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THE IMPACT OF HYPERTENSION, HYPERCHOLESTEROLEMIA, AND SMOKING HISTORY ON STROKE INCIDENCE AT DR. R. SOEDJONO SELONG REGIONAL HOSPITAL

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Abstract

Stroke is a major cause of morbidity and mortality and remains a public health problem, including in East Lombok Regency. The high incidence of stroke is closely related to modifiable risk factors, such as hypertension, hypercholesterolemia, and smoking habits. The novelty of this study lies in the analysis of stroke risk factors based on patient data from Dr R. Soedjono Selong Regional General Hospital, the main referral hospital in East Lombok, which has been reported only to a limited extent. This study aims to analyse the relationship between hypertension, hypercholesterolemia, and smoking history with stroke incidence at Dr R. Soedjono Selong Regional General Hospital. This study is an observational, analytical, cross-sectional study conducted in October–November 2025 on 84 respondents selected using a purposive sampling technique. Data obtained from medical records and structured interviews were then analysed using the chi-square test. The results showed that stroke incidence was found in 57.1% of respondents. Hypertension and hypercholesterolemia were shown to have a significant relationship with stroke incidence, with p-values of 0.005 and 0.000, respectively ($p < 0.05$), while smoking history did not show a significant relationship with stroke incidence (p-value = 0.243). The conclusion of this study shows that hypertension and hypercholesterolemia are the main risk factors associated with stroke incidence, so that control of these two factors needs to be a priority in stroke prevention efforts at the health service level.

Keywords: Hypercholesterolemia; Hypertension; Risk factors; Stress; Smoking history; Stroke.

INTRODUCTION

Stroke is a global health problem that remains a major cause of morbidity, mortality, and long-term disability. Epidemiologically, stroke is a non-communicable disease that ranks second among the causes of death worldwide and is a leading cause of disability in adults and the elderly (1). The impact of stroke is not only felt by the individual, but also places a significant burden on the healthcare system, families, and society due to high treatment costs, long-term rehabilitation needs, and decreased productivity. The rising incidence of stroke globally is closely related to demographic transition, lifestyle changes, and the increasing prevalence of uncontrolled cardiovascular risk factors (2).

In Indonesia, stroke remains a significant public health problem. National data show that the prevalence of stroke has continued to increase in recent years, both based on diagnosis by healthcare professionals and clinical symptoms. It is estimated that about 750,000 cases of stroke occur each year, including about 200,000

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cases of recurrent stroke. This shows that stroke control efforts in Indonesia still need to be improved (3).

At the regional level, West Nusa Tenggara Province (NTB) is among the areas with a relatively high burden of stroke. Stroke is recorded as one of the ten diseases with the highest prevalence in NTB (4). East Lombok Regency is one of the areas with the highest number of stroke cases in NTB Province. Based on Riskesdas data in 2018, there were 388 cases of stroke in this region. More recent data from the East Lombok Health Office in 2025 also shows an increase in stroke screening coverage in 35 health centers, from 2,175 participants (5.7%) in May to 9,250 participants (24.2%) in June. This increase in screening coverage reflects the high attention to early detection of stroke, as well as indicating the potential for a high burden of cases in the community.

However, research that specifically analyzes modifiable stroke risk factors based on local hospital data in East Lombok is still limited. Data from Dr. R. Soedjono Selong Hospital, as the main referral hospital in East Lombok, shows an increase in stroke cases from 1,079 in 2023 to 1,191 in 2024, with a high inpatient mortality rate. This condition reflects a substantial health burden at the regional level and highlights the urgency to identify the dominant risk factors contributing to the incidence of stroke in this population. Therefore, research focusing on modifiable risk factors is essential to provide evidence-based data to develop effective stroke prevention strategies in East Lombok.

The high incidence of stroke is inseparable from the role of various risk factors. Stroke risk factors are generally divided into non-modifiable factors, such as age, gender, and genetics, and modifiable factors related to an individual's medical condition and behaviour. Modifiable risk factors play a crucial role because they can be controlled through promotive and preventive interventions. Therefore, identifying key risk factors is a strategic step toward reducing stroke incidence in the community (5).

Hypertension is the primary risk factor most consistently associated with stroke. Chronic high blood pressure can cause structural and functional damage to blood vessels, accelerate atherosclerosis, and increase the risk of ischemic and hemorrhagic stroke. Various studies have

shown that most stroke patients have a history of hypertension, either diagnosed or poorly controlled. The high prevalence of hypertension in the community makes this condition a primary focus in stroke prevention efforts (6).

In addition to hypertension, hypercholesterolemia plays a role in the pathogenesis of stroke through the formation of atherosclerotic plaques that can narrow or block blood vessels in the brain. High cholesterol levels, particularly LDL cholesterol, increase the risk of ischemic stroke due to impaired blood flow to brain tissue. However, previous studies on the relationship between hypercholesterolemia and stroke incidence have shown varying findings, so further research that considers local population characteristics is needed (7).

Smoking is also known to contribute to stroke through various mechanisms, including damage to the blood vessel endothelium, increased platelet aggregation, increased blood viscosity, and decreased oxygen-carrying capacity. However, several studies have reported inconsistent results regarding the association between smoking history and stroke incidence, particularly when associated with smoking duration and intensity. These discrepancies indicate a research gap that requires further study (8).

Based on these conditions, a study is needed that specifically analyzes the relationship between hypertension, hypercholesterolemia, and smoking history with stroke incidence. These factors have a high prevalence and contribute to damage to blood vessels that can lead to stroke. In addition, the high number of cases and death rates reflect the substantial burden of stroke in East Lombok. Therefore, this research is important as a scientific basis for developing stroke prevention and control strategies at the regional health level.

RESEARCH METHOD

This study is an analytical observational study with a cross-sectional design conducted in October–November 2025 at the Neurology Clinic of Dr R. Soedjono Selong Regional General Hospital, East Lombok Regency. The study population comprised all patients visiting the Neurology Clinic in 2025, and 84 respondents were selected using a purposive sampling technique based on inclusion and exclusion criteria. The independent variables were

hypertension, hypercholesterolemia, and smoking history, while the dependent variable was stroke incidence. Data on hypertension, hypercholesterolemia, and stroke incidence were obtained from medical records. Stroke diagnosis in this study was established based on medical records documented by neurologists, and complemented by neuroimaging findings such as CT-scan when available in the medical records. Data on smoking history were obtained through structured interviews. Data analysis was performed univariately and bivariately using the chi-square test to determine the relationship between independent variables and stroke incidence, with a significance level of 5%, and results presented as p-values and prevalence ratios (PR) with 95% confidence intervals. This research has obtained approval from the Research Ethics Committee of the Faculty of Medicine, Al-Azhar Islamic University (No. 159/EC-01/FK-06/UNIZAR/X/2025) and permission from Dr R. Soedjono, Selong Regional Hospital.

RESULTS AND DISCUSSION

Results

Table 1. Univariate Analysis Results

Variable	Frequency	
	Total (n)	Percentage (%)
Stroke*		
Stroke	48	57,1
Non-Stroke	36	42,9
Total	**84**	**100,0**
Hypertension*		
Hypertension	61	72,6
Non-hypertension	23	27,4
Total	**84**	**100,0**
Hypercholesterolemia*		
Hypercholesterolemia	41	48,8
Non-hypercholesterolemia	43	51,2
Total	**84**	**100,0**
Smoking History**		
Smoker	40	47,6
Non-smoker	44	52,4
Total	**84**	**100,0**

Sources: *Secondary Data, 2025 & **Primary Data, 2025

Based on the results of the frequency distribution analysis presented in Table 1, among the 84 respondents at Dr R. Soedjono Selong Regional General Hospital, 48 respondents (57.1%) experienced stroke, while 36 respondents (42.9%) did not. In the hypertension variable, the majority of respondents had hypertension (61 respondents, 72.6%), while 23 respondents (27.4%) did not have hypertension, indicating a high prevalence of hypertension among the study respondents. The distribution of hypercholesterolemia shows that 41 respondents (48.8%) had hypercholesterolemia and 43 respondents (51.2%) did not, resulting in a relatively balanced distribution between the two groups. Meanwhile, based on smoking history, 40 respondents (52.4%) had a history of smoking, and 44 respondents (47.6%) did not have a history of smoking.

Table 2. Results of Lifestyle Frequency Distribution on Skin Aging

Variable	Stroke				Total		*P-Value*	PR	(95% CI)
	Yes		No						
	n	%	n	%	n	%			
Hypertension*									
Hypertension	41	48,8	20	23,8	61	72,6	0,005	2,208	1,162-4,198
Non-hypertension	7	8,3	16	19,0	23	27,4			
Total	**48**	**57,1**	**36**	**42,9**	**84**	**100,0**			
Hypercholesterolemia*									
Hypercholesterolemia	32	38,1	9	10,7	41	48,8	0,000	2,098	1,377-3,195
Non-hypercholesterolemia	16	19,0	27	32,1	43	51,2			
Total	**48**	**57,1**	**36**	**42,9**	**84**	**100,0**			
Smoking History**									
Smoker	26	31,0	14	16,7	40	47,6	0,243	1,300	0,895-1,887
Non-smoker	22	26,2	22	26,2	44	52,4			
Total	**48**	**57,1**	**36**	**42,9**	**84**	**100,0**			

Sources: *Secondary Data, 2025 & **Primary Data, 2025

Based on the results of the bivariate analysis presented in Table 2, using the chi-square test, it is evident that hypertension is significantly associated with stroke incidence at Dr R. Soedjono Selong Regional General Hospital ($p = 0.005$; $p < 0.05$). These results indicate that respondents with hypertension have a higher risk of stroke than respondents without hypertension. In addition, hypercholesterolemia also shows a significant relationship with the incidence of stroke, with a p-value of 0.000 ($p < 0.05$). Conversely, smoking history does not show a significant relationship with the incidence of

stroke, with a p-value of 0.243 ($p \geq 0.05$), which indicates that the incidence of stroke in respondents in this study is not significantly influenced by smoking history.

Discussion

The Relationship Between Hypertension and Stroke Incidence

The results of this study indicate a significant association between hypertension and stroke incidence at Dr. R. Soedjono Selong Regional General Hospital, as evidenced by a chi-square test with a p-value of 0.005 ($p < 0.05$). This finding indicates that respondents with hypertension are more likely to experience stroke than respondents without hypertension. These results indicate that hypertension is a significant risk factor for stroke in this study's respondents.

Hypertension is a chronic condition of elevated blood pressure that plays a significant role in cardiovascular and cerebrovascular disorders. Hypertension is a modifiable risk factor for stroke and can increase the risk of stroke up to sixfold if uncontrolled (9).

Hypertension is a major trigger for stroke, both hemorrhagic and ischemic. This is because prolonged elevated blood pressure can cause structural changes in the brain's blood vessels, leading to oxidative stress, triggering inflammation, and causing arterial baroreflex dysfunction (10). In small blood vessels, hypertension causes smooth muscle hypertrophy, changes in smooth muscle cell structure, reduced blood vessel elasticity, and thinning of the blood vessel walls. Furthermore, increased pressure and shear forces on blood vessel walls can trigger atherosclerosis and intracranial stenosis (11).

Long-term hypertension can cause damage to blood vessel walls, both through increased mechanical stress and structural changes. Persistently high blood pressure can accelerate atherosclerosis, leading to thickening and stiffening of blood vessels and increasing the risk of plaque and thrombus formation. This condition can impede blood flow to the brain and trigger an ischemic stroke. Furthermore, hypertension can weaken the walls of blood vessels in the brain, increasing the risk of blood vessel rupture and hemorrhagic stroke.

These findings are consistent with previous studies that reported that hypertension is a major risk factor for stroke. A cross-sectional study conducted at Taman Bodhi Asri Medan in 2024 also found that hypertension in the elderly was significantly associated with stroke incidence, strengthening the finding of a link between high blood pressure and stroke in the elderly (12). Furthermore, a recent systematic review and meta-analysis showed that individuals with hypertension have a significantly increased risk of stroke compared to individuals without hypertension, with various studies reporting a 1.3–2.1-fold increased risk for stroke in populations with high blood pressure (13).

The Relationship Between Hypercholesterolemia and Stroke Incidence

The results of this study indicate a significant relationship between hypercholesterolemia and stroke incidence at Dr R. Soedjono Selong Regional General Hospital, as evidenced by a chi-square test with a p-value of 0.000 ($p < 0.05$). This finding indicates that respondents with hypercholesterolemia have a greater tendency to experience stroke compared to respondents without hypercholesterolemia. These results indicate that high cholesterol levels are an important risk factor that plays a role in the occurrence of stroke in the respondents of this study.

It is known that elevated cholesterol levels can trigger atherosclerosis by damaging the endothelium, leading to changes in endothelial permeability. Endothelial damage results from toxic injury to endothelial cells. This damage triggers the release of growth factors, which stimulate the entry of monocytes and lipids and their components into the blood vessel wall. Monocytes then penetrate the endothelial layer and settle in the subendothelium. Excess cholesterol accumulates in the blood vessel wall, forming atherosclerotic plaques, which can ultimately disrupt blood flow and increase the risk of stroke (14).

This study is consistent with previous studies conducted in rural communities in northeastern China, which showed that hyperlipidemia or hypercholesterolemia is an independent risk factor for ischemic stroke (OR 1.655; 95%

CI 1.397–1.959) after adjusting for confounding variables such as age, gender, diabetes mellitus, hypertension, smoking habits, alcohol consumption, physical activity, and body mass index (15).

The relatively equal proportion of respondents with hypercholesterolemia compared to those without hypercholesterolemia in this study indicates that high cholesterol levels are a fairly common health problem in the study population. This indicates that controlling metabolic risk factors, including hypercholesterolemia, still requires serious attention in stroke prevention efforts. However, this study did not differentiate cholesterol fractions in detail or analyse the duration or severity of hypercholesterolemia, so a more in-depth causal relationship cannot be fully elucidated.

Relationship Between Smoking History and Stroke Incidence

The results of this study indicate no significant association between smoking history and stroke incidence at Dr R. Soedjono Selong Regional General Hospital, as evidenced by a chi-square test with a p-value of 0.243 ($p \geq 0.05$). This finding indicates that stroke incidence in study respondents was not significantly influenced by smoking history.

Smoking is a modifiable risk factor for stroke and plays a role in increasing the risk of ischemic stroke and also increases the risk of subarachnoid haemorrhage by 3.5%. This risk can decrease significantly within 2-4 years after quitting smoking. Smoking can increase fibrinogen levels, a blood-clotting factor that plays a role in atherosclerosis. Passive smokers have a higher risk of stroke, and female smokers are reported to have a stroke risk of approximately 20% greater than male smokers (9).

Smoking is known as a risk factor for cardiovascular disease, including stroke. Exposure to toxic substances in cigarettes, such as nicotine and carbon monoxide, can cause damage to the blood vessel endothelium, increase platelet aggregation, increase blood viscosity, and reduce oxygen-carrying capacity. These mechanisms contribute to the formation of atherosclerosis and thrombosis, which can increase the risk of stroke, particularly

ischemic stroke. However, the results of this study did not show a significant association between smoking history and stroke incidence. Another factor that may have influenced the results of this study is the presence of other dominant risk factors, such as hypertension and hypercholesterolemia, which have a stronger influence on stroke incidence. The dominance of these risk factors may have caused the effect of smoking on stroke incidence to be statistically insignificant in bivariate analysis.

The insignificant results in this study align with several previous studies that also reported no significant association between smoking history and stroke incidence. Research conducted by Dywanti et al. (2024) showed that smoking history was not associated with ischemic stroke incidence (p-value = 0.447) (16).

CONCLUSION AND RECOMMENDATION

Stroke remains a significant health problem at Dr. R. Soedjono Selong Regional General Hospital. Hypertension and hypercholesterolemia have been shown to be significantly associated with stroke incidence, making them major risk factors contributing to stroke. However, smoking history did not show a significant association, indicating that its effect may be masked by other, more dominant risk factors. These findings highlight the importance of controlling modifiable risk factors through early detection, ongoing management, and strengthening health education as key strategies in reducing stroke incidence. Therefore, this study is expected to provide a scientific basis for the development of stroke prevention interventions at the healthcare level.

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