonged LOS across independent variables. Subsequently, binary logistic regression analysis was performed to identify factors associated with prolonged LOS (≥ 7 days). Independent variables included stroke type, hypertension, diabetes mellitus, coronary heart disease, and obesity. The results were reported as odds ratios (ORs) with 95% confidence intervals (CIs). Statistical significance was determined using a two-tailed p-value of <0.05, in accordance with standard epidemiological research practices (Kim, 2022; McHugh, 2021).

This study utilized secondary data obtained from hospital medical records. Ethical approval for the study was granted by the Health Research Ethics Committee of the Faculty of Public Health, Diponegoro University (No. 338/EA/KEPK-FKM/2025).

RESULTS

A total of 404 respondents were included in this study. As presented in Table 1, the majority of respondents were male (215 patients; 53.2%), while females accounted for 189 patients (46.8%). Most stroke patients were aged 41–65 years (236 patients; 58.4%), followed by those aged ≥ 66 years (157 patients; 38.9%), and <40 years (11 patients; 2.7%). The majority of respondents had a history of hypertension (346 patients; 85.6%), did not have diabetes mellitus (314 patients; 77.7%), did not have coronary heart disease (329 patients; 81.4%), and were non-obese (285 patients; 70.5%). Regarding LOS, 378 patients (93.6%) had hospital stays ≤ 7 days, while 26 patients (6.4%) experienced LOS >7 days.

Table 1. Frequency Distribution of Respondents

Characteristics	N	%
Gender		
Male	215	53.2
Female	189	46.8
Age		
≤ 40 Years	11	2.7
41-65 Years	236	58.4
≥ 66 Years	157	38.9
History of Hypertension		
Yes	346	85.6
No	58	14.4
History of Diabetes Mellitus		
Yes	90	22.3
No	314	77.7
History of Coronary Heart Disease (CHD)		
Yes	75	18.6
No	329	81.4
History of Obesity		
Yes	119	29.5
No	285	70.5
Length of Hospital Stay		
>7 Day	26	6.4
≤7 Day	378	93.6

Bivariate analysis was conducted using cross-tabulation and Chi-square tests to assess associations between independent and dependent variables. A p-value ≤ 0.05 indicated statistical significance (Priyatno, 2014). As shown in Table 2, a statistically significant association was observed between a history of hypertension ($p \leq 0.037$) and coronary heart disease ($p \leq 0.038$) with LOS among stroke patients.

Table 2. Association Between Stroke Type and Comorbidities With Length of Hospital Stay Among Stroke Patients

Variable	Length of Hospital Stay				p-value
	>7 Day		≤ 7 Day		
	n	%	n	%	
History of Hypertension					
Yes	26	7.5	320	92.5	0.037
No	0	0.0	58	100	
History of Diabetes Mellitus					
Yes	7	7.8	83	92.9	0.730
No	19	6.1	295	93.9	
History of Coronary Heart Disease (CHD)					
Yes	9	12.0	66	88.0	0.038
No	17	5.2	312	94.8	
History of Obesity					
Yes	8	6.7	111	93.3	1.000
No	18	6.3	267	93.7	

Multivariate analysis using binary logistic regression analysis demonstrated that a history of coronary heart disease (CHD) was significantly associated with prolonged length of

hospital stay among stroke patients (OR = 2.792; 95% CI: 1.180 - 6.610; $p = 0.019$). Patients with CHD had lower odds of experiencing prolonged hospitalization compared with those without CHD. In contrast, a history of hypertension (OR = 1.000; $p = 0.997$) were not significantly associated with prolonged length of hospital stay.

Tabel 3. Factors Influencing Prolonged Length of Hospital Stay

Variable	Sig	OR	95% CI	
			Lower	Upper
History of Hypertension	0.997	1.000	0.000	-
History of Coronary Heart Disease (CHD)	0.019*	2.792	1.180	6.610

DISCUSSION

This study showed that only 6.4% of stroke patients experienced prolonged length of hospital stay (LOS ≥ 7 days), indicating relatively efficient inpatient management. Most patients were aged 41–65 years, reflecting a shift of stroke burden toward the productive age group, as reported in recent epidemiological studies (Feigin et al., 2021; Owolabi et al., 2022). Differences in healthcare systems, discharge policies, and referral mechanisms may explain the lower prevalence of prolonged LOS compared with reports from other settings (Zhang et al., 2021; Chen & Li, 2023).

Coronary heart disease (CHD) was the only comorbidity significantly associated with prolonged LOS. Interestingly, patients with CHD had lower odds of prolonged hospitalization. Similar findings have been reported in recent inpatient database studies, suggesting that patients with known cardiovascular disease often benefit from earlier risk stratification, standardized clinical pathways, and closer monitoring, which may facilitate earlier discharge (Zhang et al., 2021; Kim, 2022). In contrast, patients without documented CHD may experience delayed cardiovascular evaluation, potentially contributing to longer hospitalization.

This study found that a history of coronary heart disease (CHD) was significantly associated with a lower likelihood of prolonged length of hospital stay among stroke patients. Patients with CHD had reduced odds of hospitalization lasting ≥ 7 days compared with those without CHD. Although this finding might appear counterintuitive, similar patterns have been reported in previous studies, where patients with pre-existing cardiovascular disease often received earlier clinical recognition, closer monitoring, and more standardized inpatient management, which may have facilitated more efficient care pathways and earlier discharge planning (Zhang et al., 2021; Chen & Li, 2023).

One possible explanation is that stroke patients with known CHD were more likely to be managed under established cardiovascular protocols, including early cardiology consultation, optimized secondary prevention strategies, and strict hemodynamic monitoring. These measures may have reduced the occurrence of in-hospital complications and accelerated clinical stabilization, thereby shortening hospitalization duration. In contrast, patients without documented CHD may have experienced delayed risk stratification or unrecognized cardiovascular instability, potentially contributing to longer hospital stays. Similar findings were observed in large inpatient database analyses, which demonstrated that comorbid cardiovascular conditions did not uniformly prolong LOS and, in some cases, were associated with more streamlined inpatient care (McHugh, 2021; Kim, 2022).

Additionally, referral and discharge practices may have influenced this association. Patients with CHD may have been prioritized for early referral to specialized cardiac or stroke follow-up services, facilitating earlier discharge from acute care settings. Furthermore, clinicians may have applied greater vigilance in managing these patients due to perceived cardiovascular risk, leading to proactive complication prevention and reduced LOS. However, it should be noted that the retrospective design of this study limited the ability to account for stroke severity, treatment intensity, and post-discharge referral patterns, which may have confounded the observed association.

Therefore, the observed protective association between CHD and prolonged LOS should be interpreted cautiously. While CHD appeared to reduce the odds of prolonged hospitalization in this study, this finding does not imply a causal relationship. Further prospective studies incorporating stroke severity scores, in-hospital complications, and standardized discharge criteria are warranted to clarify the complex relationship between coronary heart disease and length of hospital stay among stroke patients.

Hypertension was not significantly associated with prolonged LOS. This finding may be explained by the high prevalence and routine management of these conditions within standardized stroke care protocols, which may reduce their impact on hospitalization duration when adequately controlled (Powers et al., 2020; Virani et al., 2021). In addition, LOS is strongly influenced by stroke severity, in-hospital complications, and functional status at admission factors that were not fully captured in this retrospective analysis and may have attenuated the observed associations. These findings highlight the importance of comprehensive cardiovascular assessment and integrated care pathways in stroke management. Early identification and optimal management of cardiac comorbidities may contribute to more efficient inpatient care and reduced LOS. From a public health perspective, the predominance

of stroke among middle-aged adults underscores the need for early prevention strategies targeting modifiable cardiovascular risk factors.

This study had limitations. Its retrospective, single-center design limited causal inference and generalizability. The absence of stroke severity measures and detailed treatment data may have introduced residual confounding. Future multicenter prospective studies incorporating standardized clinical severity scores are needed to better elucidate factors influencing LOS among stroke patients.

CONCLUSIONS

This study indicates that only 6.4% of stroke patients experienced prolonged hospitalization (≥ 7 days). Coronary heart disease (CHD) was the only comorbidity significantly associated with length of hospital stay, indicating that cardiac comorbidity influenced inpatient management and discharge processes. In contrast, hypertension was not independently associated with prolonged length of stay, possibly due to standardized management within stroke care protocols. These findings emphasize the importance of integrated cardiovascular and stroke care in optimizing hospital resource use. Future prospective multicenter studies incorporating stroke severity and clinical outcome measures are recommended to further clarify the relationship between comorbidities and length of hospital stay.

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