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Original Article

FACTORS DETERMINING THE INCIDENCE OF HEMORRHAGIC AND NON-HEMORRHAGIC STROKES IN PATIENTS AGED 35-70 AT BANYUMAS REGIONAL HOSPITAL

Farrras Arlinda Rachmawati[1], Dwi Sarwani Sri Rejeki[2,3], Eri Wahyuningsih[2], Radi[4]

[1] Banyumas Regency Hospital, Indonesia
[2] Department of Public Health, Faculty of Health Sciences, Jenderal Soedirman University, Indonesia
[3] PUI Centre of Applied Sciences for Pharmaceutical and Health, Institute for Research and Community Service, Jenderal Soedirman University, Indonesia
[4] Master of Public Health, Faculty of Medicine, Public Health, and Nursing, Gadjah Mada University, Indonesia

Corresponding author: Radi, Master of Public Health, Faculty of Medicine, Public Health, and Nursing, Gadjah Mada University, Indonesia. Email: radi.epidemiolog@gmail.com

ABSTRACT

Background: Stroke is one of the leading non-communicable diseases contributing to high mortality rates worldwide. It is classified into two types: hemorrhagic and non-hemorrhagic stroke. The mortality and morbidity associated with stroke are higher compared to many other diseases. This study aims to identify the risk factors contributing to both hemorrhagic and non-hemorrhagic strokes.

Methods: This study is a quantitative analytical study with a cross-sectional study design conducted at Banyumas Regional Hospital. The study sample consisted of 100 hemorrhagic stroke patients and 100 non-hemorrhagic stroke patients using random sampling techniques. This study was conducted in September-October 2024. The variables studied were age, gender, ancestry, history of hypertension, history of DM, dyslipidemia, smoking habits, diet, physical activity, obesity, and control compliance. The research data consisted of secondary data obtained from the medical records section of Banyumas Regional Hospital and primary data obtained through interviews using questionnaires. Data analysis used SPSS 23 software with univariate tests, bivariate with chi-square, and multivariate with logistic regression to calculate the odds ratio (OR).

Results: The average age of the study respondents was 57.4 years and female. Variables that influenced the incidence of hemorrhagic stroke were non-compliance with control (p-value 0.000 and OR of 4.869), history of hypertension (p-value 0.004 and OR of 3.110), and poor diet (p-value 0.015 and OR of 2.204). Variables that did not influence were age, gender, heredity, history of DM, dyslipidemia, smoking habits, physical activity, and obesity.

Conclusions: Patients who have a history of hypertension, poor diet, and are not compliant with medication controls are at greater risk of suffering from stroke.

Keywords: *Stroke, Control Compliance, Hypertension History, Diet*

INTRODUCTION

Stroke known as cerebrovascular disease, this disease is a neurological disease that occurs due to disruption of blood supply to the brain[1]. This disease is one of the degenerative diseases that are divided into two types, namely hemorrhagic stroke and ischemic stroke. Based on the cause, ischemic stroke is caused by thrombotic or embolic blockage, while hemorrhagic stroke is caused by bleeding due to rupture of blood vessels in a part of the brain[2].

Stroke is the second leading cause of death in the world after coronary heart disease[3]. Deaths from stroke continue to increase from year to year. In 2019, WHO released data on deaths from heart disease and stroke reaching 17 million people or almost a third of the total number of deaths in the world[4]. Death in stroke patients can be caused by patients experiencing hemorrhagic stroke (bleeding), which is a condition where the blood vessels in the brain are blocked or ruptured 5. Paralysis due to hemorrhagic stroke can occur in the limb system, especially limbs such as hands, feet, and other limbs that can no longer move/do not function as usual[6].

The incidence of stroke in Indonesia according to basic hospital data is 63.52 per 100,000 people in the age group

over 65 years. Roughly, every day two Indonesians suffer a stroke. Epidemiologists predict that currently and in the future around 12 million Indonesians aged over 35 years have the potential to suffer a stroke based on the prediction model[7].

Banyumas Regional Hospital is one of the hospitals in Banyumas Regency that has stroke care services and facilities in the form of a stroke unit. Based on data from around 2020-2023, there were approximately 100 cases of hemorrhagic stroke with an age range of 35-70 years. Based on these data, it can be seen that the average hemorrhagic stroke patient who is hospitalized at Banyumas Regional Hospital per month reaches 6-7 patients. The high incidence of stroke served at Banyumas Regional Hospital illustrates the high incidence of stroke in the community, research related to stroke risk factors in Banyumas Regency is still limited.

Many conditions are suspected to be factors that increase the risk of hemorrhagic stroke. Among them are age factors, and lifestyle changes such as eating more sugar, salt, and fat[8]. Modern lifestyles have changed human attitudes and behaviors, including eating patterns, smoking, alcohol consumption, and drugs as a lifestyle so that sufferers of degenerative diseases (diseases due to decreased organ function) are increasing and threatening lives[9].

Other factors that increase the risk of stroke include age, gender, race and genetics, hypertension, smoking, obesity, diabetes mellitus, not practicing a healthy lifestyle, not having regular medical checkups, and consuming foods that contain a lot of salt[10]. Seeing so many risk factors that influence the incidence of hemorrhagic stroke and the severity of the consequences of suffering from hemorrhagic stroke, researchers are interested in researching the analysis of risk factors that influence the incidence of hemorrhagic stroke in the 35-70-year-old age group in Banyumas Regional Hospital.

METHODS

The research design used in this study is analytical research with a cross-sectional approach. The research analyzes the relationship between independent variables (age, gender, ethnicity, ancestry, hypertension, diabetes mellitus, dyslipidemia, smoking habits, diet, physical activity, obesity, and routine control compliance) with dependent variables (incidence of hemorrhagic stroke and non-hemorrhagic stroke).

This study was conducted in the stroke unit of Banyumas Hospital in June–September 2024. The samples in this study were inpatients in the stroke unit of Banyumas Hospital who suffered from hemorrhagic stroke and non-hemorrhagic stroke. The instrument used was a questionnaire. The type of questionnaire used was a closed questionnaire, namely the answers had been determined.

The data in this study consists of primary data and secondary data. Primary data was obtained through direct interviews and filling out questionnaires by respondents. Secondary data is data obtained from agencies related to this study. Secondary data was obtained in the form of data from Banyumas Regional Hospital. Secondary data was taken in the form of the number of stroke cases, respondent identity, blood sugar check results, and patient blood pressure data in the stroke unit of Banyumas Regional Hospital.

Data analysis includes univariate analysis to determine the frequency distribution of respondents' answers, bivariate analysis with the Chi-square method to determine the relationship between independent variables and dependent variables, and multivariate analysis to determine the variables that have the most influence on the dependent variable. Data analysis uses SPSS software version 23. This research gets ethical approvement from Banyumas Regional Hospital No.266/KEPK-RSUDBMS/IX/2024 and a research permit from Banyumas Regional Hospital No: 192/DIK45/RESEARCH/IX/2024.

RESULTS

Table 1 shows that the average age of respondents in this study was 57.1 years in hemorrhagic stroke patients and 57.6 years in non-hemorrhagic stroke patients, most respondents were female 59.0% in hemorrhagic stroke patients and 63.0% in non-hemorrhagic stroke patients, the majority of respondents were Javanese 58.0% in hemorrhagic stroke patients and 48% in non-hemorrhagic stroke patients. Most of them had a work background as housewives (23.5%), and most of the respondents were high school graduates (41.0%). Based on the duration of a stroke, there were 27% of respondents had only undergone the first week while the longest respondent had suffered a stroke for 24 weeks (5%).

Table 1. Univariate Analysis from Respondent's Response

Variables	Hemorrhagic Stroke		Non-hemorrhagic Stroke	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Age				
Youngest	38	-	40	-
Oldest	70	-	70	-
Average	57,1	-	57,6	-
Gender				
Female	59	59,0	63	63,0
Male	41	41,0	38	38,0
Ethnicity				
Java	58	58,0	43	43,0

Variables	Hemorrhagic Stroke		Non-hemorrhagic Stroke	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Ethnicity				
Sunda	27	27,0	31	31,0
Batak	12	12,0	21	21,0
Betawi	3	3,0	5	5,0
Occupation				
Labor/Farmer	16	16,0	16	16,0
Civil servant	9	9,0	12	12,0
Retired civil servant	17	17,0	23	23,0
Privat employees	9	9,0	6	6,0
Housewife	27	27,0	20	20,0
Driver	22	22,0	23	23,0
Education Level				
Elementary School	10	10,0	11	11,0
Junior high School	19	19,0	12	12,0
Senior high School	38	38,0	44	44,0
Diploma/Bachelor/Master	33	33,0	33	33,0
Long Suffer of Stroke (Week)				
1	32	32,0	22	22,0
2	3	3,0	6	6,0
3	3	3,0	8	8,0
4	32	32,0	36	36,0
8	17	17,0	9	9,0
12	6	6,0	9	9,0
16	2	2,0	4	4,0
20	0	0,0	1	1,0
24	5	5,0	5	5,0

Based on the results of the bivariate analysis in Table 2, variables that are statistically related to the incidence of hemorrhagic and non-hemorrhagic stroke at the age of 35-70 years in Banyumas Regional Hospital are the history of hypertension (p-value 0.024), routine compliance with control (p-value 0.000), and diet (p-value 0.002). Variables that are not related to the incidence of hemorrhagic stroke at the age of 35-70 years at Banyumas Regional Hospital are age (p-value 0.149), education (p-value 0.420), heredity (p-value 0.321), history of DM (p-value 0.452), dyslipidemia (p-value 0.314), smoking habits (p-value 0.660), obesity (p-value 0.253), and physical activity (p-value 0.880).

Table 2. Bivariate Analysis Result

Variable	Status of Stroke				Total		OR (95% CI)	*p-value*
	Hemorrhagic		Non-Hemorrhagic					
	n	%	n	%	n	%		
Age								
>45 years old	94	49,0	98	51,0	192	100,0	0,32 (0,63-1,62)	0,149
<45 years old	6	75,0	2	25,0	8	100,0		
Education level								
Low	29	55,8	23	44,2	52	100	1,367 (0,73-2,5)	0,420
High	71	48,0	77	52,0	148	100		
Heredity of Stroke								
Yes	43	45,7	51	54,3	94	100,0	0,725 (0,42-1,27)	0,321
No	57	53,8	49	46,2	106	100,0		
Hypertension history								
Yes	86	54,4	72	45,6	158	100,0	2,39 (1,17-4,88)	0,024
No	14	33,3	28	66,7	100	100,0		
Diabetes mellitus history								
Yes	30	45,5	36	54,5	66	100,0	0,76 (0,42-1,38)	0,452
No	70	52,2	64	47,8	134	100,0		

Variable	Status of Stroke				Total		OR (95% CI)	*p-value*
	Hemorrhagic		Non-Hemorrhagic					
	n	%	n	%	n	%		
Dislipidemia								
Yes	37	45,1	45	54,9	82	100,0	0,72 (0,41-1,26)	0,314
No	63	53,4	55	46,6	118	100,0		
Smoking history								
Yes	39	52,7	35	54,9	74	100,0	1,19 (0,67-2,11)	0,660
No	61	48,4	65	47,8	126	100,0		
Obesity								
Yes	13	39,4	20	60,6	33	100,0	0,59 (0,28-1,28)	0,253
No	87	52,1	80	47,9	167	100,0		
Control Compliance								
Bad	83	61,5	52	38,5	135	100,0	4,51 (2,35-8,66)	0,000
Good	17	26,2	48	73,8	65	100,0		
Physical activity								
Bad	69	50,7	67	49,3	136	100,0	1,09 (0,61-1,99)	0,880
Good	31	48,4	33	51,6	64	100,0		
Diet								
Bad	74	58,7	52	41,3	126	100,0	2,63 (1,45-4,76)	0,002
Good	26	35,1	48	64,9	74	100,0		
Total	100	50,0	100	50,0	200	100,0		

The results of the multivariate analysis in Table 3 showed that the most influential variable in the incidence of hemorrhagic and non-hemorrhagic stroke aged 35-70 years at Banyumas Regional Hospital was routine adherence to control. The results of the analysis obtained the Odds ratio (OR) value of the variable for the use of routine adherence to control was 4.869 (95% CI: 2.451-9.671), meaning that patients who do not comply with control to the hospital are five times more at risk of experiencing hemorrhagic stroke than patients who comply with control to the hospital.

The second most influential variable on the incidence of stroke aged 35-70 years at Banyumas Regional Hospital was a history of hypertension, the results of the analysis obtained the Odds ratio (OR) value of the variable for the history of hypertension was 3.110 (95% CI: 1.448-6.683), meaning that patients who have a history of hypertension are three times more at risk of experiencing hemorrhagic stroke than patients who do not have a history of hypertension.

The third variable that has the most influence on the incidence of stroke in patients aged 35-70 at Banyumas Regional Hospital is diet. The results of the analysis obtained show that the Odds ratio (OR) value of the diet variable is 2.204 (95% CI: 1.164-4.174), meaning that patients who have poor diets are twice as likely to experience hemorrhagic stroke as patients who do not have a history of hypertension.

Table 3. Last Modle of Multivariate Analysis

Variable	B	*p-value*	OR	95%CI
Hypertension history	1,135	0,004	3,110	1,448-6,683
Control Compliance	1,583	0,000	4,869	2,451-9,671
Diet	0,790	0,015	2,204	1,164-4,174

DISCUSSION

The study showed that variables that influence the incidence of hemorrhagic and non-hemorrhagic stroke in Banyumas Hospital are control compliance, hypertension history, and diet. The results of the study at Banyumas Regional Hospital showed a significant influence between control compliance and the incidence of hemorrhagic stroke at the age of 35-70 years. Multivariate analysis revealed that control compliance was the most influential variable on the incidence of stroke in individuals aged 35–70 years, with a p-value of 0.000 and an odds ratio (OR) of 4.869. This indicates that patients who were non-compliant with control had a fivefold greater risk of experiencing a stroke compared to those who were compliant.

This study's results align with research conducted at the University Hospital Basel, Switzerland, which showed an influence between treatment compliance and the incidence of stroke (p-value 0.010). In this study, treatment control compliance in hemorrhagic stroke patients was higher than treatment compliance in ischemic stroke patients[12]. Patients with hemorrhagic stroke have more compliance because the family understands the high risk of death.

Patient compliance in carrying out control can minimize the risk of danger that occurs if the body experiences conditions that lead to hemorrhagic stroke. Irregularity in carrying out controls can be caused by various factors such as the absence of family members to remind them, refusal to take medication, or patients feeling bored with undergoing treatment that takes quite a long time[13].

The study revealed that 83% of stroke patients demonstrated poor compliance with control measures, a figure significantly higher than the 52% non-compliance rate observed in the hypertension control group. This finding indicates a positive correlation between higher rates of non-compliance and the incidence of both hemorrhagic and non-hemorrhagic strokes among patients aged 35–70 years at the hospital. Moreover, patients who fail to adhere to their treatment plans face a greater risk of experiencing hemorrhagic stroke.

The results of the study at Banyumas Regional Hospital showed that there was a significant influence between a history of hypertension and the incidence of hemorrhagic and non-hemorrhagic stroke aged 35-70 years. Based on the results of the multivariate analysis, it was found that a history of hypertension was the second most influential variable on the incidence of hemorrhagic and non-hemorrhagic stroke with a p-value of 0.004 and an OR of 3.110, meaning that patients who have a history of hypertension are three times more at risk of experiencing hemorrhagic stroke than patients who do not have a history of hypertension.

The results of this study are in line with research conducted in the Democratic Republic of Congo which showed a significant effect between hypertension and the incidence of hemorrhagic stroke (aOR = 8:19; 95% CI: 2.72–24.66; p <0:0001). In this study, the effect of hypertension on the incidence of hemorrhagic stroke was caused by uncontrolled hypertension[14]. Uncontrolled high blood pressure that occurs for a long time will cause changes in the structure of the brain's blood vessels which increase the risk of hemorrhagic stroke[15].

Similar research conducted in Peru Latin America, showed that hypertension is a factor associated with the incidence of hemorrhagic stroke p-value 0.029. In this study, hypertension is known to cause the narrowing of the diameter of the blood vessels in the brain which can disrupt blood flow[16]. Narrowing of blood vessels and increased stiffness of blood vessels can cause rupture of blood vessels in the brain and cause hemorrhagic stroke[15]. Hypertension that occurs for a long time will cause various blood vessel disorders including stroke[17]. The results of the study at Banyumas Hospital showed that 86% of stroke patients had a history of hypertension. This condition showed that the higher proportion of hypertension is positively correlated with the incidence of hemorrhagic and non-hemorrhagic stroke aged 35-70 years at Banyumas Hospital. Patients with hypertension are at greater risk of experiencing hemorrhagic stroke[18]. Research in Zambia, Africa, showed that 80% of hemorrhagic stroke patients had hypertension and more than half of hemorrhagic stroke patients did not control their hypertension[19].

A study conducted at Banyumas Regional Hospital revealed a significant relationship between diet and the incidence of hemorrhagic and non-hemorrhagic stroke aged 35-70 years. Multivariate analysis identified diet as the third most influential factor, with a p-value of 0.015 and an odds ratio (OR) of 2.204. This indicates that patients with poor dietary habits are five times more likely to experience hemorrhagic stroke compared to those who adhere to dietary recommendations.

The results of this study are similar to research conducted at the neurology polyclinic of Tgk Chik Ditiro Sigli Hospital, Aceh, showing a significant influence between diet and the incidence of hemorrhagic stroke. The results showed that consumption of high-fat foods (p-value 0.003 OR = 2.81 95% CI 1.39-5.69), instant snacks (p-value <0.001 OR = 3.91 95% CI 1.90-8.03), and low-fiber foods (p-value <0.001 OR = 3.58 95% CI 1.73-7.41) had a significant effect on the incidence of hemorrhagic stroke[20]. Consumption of foods high in fat, salt, and low in fiber can increase blood pressure which can increase the risk of hemorrhagic stroke[21].

Similar research conducted at Dr. Doris Sylvanus Palangka Raya, South Kalimantan showed that diet affects the incidence of stroke. The results showed that consuming a lot of instant food (OR 7.53 CI 95%: 1.38 - 41.13), eating less fruit (OR 6.98 CI 95%, 1.53-31.80), and consuming less fish (OR 6.36 CI 95%: 1.15 - 34.99) had a significant effect on the incidence of stroke[22]. Eating foods that are high in sodium and lack of consumption increases blood fat levels. If consumption of unhealthy foods continues for a long period, it can cause

stiffness of blood vessels and rupture of blood vessels in the brain and cause stroke[23].

The results of the study at Banyumas Regional Hospital showed that 74% of hemorrhagic and non-hemorrhagic stroke patients had poor diets. This condition shows that the higher proportion of poor diets is positively correlated with the incidence of hemorrhagic and non-hemorrhagic stroke aged 35-70 years at Banyumas Regional Hospital. Respondents have a bad habbit to consumed foods with high salt and fat. This condition triggers various problems in the blood vessels including provoking the risk of stroke.

The study revealed no significant relationship between age and the incidence of hemorrhagic or non-hemorrhagic strokes among individuals aged 35-70 years (p-value = 0.149). This lack of substantial effect was attributed to the fact that most stroke patients were within the same age group, specifically those aged >45 years, in both hemorrhagic and non-hemorrhagic cases. Additionally, the risk of cerebral blood vessel rupture was likely influenced by other factors, such as a history of hypertension among the respondents[23]. The frequency distribution results showed that 86% of hemorrhagic stroke patients and 72% of non-hemorrhagic stroke patients had a history of hypertension. This finding indicates that a significant proportion of study respondents had hypertension before experiencing a stroke.

Gender or sex does not influence the incidence of hemorrhagic and non-hemorrhagic strokes. This lack of significant effect can be attributed to the higher proportion of female respondents among stroke patients—59.0% in hemorrhagic stroke cases and 62.0% in non-hemorrhagic stroke cases. Additionally, the average age of respondents is above 57 years, a stage categorized as elderly, during which blood vessel health declines in both men and women[24]. Consequently, the effect of gender on stroke incidence diminishes as age becomes a more dominant factor.

Education level does not significantly affect the incidence of hemorrhagic and non-hemorrhagic stroke. This lack of impact may be attributed to the fact that most respondents are highly educated, with 71.0% of hemorrhagic stroke patients and 77.0% of non-hemorrhagic stroke patients having completed high school or higher education. This suggests that most stroke patients had access to higher education, which could enhance their knowledge and awareness. However, other situations like smoking habits in people with high education levels can increase the risk of stroke[25].

Heredity does not significantly influence the incidence of hemorrhagic and non-hemorrhagic strokes. This is evident as the majority of respondents with hemorrhagic stroke (57.0%) reported no family history of stroke, while the difference was less pronounced among those with non-hemorrhagic stroke. These findings suggest that other factors, such as an individual's diet, may play a greater role in increasing stroke risk. Additionally, heredity does not directly cause strokes. Instead, most cases are triggered by medical conditions, such as hypertension, that can often be prevented or managed.

History of diabetes mellitus does not affect the incidence of hemorrhagic and non-hemorrhagic stroke. The absence of a significant effect was because most respondents did not have a history of DM, either in hemorrhagic stroke patients (70.0%) or non-hemorrhagic stroke patients (64.0%). In addition, DM does not directly affect the incidence of stroke, but high blood sugar levels can trigger angiopathy or blood vessel damage. This condition causes reduced elasticity of blood vessels so when a person's blood pressure is high, it can increase the risk of blood vessel rupture and cause stroke[26].

Dyslipidemia does not significantly influence the incidence of hemorrhagic or non-hemorrhagic stroke. This lack of effect can be attributed to the fact that the majority of respondents in the study did not have dyslipidemia, with 63.0% of hemorrhagic stroke patients and 55.0% of non-hemorrhagic stroke patients being unaffected. Moreover, while dyslipidemia itself does not directly cause strokes, elevated LDL cholesterol levels in the blood can lead to vessel blockages, which may rupture under increased blood pressure[27].

Smoking history does not significantly influence the incidence of hemorrhagic or non-hemorrhagic strokes. This is likely because the majority of respondents in the study do not have a history of smoking, with 61.0% of hemorrhagic stroke patients and 65.0% of non-hemorrhagic stroke patients reporting no smoking habits. While smoking itself may not directly cause these types of strokes, the chemical compounds in cigarettes, such as nicotine, can reduce blood vessel flexibility and elevate blood pressure. These conditions increase the risk of stroke in individuals with a history of smoking[28].

Obesity does not significantly influence the incidence of hemorrhagic or non-hemorrhagic strokes. The absence of a significant effect is because most respondents are not obese, both in hemorrhagic stroke patients (87.0%) and non-hemorrhagic stroke patients (80.0%). In addition, obesity does not cause stroke directly, but obesity can cause various problems such as blood vessel disorders, hypertension, and fat accumulation around organs[29].

Physical activity does not significantly influence the incidence of hemorrhagic or non-hemorrhagic strokes. The absence of physical activity's effect on stroke incidence is possible because respondents before suffering from stroke had suffered from other diseases such as hypertension which caused their physical activity to be poor.

CONCLUSION

The incidence of hemorrhagic stroke in patients aged 35–70 years at Banyumas Regional Hospital is significantly influenced by a history of hypertension ($p = 0.004$), poor diet ($p = 0.015$), and compliance with treatment control ($p < 0.001$). In contrast, age ($p = 0.210$) does not have a significant effect.

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REFERENCES

[1] Soremekun O, Dib M-J, Rajasundaram S, Fatumo S, Gill D. Genetic heterogeneity in cardiovascular disease across ancestries: Insights for mechanisms and therapeutic intervention. Cambridge Prism Precis Med 2023;1. https://doi.org/10.1017/pcm.2022.13.

[2] Haiga Y, Prima Putri Salman I, Wahyuni S. Perbedaan Diagnosis Stroke Iskemik dan Stroke Hemoragik dengan Hasil Transcranial Doppler di RSUP Dr. M. Djamil Padang. Sci J 2022;1:391–400. https://doi.org/10.56260/sciena.v1i5.72.

[3] Kemenkes RI. Kenali Stroke dan Penyebabnya. Kemenkes RI 2023. https://ayosehat.kemkes.go.id/kenali-stroke-dan-penyebabnya (accessed July 14, 2024).

[4] WHO. Cardiovascular Diseases (CVDs). WHO 2022. https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds) (accessed July 14, 2024).

[5] Setiawan et al. Diagnosis Dan Tatalaksana Stroke Hemoragik. J Med Utama 2021;02:402–6.

[6] Kurniawati F, Sari DAKW. Analysis of Factors Related to Mortality in Hemorrhagic Stroke Patients. 3rd Jt Int Conf 2021;3:425–31.

[7] Ministry of Health of the Republic of Indonesia. Hasil Utama Riskesdas 2018. 1st ed. Jakarta: Kemenkes RI; 2019.

[8] Hisni D, Saputri ME, Sujarni S. Faktor - Faktor Yang Berhubungan Dengan Kejadian Stroke Iskemik Di Instalasi Fisioterapi Rumah Sakit Pluit Jakarta Utara Periode Tahun 2021. J Penelit Keperawatan Kontemporer 2022;2:140–9. https://doi.org/10.59894/jpkk.v2i1.333.

[9] Masitha IS, Media N, Wulandari N, Tohari MA. Sosialisasi Pencegahan dan Pengendalian Penyakit Tidak Menular di Kampung Tidar. JurnalUmjAcId 2021:1–8.

[10] Potter TBH, Tannous J, Vahidy FS. A Contemporary Review of Epidemiology, Risk Factors, Etiology, and Outcomes of Premature Stroke. Curr Atheroscler Rep 2022;24:939–48. https://doi.org/10.1007/s11883-022-01067-x.

[11] Rekk K, Arnet I, Dietrich F, Polymeris AA, Lyrer PA, Engelter ST, et al. Relationship between electronically monitored adherence to direct oral anticoagulants and ischemic or hemorrhagic events after an initial ischemic stroke-A case control study. PLoS One 2024;19:1–17. https://doi.org/10.1371/journal.pone.0301421.

[12] Cholisoh Z, Karuniawati H, Azizah T, Zaenab, Hekmah LN. Faktor-Faktor yang Mempengaruhi Ketidakpatuhan Dalam Melakukan Terapi Pencegahan Sekunder pada Pasien Stroke Iskemik. Jmpf 2018;8:90–9.

[13] Musung JM, Kakoma PK, Bugeme M, Banze JPM, Mukeng CK, Muyumba ON, et al. Risk Factors for Hemorrhagic Stroke among Adults in the Democratic Republic of the Congo: A Hospital-Based Study in a Limited Resource Setting. Stroke Res Treat 2022;2022. https://doi.org/10.1155/2022/7840921.

[14] Priyatna RE, Sinardja CWD, Artana IGNB, Prunamasidhi CAW. Hubungan Tekanan Darah Tinggi Terhadap Kejadian Stroke di RSUP Prof. Dr. I.G.N.G Ngoerah. J Med Udayana 2023;12:45–9.

[15] Rimache JR, Martinez PR, Llulluy FS, Quispe G. Risk factors associated with hemorrhagic cerebrovascular accident. Medicine (Baltimore) 2023;42:1–6.

[16] Omidi F, Nasiri MJ, Sadeghi S. Impact of hypertension and lipid profile on cardiac function in an Iranian teaching hospital: A cross-sectional analysis. Glob Cardiol Sci Pract 2024;2024. https://doi.org/10.21542/gcsp.2024.29.

[17] Tento T, Kume A, Kumaso S. Risk factors for stroke-related functional disability and mortality at Felege Hiwot Referral Hospital, Ethiopia. BMC Neurol 2023;23:1–11. https://doi.org/10.1186/s12883-023-03444-8.

[18] Nutakki A, Chomba M, Chishimba L, Zimba S, Gottesman RF, Bahouth MN, et al. Risk factors and outcomes of hospitalized stroke patients in Lusaka, Zambia. J Neurol Sci 2021;424. https://doi.org/10.1016/j.jns.2021.117404.

[19] Jauhardin T, Hartanto RA, Basuki E, Ismail Setyopranoto. Pengaruh Pola Makan Terhadap Kejadian Stroke Hemoragik Di Ruang Poliklinik Saraf Rsud Tgk Chik Ditiro Sigli. Neurona 2020;38:40–7.

[20] Ruan H, Ran X, Li SS, Zhang Q. Dyslipidemia versus obesity as predictors of ischemic stroke prognosis: a multi-center study in China. Lipids Health Dis 2024;23:1–14. https://doi.org/10.1186/s12944-024-02061-9.

[21] Perawaty P, Dahlan P, Astuti H. Pola makan dan hubungannya dengan kejadian stroke di RSUD dr. Doris Sylvanus Palangka Raya. J Gizi Dan Diet

Indones (Indonesian J Nutr Diet 2016;2:51. https://doi.org/10.21927/ijnd.2014.2(2).51-61.

[22] Harshfield EL, Georgakis MK, Malik R, Dichgans M, Markus HS. Modifiable Lifestyle Factors and Risk of Stroke: A Mendelian Randomization Analysis. Stroke 2021;52:931–6. https://doi.org/10.1161/STROKEAHA.120.031710.

[23] Utama YA, Nainggolan SS. Faktor Resiko yang Mempengaruhi Kejadian Stroke: Sebuah Tinjauan Sistematis. J Ilm Univ Batanghari Jambi 2022;22:549. https://doi.org/10.33087/jiubj.v22i1.1950.

[24] Maier JA, Andrés V, Castiglioni S, Giudici A, Lau ES, Nemcsik J, et al. Aging and Vascular Disease: A Multidisciplinary Overview. J Clin Med 2023;12:1–14. https://doi.org/10.3390/jcm12175512.

[25] Yu YY, Lei D, He Q, Chen W. A cohort study on the relationship between education level and high-risk population of stroke. Ibrain 2021;7:181–91. https://doi.org/10.1002/j.2769-2795.2021.tb00082.x.

[26] Mosenzon O, Cheng AYY, Rabinstein AA, Sacco S. Diabetes and Stroke: What Are the Connections? J Stroke 2023;25:26–38. https://doi.org/10.5853/jos.2022.02306.

[27] Ha SH, Kim BJ. Dyslipidemia Treatment and Cerebrovascular Disease: Evidence Regarding the Mechanism of Stroke. J Lipid Atheroscler 2024;13:139–54. https://doi.org/10.12997/jla.2024.13.2.139.

[28] Sifat AE, Nozohouri S, Archie SR, Chowdhury EA, Abbruscato TJ. Brain Energy Metabolism in Ischemic Stroke: Effects of Smoking and Diabetes. Int J Mol Sci 2022;23. https://doi.org/10.3390/ijms23158512.

[29] Jia W, Liu F. Obesity: Causes, consequences, treatments, and challenges. J Mol Cell Biol 2021;13:463–5. https://doi.org/10.1093/jmcb/mjab056.