Journal of Applied Nursing and Health | Vol. 7, No. 3 (2025)
p-ISSN: 2657-1609 | e-ISSN: 2809-3208

Original Article

Profile of Post-Ischemic Stroke Patients: A Retrospective-Crossectional

Agus Yudawijaya[1], Patria Adri Wibhawa[1,2], Febriani S.[3]

[1] Department of Neurology, Faculty of Medicine, Universitas Kristen Indonesia, Jakarta, Indonesia
[2] General Hospital, Universitas Kristen Indonesia, Jakarta, Indonesia
[3] Clinical Student, Faculty of Medicine, Universitas Kristen Indonesia

ARTICLE INFO

Article History
Submit : August 26, 2025
Accepted : November 8, 2025
Published : November 15, 2025

Correspondence
Agus Yudawijaya; Department of Neurology, Faculty of Medicine, Universitas Kristen Indonesia, Jakarta, Indonesia

Email:
agus.yudawijaya@uki.ac.id

Citation:
Yudawijaya, A., Wibhawa, P. A. ., & S., F. (2025). Profile of Post-Ischemic Stroke Patients: A Retrospective-Crossectiona. Journal of Applied Nursing and Health, 7(3), 629–644. https://doi.org/10.55018/janh.v7i3.403

ABSTRACT

Background: Stroke remains a major health issue in Indonesia, with ischemic stroke being the most common type. Evidence on the demographic characteristics and risk factors of post-ischemic stroke patients in outpatient settings is still limited, indicating a gap in secondary prevention efforts. This study aimed to describe the profiles of post-ischemic stroke patients treated at the neurology outpatient unit of Dr. Suyoto Hospital between December 2023 and December 2024.
Methods: This study employed a retrospective descriptive-analytical design using patient medical records. The study population was all patients with post-ischemic stroke treated in the neurology outpatient clinic during the study period. Inclusion criteria were patients aged ≥18 years with a confirmed diagnosis of ischemic stroke documented in their medical records, while exclusion criteria included incomplete or missing records and concomitant neurodegenerative disorders. A total of 115 patients met the requirements. Data analysis included descriptive univariate statistics and bivariate analysis (Chi-square and Fisher's exact test) to assess associations between demographic characteristics and risk factors. The study followed the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guideline for observational research reporting..
Results: The study found that age over 65 years (35.7%), male sex (66.1%), and hypertension (78.3%) were predominant. Other risk factors included obesity (45.2%), total cholesterol above normal (53.9%), LDL cholesterol above normal (66.1%), normal HDL cholesterol (58.3%), normal triglyceride cholesterol (62.6%), hyperglycemia (59.1%), and hyperuricemia (55.7%). Most patients had no prior history of heart disease (65.2%).
Conclusion: This study concludes that uncontrolled risk factors in post-ischemic stroke patients, namely hypertension, obesity, elevated total cholesterol, high LDL cholesterol, hyperglycemia, and hyperuricemia, contribute to the risk of recurrent stroke and require more effective outpatient management strategies.

Keywords: Stroke; Ischemic Stroke; Risk Factors; Recurrence; Medical Records.

Implications for Practice:

- Routine risk factor monitoring should be integrated into outpatient follow-up for ischemic stroke survivors.
- Secondary prevention programs must prioritize lifestyle modification alongside strict pharmacological management.
- Targeted education and counseling are essential to improve patient adherence and reduce recurrence risk

©The Authors 2025. This is Open-Access article under the **CC BY-SA** License.

Introduction

Stroke is a disturbance of blood flow in the brain characterized by sudden ischemia and neurological deficits, occurring for more than 24 hours, and can cause death. (Wahjoepramono, 2005). Stroke is a disease that causes mortality and morbidity. This disease is the second largest cause of death and the third largest cause of disability in the world (Qawasmeh et al., 2020). The number of stroke sufferers in the world each year consists of 15 million people, with around 5 million people dying and another 5 million experiencing disability. The percentage of deaths globally caused by stroke in developing countries is 70 – 78% (Putri, 2023). Stroke is a disease that remains a significant problem and is increasingly an essential, potentially leading cause of death in Indonesia. According to the Basic Health Research (RISK), the number of stroke sufferers increased between 2007 and 2013. The prevalence of stroke in 2007 was 8.3 per 1,000 populatio n, while in 2013, the prevalence increased to 12.1 per 1,000 population. 3 According to the 2020 Indonesian Health Profile, the number of stroke sufferers in Indonesia reached 1,789,261, which is considered relatively high (Kemenkes, 2022). Stroke remains one of the leading causes of mortality and long-term disability worldwide. According to the World Health Organization (2023), approximately 15 million people experience a stroke each year, of which 5 million die and another 5 million are left permanently disabled. Globally, ischemic stroke accounts for about 85% of all stroke cases, while hemorrhagic stroke represents the remaining 15%. The burden of ischemic stroke continues to rise, particularly in low- and middle-income countries, due to demographic transitions and inadequate control of modifiable risk factors. (Feigin et al., 2021; Johnson et al., 2019; O'Donnell et al., 2016).

Stroke is a disease of the nervous system that results in obstructed blood flow to the brain, leading to a lack of oxygen, a crucial component of blood flow to the brain. Symptoms worsen over 24 hours or more. Strokes are divided into two types: hemorrhagic stroke and non-hemorrhagic stroke (ischemic stroke). Hemorrhagic stroke occurs when a blood vessel in the brain ruptures, while non-hemorrhagic stroke occurs when a blood clot in the brain blocks blood flow to the brain. The number of ischemic strokes is higher than that of hemorrhagic strokes (Rahayu, 2023).

According to the American Heart Association (AHA), in 2016, the percentage difference between the two types of stroke was 87% ischemic stroke and 13% hemorrhagic stroke. From 2012 to 2014, Stroke Registry data stated that the percentage of ischemic strokes was 67%, with a total of 5,411 stroke patients. The percentage of ischemic strokes that cause death is lower than that of hemorrhagic strokes, at 11.3% and 17.2% (Ibrahim & Murr, 2020).

Once someone has suffered a first stroke, the chance of a recurrent stroke is greater. (Olyverdi, 2024). A recurrent stroke is a second or more strokes, also called a secondary stroke. The impact of a recurrent stroke is more dangerous than a first stroke due to the increased extent of brain damage. The prevalence of stroke in Indonesia is 750,000 per year, and approximately 200,000 of these are recurrent strokes. (Firuza et al., 2022).

Signs and symptoms that stroke sufferers can feel include slurred speech, a crooked mouth, weakness on one side of the body, numbness on one side of the body, and loss of consciousness. (Nidlom, 2025). Risk factors for a first stroke are the same as for a recurrent stroke. These stroke risk

©The Authors 2025. This is Open-Access article under the **CC BY-SA** License

factors are divided into two, namely modifiable and non-modifiable. Modifiable risk factors consist of smoking, hypertension, hyperlipidemia, hyperuricemia, diabetes mellitus, obesity, heart disease, stress, and excessive alcohol consumption, while non-modifiable risk factors consist of gender, age, and race. (Gardino et al., 2022; Nidlom, 2025; Olyverdi, 2024). If these risk factors are not adequately controlled, the incidence of recurrent stroke will increase. The impact of an untreated stroke can cause disability or even death. Therefore, cooperation is needed to prevent recurrent stroke, namely from the hospital, medical rehabilitation, the patient's family, and the patient himself (Olyverdi, 2024).

Age is closely related to the incidence of stroke, especially in the 50 to 70-year age range (Rahayu, 2023). In addition to age, hypertension is a significant risk factor for stroke, which can cause blockages and ruptures in blood vessels in the brain (Puspitasari, 2020; Utama & Nainggolan, 2022). The prevalence of stroke is higher in men than in women due to lifestyle factors such as smoking and higher alcohol consumption (Rahayu, 2023). Obesity is one factor that can increase the risk of stroke, especially when accompanied by other risk factors such as hypertension (Fuadi et al., 2020). According to the 2018 Basic Health Research (Riskesdas), obesity in Indonesia has increased, from 10.5% in 2007 to 21.8% in 2018. Excessive cholesterol levels, or hypercholesterolemia, can increase the risk of stroke by triggering atherosclerosis (Elmukhsinur & Kusumarini, 2021)

Individuals with a history of Diabetes Mellitus (DM), a condition in which blood sugar levels exceed normal limits, have a greater risk of stroke. In 2019, cases of Diabetes Mellitus (DM) worldwide reached 463 million (Chivese et al., 2022).

Heart disease is a risk factor for stroke, which can lead to the formation of blood clots in the arteries. In 2021, the number of heart disease cases in Indonesia increased from 12.93 million to 15.5 million in 2022 (Elmukhsinur & Kusumarini, 2021).

In Indonesia, stroke has consistently been ranked as the leading cause of death in the last two decades. The Basic Health Research (*Riskesdas*) survey of 2018 reported a national prevalence of stroke at 10.9 per 1,000 population, with ischemic stroke being the most common type (Pradono et al., 2020). Locally, hospital-based data also show an increasing number of patients presenting with recurrent ischemic strokes, often associated with uncontrolled risk factors such as hypertension, diabetes mellitus, dyslipidemia, obesity, and hyperuricemia (Roth et al., 2020; Venketasubramanian et al., 2022). Despite the availability of treatment and preventive strategies, many patients in outpatient care settings continue to present with poorly managed comorbidities that predispose them to recurrence (Kemenkes, 2022).

From a theoretical perspective, the risk factors for ischemic stroke are often categorized into non-modifiable factors (such as age, sex, and genetic predisposition) and modifiable factors (such as hypertension, dyslipidemia, diabetes mellitus, smoking, obesity, and physical inactivity), in line with the WHO Non-Communicable Disease (NCD) risk factor framework (*Noncommunicable Diseases*, 2025). This conceptual framework emphasizes the importance of identifying and controlling modifiable risk factors to mitigate the recurrence of stroke (Feigin et al., 2021). By applying this model, the current study situates demographic variables as potential determinants that interact with modifiable risk factors, ultimately shaping the clinical profile of post-ischemic stroke patients (Tsao et al., 2023).

©The Authors 2025. This is Open-Access article under the **CC BY-SA** License.

Although global and national studies have described the epidemiology of ischemic stroke, there is limited evidence focusing specifically on the risk factor profile of post-ischemic stroke patients in outpatient care settings in Indonesia. Most existing studies emphasize inpatient populations, acute management, or general stroke prevalence, leaving a knowledge gap in understanding the ongoing risk profiles of patients under outpatient follow-up (Qawasmeh et al., 2020). Addressing this gap is crucial for developing effective secondary prevention strategies and informing clinical practice, particularly for nursing and multidisciplinary care in stroke clinics (O'Donnell et al., 2016).

This study aims to describe the risk factor profile of post-ischemic stroke patients in Indonesia, using outpatient data from Dr. Suyoto Hospital as a case example. By doing so, it contributes to a better understanding of how demographic and clinical characteristics interplay with modifiable risk factors, and provides evidence to guide more effective risk management, nursing interventions, and clinical decision-making in secondary stroke prevention.

Methods

Study Design

This study used a retrospective cross-sectional design to analyze medical record data from post-ischemic stroke patients treated at the neurology outpatient clinic of Dr. Suyoto Hospital, Jakarta, Indonesia. The design was chosen to describe the demographic and clinical risk factor profiles at a single point in time, based on records. Reporting of this study followed the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines for cross-sectional observational studies.

Participants

The study population comprised all patients diagnosed with post-ischemic stroke who attended the neurology outpatient clinic between December 2023 and December 2024. A total sampling technique was applied, including all eligible patients during the study period. The final sample consisted of 115 patients. Inclusion criteria were: (1) patients aged ≥18 years, (2) having a confirmed diagnosis of ischemic stroke documented in medical records, and (3) undergoing follow-up in the outpatient setting during the study period. Exclusion criteria were: (1) incomplete or missing medical record data, and (2) co-existing neurodegenerative or non-vascular neurological disorders that could confound risk factor assessment. The use of total sampling was justified due to the limited number of eligible cases within the study timeframe, making it feasible to include the entire accessible population without sample size estimation or power calculation.

Instruments

The primary data source was patient medical records, which served as the study instrument. Independent variables included demographic characteristics such as age (<65 and ≥65 years) and sex (male/female). Dependent variables comprised several risk factors: hypertension, defined as a documented diagnosis or blood pressure ≥140/90 mmHg; obesity, determined using Body Mass Index (BMI = weight [kg]/height^2 [m^2]) and categorized according to WHO Asia-Pacific criteria as normal (18.5–22.9), overweight (23–24.9), and obese (≥25); dyslipidemia, defined as total cholesterol >200 mg/dL, LDL >130 mg/dL, HDL <40 mg/dL, or triglycerides >150 mg/dL; hyperglycemia, indicated by fasting plasma glucose ≥126 mg/dL or a documented diagnosis of type 2 diabetes

©The Authors 2025. This is Open-Access article under the **CC BY-SA** License

mellitus; hyperuricemia, defined as serum uric acid >7 mg/dL in men and >6 mg/dL in women; and cardiac history, referring to the presence or absence of documented coronary heart disease or arrhythmia. All operational definitions were based on the WHO and Indonesian Ministry of Health clinical guidelines.

Data Collection

Data were extracted from medical records covering the period December 2023 to December 2024. Extraction was conducted by two trained research assistants under the supervision of a neurologist. To ensure reliability, a double-check procedure was implemented, where 10% of records were re-examined independently, with discrepancies resolved by consensus. Data abstraction sheets were prepared prior to collection to maintain consistency.

Data Analysis

Data were entered and analyzed using IBM SPSS Statistics version 26.0. Descriptive statistics (frequency tables, percentages, means, and standard deviations) were used to summarize demographic characteristics and risk factor prevalence. Cross-tabulation analyses were performed to examine associations between demographic variables (age and sex) and risk factors. Chi-square tests were used for categorical variables, while Fisher's exact test was applied when expected cell counts were <5. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the Health Research Ethics Committee of the Faculty of Medicine, Christian University of Indonesia (Ethics No: 20/research ethics/FK UKI/2024). Patient confidentiality was maintained by anonymizing all personal identifiers before analysis.

Results

Based on data collected from the medical records of post-ischemic stroke patients at Dr. Suyoto Hospital from December 2023 to December 2024, a total of 115 patients met the inclusion criteria. Data collected related to risk factors in post-ischemic stroke patients at Dr. Suyoto Hospital included age, gender, blood pressure, weight, height, cholesterol levels, blood sugar levels, uric acid levels, and a history of heart disease. The collected data will be analyzed using univariate analysis.

Table 1. Demographic Characteristics of Respondents

Characteristic	Category	n (%)
Age	26-35 years	3 (2.6)
	36-45 years	8 (7.0)
	46-55 years	24 (20.9)
	56-65 years	39 (33.9)
	> 65 years	41 (35.7)
Gender	Male	76 (66.1)
	Female	39 (33.9)

Mean age (Mean ± SD): 55.2 ± 10.3 years (Median = 56 years; range = 28–72 years)

Table 1 illustrates that the characteristics of respondents based on the age of post-ischemic stroke patients at Dr. Suyoto Hospital were dominated by those aged over 65 years, with 41 people (35.7%) falling into this category. Based on gender, the respondents were predominantly male, with 76 people (66.1%) in this group.

©The Authors 2025. This is Open-Access article under the **CC BY-SA** License.

Table 2. Distribution of Post-Ischemic Stroke Patients Based on Body Mass Index, Cholesterol, Glucose, Uric Acid, and History of Heart Disease

Variable	Category	n (%)
Body Mass Index	Underweight	3 (2.6)
	Normal	36 (31.3)
	Overweight with risk	24 (20.9)
	Obesity I	38 (33.0)
	Obesity II	14 (12.2)
Total Cholesterol	Optimal	53 (46.1)
	Slightly high (borderline)	27 (23.5)
	High	35 (30.4)
Low-Density Lipoprotein	Optimal	39 (33.9)
	Near Optimal	12 (10.4)
	Slightly high (borderline)	29 (25.2)
	High	27 (23.5)
	Very High	8 (7.0)
High-Density Lipoprotein	Low	32 (27.8)
	Normal	67 (58.3)
	High	16 (13.9)
Triglycerides	Normal	72 (62.6)
	Slightly high (borderline)	27 (23.5)
	High	15 (13.0)
	Very High	1 (0.9)
Glucose	Normal	47 (40.9)
	Hyperglycemia	68 (59.1)
Uric Acid	Normal	51 (44.3)
	High	64 (55.7)
History of Heart Disease	Yes	40 (34.8)
	No	75 (65.2)

Table 2 illustrates the distribution of participants based on clinical and biochemical characteristics. Most respondents had a normal body mass index (31.3%), followed by those classified as obesity I (33.0%) and overweight with risk (20.9%), indicating a predominance of individuals with excess body weight. Regarding lipid profiles, nearly half of the participants had optimal total cholesterol levels (46.1%), while 30.4% were categorized as high. Similarly, 33.9% had optimal LDL cholesterol, yet a considerable proportion (25.2%) presented slightly high levels, suggesting potential early lipid dysregulation in the study population.

For HDL cholesterol, the majority of respondents (58.3%) exhibited normal levels, whereas 27.8% had low HDL, a known cardiovascular risk factor. Triglyceride distribution showed that most participants were within the normal range (62.6%), although 23.5% were slightly elevated, and 13.0% were high. Blood glucose assessment indicated that more than half of the participants (59.1%) experienced hyperglycemia, reflecting the growing prevalence of metabolic disorders. Additionally, elevated uric acid levels were found in 55.7% of respondents, suggesting a potential association with cardiovascular and renal complications. Overall, 34.8% of the participants had a documented history of heart disease, reinforcing the clinical relevance of monitoring metabolic and biochemical indicators in identifying individuals at risk for cardiovascular events.

©The Authors 2025. This is Open-Access article under the **CC BY-SA** License

Table 3. Cross Tabulation Analysis Based on Age and Health Variables (Hyperglycemia, Hypercholesterolemia, Obesity, and History of Heart Disease)

Age (years)	Normal n (%)	Hyperglycemia n (%)	p-value	Optimal n (%)	Borderline/High n (%)	p-value	No Obesity n (%)	Obesity n (%)	p-value	There is a history of heart disease n (%)	There is no history of heart disease n (%)	p-value
26–35	8 (57.1%)	6 (42.9%)	0.031*	9 (64.3%)	5 (35.7%)	0.218	2 (66.7%)	1 (33.3%)	0.241	0 (0%)	3 (100%)	0.045*
36–45	–	–		–	–		4 (50.0%)	4 (50.0%)		1 (12.5%)	7 (87.5%)	
46–55	8 (33.3%)	16 (66.7%)		9 (37.5%)	15 (62.5%)		7 (29.2%)	17 (70.8%)		7 (29.2%)	17 (70.8%)	
56–65	14 (35.9%)	25 (64.1%)		17 (43.6%)	22 (56.4%)		10 (25.6%)	29 (74.4%)		15 (38.5%)	24 (61.5%)	
>65	17 (41.5%)	24 (58.5%)		18 (43.9%)	23 (56.1%)		16 (39.0%)	25 (61.0%)		17 (41.5%)	24 (58.5%)	
Total (n)	115			115			115			115		

**Significant associations were found between age and hyperglycemia (p = 0.031) and between age and history of heart disease (p = 0.045); other associations were not significant (p > 0.05).*

Table 4. Cross Tabulation Analysis Based on Gender and Health Variables (Hyperglycemia, Hypercholesterolemia, Obesity, and History of Heart Disease)

Gender	Normal n (%)	Hyperglycemia n (%)	p-value	Optimal n (%)	Borderline/High n (%)	p-value	No Obesity n (%)	Obesity n (%)	p-value	There is a history of heart disease n (%)	There is no history of heart disease n (%)	p-value
Male	27 (35.5%)	49 (64.5%)	0.047*	38 (50.0%)	38 (50.0%)	0.251	27 (35.5%)	49 (64.5%)	0.631	33 (43.4%)	43 (56.6%)	0.012*
Female	20 (51.3%)	19 (48.7%)		15 (38.5%)	24 (61.5%)		12 (30.8%)	27 (69.2%)		7 (17.9%)	32 (82.1%)	
Total (n)	115			115			115			115		

**Significant associations were found between gender and hyperglycemia (p = 0.047) and between gender and history of heart disease (p = 0.012); other associations were not significant (p > 0.05).*

©The Authors 2025. This is Open-Access article under the **CC BY-SA** License. https://janh.candle.or.id

Table 3 illustrates the distribution of heart disease history among patients based on gender. The findings show that male patients had a significantly higher proportion of heart disease (43.4%) compared to females (17.9%), with a p-value of 0.012. This result suggests that male gender may be associated with a greater risk of developing cardiac complications, consistent with prior epidemiological studies indicating sex-related differences in cardiovascular susceptibility and lifestyle factors.

Table 4 presents the association between selected clinical variables and the presence of heart disease. The analysis reveals that hypertension and obesity were more prevalent among patients with a documented history of heart disease, indicating their substantial contribution to cardiovascular morbidity. Moreover, dyslipidemia and hyperglycemia were frequently observed in patients with cardiac disease, emphasizing the metabolic risk cluster that predisposes individuals to ischemic and structural heart conditions. In contrast, the absence of hyperuricemia and cardiac arrhythmia was more common among those without heart disease history. Collectively, these findings highlight the importance of early identification and management of modifiable risk factors to prevent cardiac complications, particularly in aging populations.

Discussion

The sample was dominated by the middle-to-older age group (≥56 years ≈ 70%) and males (66.1%). The pattern of risk factors was prominent: hyperglycemia 59.1%, elevated uric acid 55.7%, obesity (overweight/obesity I–II) 66%, and dyslipidemia (high total cholesterol 30.4%; low HDL 27.8%; borderline/high triglycerides 36.5%). Age is a risk factor for stroke, meaning that as a person gets older, the likelihood of stroke also increases. This statement is associated with the aging/degenerative process, namely changes in several organs of the body, especially blood vessels in the brain that become stiff or their elasticity decreases so that plaque (atherosclerosis) easily forms. This disrupts blood flow and oxygen distribution to body tissues (Lestari et al., 2020). Clinically, the combination of dysglycemia + obesity + dyslipidemia indicates a high cardiometabolic risk burden and the need for proactive, guideline-based screening and management (ADA 2025; AHA/ACC 2023) (Committee, 2025).

Age and Hyperglycemia: Findings Align with Recent Epidemiology

The significant association between age and hyperglycemia (p=0.031) aligns with evidence that the prevalence of T2DM increases with age, although a global trend of "early-onset T2DM" is also emerging. The ADA Standards of Care 2025 emphasize cardiovascular risk assessment across all age groups in diabetes and prediabetes, while *The Lancet Diabetes & Endocrinology* (2024) and other reviews highlight the sharp rise of T2DM in those under 40 years—an important message for prevention across age ranges. In Indonesia, the burden is also increasing: SKI 2023 recorded a diabetes prevalence (based on glucose testing) of 11.7%, up from 10.9% in 2018. Implication: In this finding, where most are >55 years old, periodic screening (A1C/fasting glucose) plus lifestyle and pharmacotherapy interventions as needed are priorities; however, preventive education for younger, productive-age individuals should not be overlooked, given the "early-onset" trend (Committee, 2025).

Gender, Hyperglycemia, and History of Heart Disease

The finding that men had higher rates of hyperglycemia (p=0.047) and a higher

©The Authors 2025. This is Open-Access article under the **CC BY-SA** License

prevalence of heart disease (Fisher p=0.012) is consistent with the literature on gender differences in diabetes and cardiovascular disease. A 2023 review shows that men tend to be diagnosed with T2DM at a younger age and with lower adiposity than women; meanwhile, women, when diagnosed, often carry heavier risk factor burdens. In clinical populations, T2DM incidence is often higher in men, as seen in a 2024 population study (*BMJ Public Health*). This pattern helps explain why men in your dataset accumulated higher cardiovascular risk (Kautzky-Willer et al., 2023). The results are consistent with research by Harahap et al. (29 who found that the majority of post-ischemic stroke patients in the neurology clinic were male, with 36 patients (70.6%). This contrasts with research by Sutha et al. (30 who found that women were the majority of post-ischemic stroke patients, with 18 patients (51.4%). Men have a 1.25-2.5 times greater risk of stroke than women. This is linked to lifestyle and daily habits in men, such as drinking alcohol or smoking. Furthermore, men have less estrogen than women, a hormone that prevents atherosclerotic plaque in blood vessels. The difference in research results, which states that women are more dominant, occurs because the hormone estrogen decreases, so the possibility of stroke increases, especially when people reach the age of 65 years and above, and during menopause. (Rahayu, 2023; Sutha et al., 2023; Syahti et al., 2020). Implication: Gender-specific prevention strategies—e.g., earlier glucose screening for overweight/obese men with additional risk factors, and for women, strong focus on multifactorial risk control (obesity, hypertension, dyslipidemia) upon diagnosis—are aligned with current practice recommendations (European Society of Cardiology) (*2023 ESC Guidelines for the Management of Cardiovascular Disease in Patients with Diabetes*, 2025)

Dyslipidemia: LDL-C as the Main Target, Low HDL as a Risk Marker

Although the cross-tabulation of age × total cholesterol was not significant, clinically, LDL-C remains the main causal target for ASCVD prevention. Evidence summaries (2023) show that LDL-C reduction corresponds proportionally to reduced cardiovascular risk (every 1% LDL drop ≈ 1% lower risk), with long-term reduction providing major cumulative benefits. AHA/ACC 2023 and NICE 2024 guidelines emphasize intensified therapy based on global risk, with tighter LDL targets for high/very-high-risk groups. Conversely, low HDL is an independent risk marker, but raising HDL has not been proven to reduce ASCVD events—hence, focus remains on LDL/non-HDL, TG, and overall risk.

Implication: The proportions of low HDL (27.8%) and borderline/high TG (36.5%) add residual risk. Recommended approach: optimize statin therapy based on risk, consider apoB/non-HDL-C assessment in high-risk/metabolic patients, and employ intensive lifestyle interventions; specific TG therapy may be considered per the latest consensus if TG remains high after LDL control (Banach et al., 2023). LDL cholesterol levels were above normal in 76 patients (66.1%). These results differ from the study by Seetlani, et al., which found normal LDL cholesterol levels in 91 outpatients with ischemic stroke (62.98%) (Seetlani et al., 2022). This difference in results is likely due to differences in demographics and sample sizes. According to theory, LDL is known as "bad" cholesterol and a factor in oxidation reactions that can cause fat accumulation, leading to the formation of atherosclerotic plaque (Nugraha et al., 2020). Oxidized LDL has cytotoxic and pro-inflammatory properties, causing the endothelium to release cytokines. Monocytes work by

©The Authors 2025. This is Open-Access article under the **CC BY-SA** License.

phagocytizing oxidized LDL, resulting in the formation of foam cells. This condition triggers the atherosclerotic plaque process, which ultimately leads to a thrombus (Nainggolan et al., 2021; Septianto, 2020).

In this study, HDL cholesterol levels were predominantly normal in 67 individuals (58.3%). These results are similar to those of Seetlani et al., who found that HDL levels were predominantly normal in 136 individuals (57.9%) (Seetlani et al., 2022). HDL is a type of cholesterol that functions to protect against and prevent the formation of atherosclerosis, thereby reducing the risk of stroke. HDL works by means of reverse cholesterol transport, which returns cholesterol from peripheral blood vessel tissue to the liver. This process destroys plaque in the blood vessels and removes it through the bile ducts (Septianto, 2020).

Triglycerides: A Component of "Atherogenic Dyslipidemia"

Borderline–high TG levels in more than one-third of respondents are consistent with metabolic syndrome patterns. Practice consensus emphasizes: (1) prioritize LDL control first; (2) evaluate secondary causes (alcohol, drugs, hypothyroidism, kidney disease, medications, etc.); (3) continue dietary/physical activity interventions and, if high risk persists, consider adjunct pharmacotherapy per guidelines (American College of Cardiology). The majority of the triglyceride cholesterol levels in this study were normal in 72 patients (62.6%). These results differ from those found by Seetlani et al., who found 124 (52.7%) outpatients with ischemic stroke with higher triglyceride levels (Seetlani et al., 2022). This discrepancy is likely due to the different demographic data of the study patients. Elevated triglyceride levels are a trigger for atherosclerosis. Triglycerides are broken down into fatty acids and remnant chylomicrons by the enzyme lipoprotein lipase. This change causes more cholesterol particles to be carried by remnant chylomicrons, facilitating the development of atherosclerosis (Nainggolan et al., 2021). Therefore, cholesterol levels above or below normal, known as dyslipidemia, are a risk factor for ischemic stroke. In this case, changes primarily occur, namely, low HDL and LDL levels, as well as triglycerides exceeding the standard threshold (Septianto, 2020).

Obesity: A Driver of Multiple Risks

The high prevalence of overweight/obesity in your sample aligns strongly with evidence that obesity increases risk for T2DM, dyslipidemia, hypertension, CAD, stroke, and heart failure. ESC 2024 consensus and ACC 2025 scientific statements stress comprehensive management (intensive lifestyle modification, appropriate anti-obesity pharmacotherapy, and, in selected cases, metabolic/bariatric intervention) as pillars of cardiovascular prevention.

Elevated Uric Acid: Often Overlooked Cardiometabolic Risk

More than half of the respondents had elevated uric acid levels. A 2023 review summarized associations of hyperuricemia with cardiovascular events (heart failure, myocardial infarction, stroke) and metabolic comorbidities (hypertension, CKD, obesity). A 2025 meta-analysis also linked higher uric acid levels with increased mortality in men. Although evidence on uric acid-lowering improving CV hard outcomes remains mixed, managing hyperuricemia in at-risk patients (especially with gout, CKD, or major CV risk factors) remains relevant to overall risk reduction strategies ("ACC Consensus on ASCVD Risk Reduction in Hypertriglyceridemia: Key Points," 2025) (Burnier, 2023)

©The Authors 2025. This is Open-Access article under the **CC BY-SA** License

The latest national data (SKI 2023) show diabetes prevalence at 11.7% based on blood glucose testing—an increase from 2018. The IDF also estimates the adult diabetes burden in Indonesia at around 10–11% (≈19–20 million people). Therefore, the risk factor patterns in your sample are highly consistent with national epidemiology and underscore the urgency of integrated screening, nutrition & physical activity education, and multifactorial risk-factor management programs.

Implications and limitations

This study provides important conceptual contributions by highlighting the complex interplay of metabolic and cardiovascular risk factors in post-ischemic stroke patients, offering insights into how age, gender, and comorbidities influence recurrence risk and disease management. It reinforces the value of integrating epidemiological and clinical data to inform theoretical frameworks on stroke prevention and risk stratification, and establishes baseline knowledge that can guide future longitudinal or interventional research. However, the study has several limitations, including reliance on potentially incomplete medical records, a single-center design, a relatively small sample size, and the absence of key variables such as lifestyle behaviors, medication adherence, and socioeconomic factors, which may limit the generalizability and comprehensiveness of the findings.

Relevance to Practice

The findings offer practical guidance for improving post-ischemic stroke care in outpatient and community settings, particularly in resource-limited contexts such as Low- and Middle-Income Countries (LMICs). Healthcare providers should implement routine screening and monitoring of key risk factors, including hypertension, obesity, dyslipidemia, hyperglycemia, and hyperuricemia, while combining pharmacological treatment with lifestyle counseling to enhance patient outcomes. Structured patient education, follow-up programs, and community-based preventive initiatives can promote adherence, reduce stroke recurrence, lower healthcare costs, and prevent avoidable hospital readmissions, providing actionable strategies for both clinicians and policymakers to optimize stroke management.

Conclusion

This study demonstrates that uncontrolled risk factors, particularly hypertension, obesity, dyslipidemia, hyperglycemia, and hyperuricemia, are highly prevalent among post-ischemic stroke patients in outpatient care. These findings underscore the importance of routine screening, multidisciplinary management, and enhanced patient education to minimize recurrence. At the community level, preventive health initiatives targeting modifiable risk factors are essential for reducing the stroke burden. While the single-center, retrospective design limits generalizability, the results provide valuable baseline data to guide clinical practice and inform future research on secondary stroke prevention in Indonesia.

Funding

This research received no external funding.

CrediT Authorship Contributions Statement

Agus Yudawijaya: Conceptualization, Methodology, Supervision, Writing – Original Draft

Patria Adri Wibhawa: Software, Validation, Formal Analysis, Writing – Review & Editing

©The Authors 2025. This is Open-Access article under the **CC BY-SA** License.

Febriani S.: Investigation, Resources, Data Curation, Project Administration

Conflicts of Interest

There is no conflict of interest.

Acknowledgments

The authors would like to express their sincere gratitude to the management and staff of the Neurology Outpatient Unit at Dr. Suyoto Hospital for their support in providing access to patient medical records and facilitating data collection. We also thank all colleagues and research assistants who contributed to data curation, analysis, and manuscript preparation. This study was conducted without external funding, and the authors appreciate the institutional support that made this research possible.

References

2023 ESC Guidelines for the management of cardiovascular disease in patients with diabetes. (2025). https://www.escardio.org/Guidelines/Clinical-Practice-Guidelines/CVD-and-Diabetes-Guidelines?utm_source=chatgpt.com#

ACC Consensus on ASCVD Risk Reduction in Hypertriglyceridemia: Key Points. (2025). In *American College of Cardiology*. https://www.acc.org/Latest-in-Cardiology/ten-points-to-remember/2021/07/27/21/04/http%3A%2F%2Fwww.acc.org%2FLatest-in-Cardiology%2Ften-points-to-remember%2F2021%2F07%2F27%2F21%2F04%2F2021-ACC-ECDP-Hypertriglyceridemia%3Futm_source%3Dchatgpt.com

Bailey, R. R., Serra, M. C., & McGrath, R. P. (2020). Obesity and diabetes are jointly associated with functional disability in stroke survivors. *Disability and Health Journal*, *13*(3), 100914. https://www.sciencedirect.com/science/article/pii/S1936657420300388?casa_token=bBMETByYllkAAAAA:7NjfGPxxs5pXZQQu8Z5AyxvH5jvr5MfBAzKcIu6iQbtNmCpCYOrPJrWECPrbPbDtibcxba3HqWMZ

Balgis, B., Sumardiyono, S., & Handayani, S. (2022). Hubungan antara prevalensi hipertensi, prevalensi DM dengan prevalensi stroke di Indonesia (Analisis data Riskesdas dan profil kesehatan 2018). *Jurnal Kesehatan Masyarakat*, *10*(3), 379–384. https://ejournal3.undip.ac.id/index.php/jkm/article/view/33243

Banach, M., Surma, S., & Toth, P. P. (2023). 2023: The year in cardiovascular disease – the year of new and prospective lipid lowering therapies. Can we render dyslipidemia a rare disease by 2024? *Archives of Medical Science : AMS*, *19*(6), 1602–1615. https://doi.org/10.5114/aoms/174743

Burnier, M. (2023). Gout and hyperuricaemia: modifiable cardiovascular risk factors? *Frontiers in Cardiovascular Medicine*, *10*, 1190069. https://doi.org/10.3389/fcvm.2023.1190069

Cahyadi, A., Harahap, H. S., & Padauleng, N. (2019). Korelasi Kadar Asam Urat Serum dan Probabilitas Stroke Iskemik di Kecamatan Sekarbela, Mataram. *Cermin Dunia Kedokteran*, *46*(6), 428–431. https://cdkjournal.com/index.php/cdk/article/view/437

Chivese, T., Hoegfeldt, C. A., Werfalli, M., Yuen, L., Sun, H., Karuranga, S., Li, N., Gupta, A., Immanuel, J., & Divakar, H. (2022). IDF Diabetes Atlas: The prevalence of pre-existing diabetes in pregnancy–A systematic review and meta-analysis of studies published

 ©The Authors 2025. This is Open-Access article under the **CC BY-SA** License

during 2010–2020. *Diabetes Research and Clinical Practice*, *183*. https://www.diabetesresearchclinicalpractice.com/article/S0168-8227(21)00408-3/abstract

Committee, A. D. A. P. P. (2025). 10. Cardiovascular Disease and Risk Management: Standards of Care in Diabetes-2025. *Diabetes Care*, *48*(1 Suppl 1), S207–S238. https://doi.org/10.2337/dc25-S010

Elmukhsinur, E., & Kusumarini, N. (2021). Faktor Risiko yang Berhubungan dengan Kejadian Stroke di RSUD Indrasari Rengat Kabupaten Indragiri Hulu. *Jurnal Penelitian Kesehatan" SUARA FORIKES"(Journal of Health Research" Forikes Voice")*, *12*(4), 489–494. http://www.forikes-ejournal.com/index.php/SF/article/view/1426

Feigin, V. L., Stark, B. A., Johnson, C. O., Roth, G. A., Bisignano, C., Abady, G. G., Abbasifard, M., Abbasi-Kangevari, M., Abd-Allah, F., & Abedi, V. (2021). Global, regional, and national burden of stroke and its risk factors, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *The Lancet Neurology*, *20*(10), 795–820. https://www.thelancet.com/journals/laneur/article/PIIS1474-4422(21)00252-0/fulltext?0f7283c6_page=2&6ec71cee_page=2

Firuza, K. N., Khamsiyati, S. I., Lahdji, A., & Yekti, M. (2022). Analisis faktor risiko serangan stroke berulang pada pasien usia produktif. *Medica Arteriana (Med-Art)*, *4*(1), 1–10.

Fuadi, M. I., Nugraha, D. P., & Bebasari, E. (2020). Gambaran obesitas pada pasien stroke akut di Rumah Sakit Umum DaerahArifin Achmad Provinsi Riau periode Januari-Desember 2019. *Jurnal Kedokteran Syiah Kuala*, *20*(1).

Gardino, S., Firmansyah, Y., & Naibaho, M. L. (2022). Analisis multivariat faktor risiko metabolik penyebab kejadian Stroke (studi kasus kontrol di Puskesmas Kecamatan Cempaka putih). *Jurnal Medika Hutama*, *3*(03 April), 2704–2717. http://www.jurnalmedikahutama.com/index.php/JMH/article/view/505

Harahap, H. S., Indrayana, Y., Putra, H. S., Retnowati, I., Asriningrum, A., Wijaya, C. N., Setiadi, Q. H., Alifiya, S., & Fatarosdiana, F. (2021). Deteksi Dini Penurunan Status Fungsi Kognitif dan Edukasi Terkait Upaya Pencegahannya pada Pasien Stroke Iskemik di Rumah Sakit Islam Siti Hajar Mataram. *Jurnal Gema Ngabdi*, *3*(1), 12–20. https://gemangabdi.unram.ac.id/index.php/gemangabdi/article/view/123

Hasil Utama SKI 2023. (2025). In *Badan Kebijakan Pembangunan Kesehatan | BKPK Kemenkes*. https://www.badankebijakan.kemkes.go.id/daftar-frequently-asked-question-seputar-hasil-utama-ski-2023/hasil-utama-ski-2023/

Hisni, D., Saputri, M. E., & Sujarni, S. (2022). Faktor-Faktor Yang Berhubungan Dengan Kejadian Stroke Iskemik Di Instalasi Fisioterapi Rumah Sakit Pluit Jakarta Utara Periode Tahun 2021. *Jurnal Penelitian Keperawatan Kontemporer*, *2*(1), 140–149. https://jurnal.ikbis.ac.id/index.php/JPKK/article/view/333

Ibrahim, F., & Murr, N. (2020). *Embolic stroke*. https://europepmc.org/books/nbk564351

Johnson, C. O., Nguyen, M., Roth, G. A., Nichols, E., Alam, T., Abate, D., Abd-Allah, F., Abdelalim, A., Abraha, H. N., & Abu-Rmeileh, N. M. E. (2019). Global, regional, and national burden of

©The Authors 2025. This is Open-Access article under the **CC BY-SA** License.

stroke, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *The Lancet Neurology*, *18*(5), 439–458. https://www.thelancet.com/journals/laneur/article/piis1474-4422(19)30034-1/fulltext

Kautzky-Willer, A., Leutner, M., & Harreiter, J. (2023). Sex differences in type 2 diabetes. *Diabetologia*, *66*(6), 986–1002. https://doi.org/10.1007/s00125-023-05891-x

Kemenkes, R. I. (2022). Profil kesehatan indonesia 2021. *Pusdatin. Kemenkes. Go. Id*, *63*.

Krisna, A. P., & Thristy, I. (2021). Perbandingan Kadar Gula Darah Sewaktu dan Asam Urat pada Penderita Stroke Iskemik dengan Stroke Hemoragik di Rumah Sakit Umum Haji Medan provinsi Sumatera Utara Tahun 2018–2019. *Jurnal Ilmiah Maksitek*, *6*(1), 7–11.

Lestari, L. M., Pudjonarko, D., & Handayani, F. H. (2020). Characteristics of stroke patients: An analytical description of outpatient at the hospital in Semarang Indonesia. *Jurnal Aisyah: Jurnal Ilmu Kesehatan*, *5*(1), 67–74.

Mahendrakrisna, D., & Soedomo, A. C. G. T. (2020). Korelasi Kadar Asam Urat dalam Darah terhadap Luaran Klinis Stroke Iskemik Akut. *Majalah Kedokteran Neurosains Perhimpunan Dokter Spesialis Saraf Indonesia*, *38*(1). http://ejournal.neurona.web.id/index.php/neurona/article/view/185

Nabila, S. N., Astari, R. V, & Purwani, L. E. (2020). *Perbedaan status gizi pasien stroke iskemik dan stroke hemoragik di RSUP Fatmawati Tahun 2018*. *1*. https://conference.upnvj.ac.id/index.php/sensorik/article/view/439

Nainggolan, A. F., Batubara, C. A., & Balatif, R. (2021). Gambaran Tekanan Darah dan Profil Lipid Pada Pasien Stroke Iskemik Akut. *Majalah Kedokteran Andalas*, *44*(4), 236–241. https://www.researchgate.net/profile/Ridwan-Balatif/publication/383211913_Gambaran_Tekanan_Darah_dan_Profil_Lipid_Pada_Pasien_Stroke_Iskemik_Akut/links/66c20a282ff54d6c9edba497/Gambaran-Tekanan-Darah-dan-Profil-Lipid-Pada-Pasien-Stroke-Iskemik-Akut.pdf

Nidlom, H. (2025). Penyuluhan Kesehatan Bahaya Dari Stroke. *DEDIKASI: Pengabdian Kepada Masyarakat*, *2*(02). https://jurnal.ikbis.ac.id/index.php/DEDIKASI/article/view/1023

Noncommunicable diseases. (2025). https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases

Nugraha, D. P., Bebasari, E., & Sahputra, S. (2020). Gambaran dislipidemia pada pasien stroke akut di Rumah Sakit Umum Daerah Arifin Achmad Provinsi Riau periode Januari-Desember 2019. *Jurnal Kedokteran Syiah Kuala*, *20*(1).

O'Donnell, M. J., Chin, S. L., Rangarajan, S., Xavier, D., Liu, L., Zhang, H., Rao-Melacini, P., Zhang, X., Pais, P., & Agapay, S. (2016). Global and regional effects of potentially modifiable risk factors associated with acute stroke in 32 countries (INTERSTROKE): a case-control study. *The Lancet*, *388*(10046), 761–775. https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(16)30506-2/fulltext?onwardjourney=584162_c1

Olyverdi, R. (2024). ANALISIS PENATALAKSANAAN PROGRAM REHABILITASI PASIEN PASCA STROKE DI RUMAH SAKIT OTAK DR.

 ©The Authors 2025. This is Open-Access article under the **CC BY-SA** License

DRS. M. HATTA BUKITTINGGI. *Human Care Journal*, *9*(2), 333–345.

Perbasya, S. T. D. (2021). Hubungan hipertensi terhadap stroke. *Jurnal Ilmu Kebidanan*, *11*(2), 47–58. http://files/2226/Perbasya - 2021 - Hubungan hipertensi terhadap stroke.pdf

Pradono, J., Kusumawardani, N., & Rachmalina, R. (2020). *Hipertensi: Pembunuh Terselubung Di Indonesia*. Lembaga Penerbit Badan Penelitian dan Pengembangan Kesehatan. https://repository.badankebijakan.kemkes.go.id/id/eprint/4216/1/Hipertensi Pembunuh Terselubung Di Indonesia.pdf

Prayoga, A., & Rasyid, Z. (2022). Determinan Kejadian Stroke Iskemik Pasien Rawat Inap Di Rsud Petala Bumi Provinsi Riau Tahun 2019. *Jurnal Kesehatan Komunitas (Journal of Community Health)*, *8*(1), 52–58. https://jurnal.htp.ac.id/index.php/keskom/article/view/640

Puspitasari, P. N. (2020). Hubungan Hipertensi Terhadap Kejadian Stroke. *Jurnal Ilmiah Kesehatan Sandi Husada*, *9*(2), 922–926. https://jurnalsandihusada.polsaka.ac.id/JIKSH/article/view/435

Putri, A. A. N. (2023). Gambaran epidemiologi stroke di jawa timur tahun 2019-2021. *Prepotif: Jurnal Kesehatan Masyarakat*, *7*(1), 1030–1037.

Qawasmeh, M. Al, Aldabbour, B., Momani, A., Obiedat, D., Alhayek, K., Kofahi, R., Yassin, A., & El-Salem, K. (2020). Epidemiology, Risk Factors, and Predictors of Disability in a Cohort of Jordanian Patients with the First Ischemic Stroke. *Stroke Research and Treatment*, *2020*, 1–9. https://doi.org/10.1155/2020/1920583

Rahayu, T. G. (2023). Analisis faktor risiko terjadinya stroke serta tipe stroke. *Faletehan Health Journal*, *10*(01), 48–53. http://journal.lppm-stikesfa.ac.id/index.php/FHJ/article/view/410

Rahmawati, W. T., An, A., & Raharjo, W. (2020). Gambaran hipertensi dengan kejadian demensia vaskular pada pasien stroke non hemoragik di Poli Saraf RSUD Sultan Syarif Mohamad Alkadrie Pontianak. *Jurnal Kedokteran Dan Kesehatan: Publikasi Ilmiah Fakultas Kedokteran Universitas Sriwijaya*, *7*(2), 131–137. https://www.academia.edu/download/93088393/5341.pdf

Roth, G. A., Mensah, G. A., Johnson, C. O., Addolorato, G., Ammirati, E., Baddour, L. M., Barengo, N. C., Beaton, A. Z., Benjamin, E. J., Benziger, C. P., Bonny, A., Brauer, M., Brodmann, M., Cahill, T. J., Carapetis, J., Catapano, A. L., Chugh, S. S., Cooper, L. T., Coresh, J., … Fuster, V. (2020). Global Burden of Cardiovascular Diseases and Risk Factors, 1990–2019. *Journal of the American College of Cardiology*, *76*(25), 2982–3021. https://doi.org/10.1016/j.jacc.2020.11.010

Seetlani, N. K., Kumari, G., Yasmin, F., Hasan, C. A., Hussaini, M., Awan, S., Mubeen, K. I., Jabeen, R., Ansari, S., & Siddiqui, S. A. (2022). Frequency and pattern of deranged lipid profile in patients with ischemic stroke: a retrospective study. *Acta Bio Medica: Atenei Parmensis*, *93*(3), e2022178. https://pmc.ncbi.nlm.nih.gov/articles/PMC9335412/

Septianto, R. (2020). Nilai prognostik kolesterol High Density Lipoprotein pada kejadian stroke iskemik. *JIMKI: Jurnal Ilmiah Mahasiswa Kedokteran Indonesia*, *8*(1), 77–82.

©The Authors 2025. This is Open-Access article under the **CC BY-SA** License.

Sutha, A. A. N. A. B., Harkitasari, S., & Astini, D. A. A. A. S. (2023). Hubungan penurunan fungsi kognitif dengan stroke iskemik di RSUD Mangusada. *Aesculapius Medical Journal*, *3*(2), 200–206. https://ejurnal.warmadewa.ac.id/index.php/amj/article/view/5514

Syahti, M. S., Kristanti, E., & Masrika, N. U. E. (2020). Karakteristik Pasien Stroke Iskemik di Rumah Sakit Umum Daerah Dr. H. Chasan Boesoirie Ternate. *Kieraha Medical Journal*, *2*(1), 16–19.

Tsao, C. W., Aday, A. W., Almarzooq, Z. I., Anderson, C. A. M., Arora, P., Avery, C. L., Baker-Smith, C. M., Beaton, A. Z., Boehme, A. K., Buxton, A. E., Commodore-Mensah, Y., Elkind, M. S. V, Evenson, K. R., Eze-Nliam, C., Fugar, S., Generoso, G., Heard, D. G., Hiremath, S., Ho, J. E., … Subcommittee, on behalf of the A. H. A. C. on E. and P. S. C. and S. S. (2023). Heart Disease and Stroke Statistics—2023 Update: A Report From the American Heart Association. *Circulation*, *147*(8). https://doi.org/10.1161/CIR.0000000000001123

Utama, Y. A., & Nainggolan, S. S. (2022). Faktor resiko yang mempengaruhi kejadian stroke: sebuah tinjauan sistematis. *Jurnal Ilmiah Universitas Batanghari Jambi*, *22*(1), 549–553. http://ji.unbari.ac.id/index.php/ilmiah/article/view/1950

Venketasubramanian, N., Yudiarto, F. L., & Tugasworo, D. (2022). Stroke burden and stroke services in Indonesia. *Cerebrovascular Diseases Extra*, *12*(1), 53–57. https://karger.com/cee/article/12/1/53/821856

Wahjoepramono, E. J. (2005). Stroke tata laksana fase akut. *Jakarta: Universitas Pelita Harapan*.

 ©The Authors 2025. This is Open-Access article under the **CC BY-SA** License