

Affecting Factors of Stroke **Incidence** : A Case Control Study

Faktor yang Mempengaruhi **Insiden** Stroke : Studi Kasus

Kontrol

Aulia Imanda¹, Santi Martini^{2*}, Kurnia Dwi Artanti³

¹ Faculty of Public Health, Universitas Airlangga, Surabaya, Indonesia

² Epidemiology Department Faculty of Public Health Universitas Airlangga, Surabaya,
Indonesia.

³ Epidemiology Department Faculty of Public Health Universitas Airlangga, Surabaya,
Indonesia..

* Corresponding Author: Santi Martini, Epidemiology Department Faculty of Public Health Universitas Airlangga, Surabaya, Indonesia, E-mail: santi-m@fkm.unair.ac.id, Phone: + 031-5920948, Fax: + 031-5924618

Abstract

Stroke is one of the non-communicable diseases that is the leading cause of death in Indonesia. The number of stroke patients always increases every year. A stroke prevention strategy needs to be done to control the number of stroke patients by knowing the factors that affect it. The purpose of this study was to determine the factors that

Commented [j1]: Pelajari kembali mengenai "insiden dan prevalensi"

the word incidence is not necessary in any senteces

Commented [j2]: Penggunaan kata insiden keliru
Penulis tidak paham apa beda "Insiden" dengan "Prevalen"

Yang pasti, pada disain Kasus Kontrol, tidak mungkin mendapatkan insiden

Saran perbaikan judul:

"Faktor Risiko Stoke: Studi Kasus Kontrol di RSUD Ngudi Waluyo Wlingi Kabupaten Blitar"

influence the incidence of stroke including smoking status, past hypertension, past diabetes, diet, physical activity, alcohol consumption. The design of this study is case control with a ratio of 1: 1. The total number of respondents is 132 people. Research subjects were selected using systematic random sampling. This research was conducted at Ngudi Waluyo Hospital in Wlingi. Blitar, Indonesia in October till November 2017. Bivariate analysis showed that factors significantly related to stroke were smoking status ($p=0.011$, $OR=2.6$), history of past hypertension ($p=0.00$, $OR= 6$), past diabetes ($p=0.015$; $OR=5,7$), and unhealthy diet ($p= 0,00$; $OR = 5,7$). Multivariate analysis showed that factors that significantly influence stroke are smoking, having hypertension in the past, and unhealthy diet. Conclusion of this study was smoking, having hypertension in the past, and unhealthy diet are factors that influence the incidence of stroke. Maintaining normal blood pressure, maintaining a diet, and not smoking are precautions should be taken in order to prevent stroke.

Abstrak

Stroke merupakan salah satu penyakit tidak menular yang menjadi penyebab kematian tertinggi di Indonesia. Jumlah penderita stroke selalu meningkat setiap tahunnya. Strategi pencegahan stroke perlu dilakukan untuk mengendalikan jumlah penderita stroke dengan mengetahui faktor yang mempengaruhinya. Tujuan dari penelitian ini adalah untuk mengetahui faktor yang mempengaruhi kejadian stroke meliputi status merokok, riwayat hipertensi sebelumnya, riwayat diabetes sebelumnya, diet, aktifitas fisik, konsumsi alkohol. Rancangan penelitian ini menggunakan case control dengan perbandingan 1:1. Jumlah seluruh responden adalah sebanyak 132 orang. Subjek penelitian diambil dari populasi dengan cara *systematic random sampling*. Penelitian ini dilakukan di RSUD

Ngudi Waluyo Wlingi Kabupaten Blitar, Indonesia pada bulan Oktober – November 2017. Analisis bivariat menunjukkan bahwa faktor yang berhubungan secara signifikan terhadap stroke adalah status merokok ($p=0,011$; $OR=2,6$), riwayat hipertensi sebelumnya ($p=0,00$; $OR=6$), Riwayat diabetes sebelumnya ($p=0,015$; $OR=5,7$), dan diet tidak sehat ($p=0,00$; $OR=5,7$). Pada analisa multivariat, faktor yang berpengaruh secara signifikan terhadap stroke adalah merokok, memiliki riwayat hipertensi sebelumnya, dan diet tidak sehat. Kesimpulan dari penelitian ini adalah merokok, memiliki riwayat hipertensi sebelumnya, dan diet tidak sehat merupakan faktor yang berpengaruh terhadap kejadian stroke. Menjaga tekanan darah agar tetap normal, menjaga pola makan, dan tidak merokok adalah pencegahan yang penting dilakukan agar terhindar dari stroke.

Keywords

stroke, smoking, unhealthy diet, hypertension, case control.

Introduction

The global mortality in 2002 was 57 million and 10% (5.5 million) of it was caused by stroke [1]. The global mortality in 2015 was 56.4 million in which heart disease and ischemic stroke were the world's highest cause of death in that year. Heart disease and stroke are also the leading cause of death in the world in the last 15 years [2]. Stroke is the fifth leading cause of death in the United States and has killed 129,000 people annually [3]. Stroke rates in low- and middle-income countries have doubled in the last four decades [4].

A stroke occurs when something is blocking the blood supply to the part of the brain or when a blood vessel enters the brain. This makes the brain damaged or dead. Stroke

can cause long-term brain damage, long-term disability, or even death [5]. Stroke greatly affects patient's productivity, social and economic development of patient's family, and even a country's economic burden.

Stroke may occur to anyone at any age and is a preventable and controllable disease. An effective prevention and control strategy is necessary to prevent an increase in stroke incidence especially in low- and middle-income countries. Stroke prevention and control can be carried out if the risk factors are ascertained. This study aims to determine the factors that influence the incidence of stroke including smoking status, past hypertension, past diabetes, diet, alcohol consumption, and physical activity.

Commented [j3]: Please do not use the terminology of "INCIDENCE" for the Cases Control Study

Method

This research was analytical observational study using case control design. This study was conducted to determine the factors that influence the incidence of stroke.

Our study subjects were recruited from Ngudi Waluyo Hospital in Wlingi, Blitar, East Java. We used systematic random sampling with a multiple of four. The sample size was calculated using Lemeshow's comparison case which generated 66 samples in each group. The samples of this research were patients with stroke who are not less than 17 years of age. The control samples in this study were hospital visitors who did not suffer from stroke and are not less than 17 years of age.

Commented [j4]: Please explain more detail, why the author used "systematic random sampling with a multiple of four"?

Commented [j5]: What assumption that was used by the author for resulting 66 sampel?

The questionnaire used in this study is adopted from the Basic Health Research in 2013 and the Ministry of Health of the Republic of Indonesia's Cohort Questionnaire of Non Contagious Diseases in 2011 which have been sorted out and modified in accordance to the needs of the study.

Commented [j6]: Bagaimana pemilihan sampel kontrol? Apakah dilakukan matching atau tidak?

Umur dan Jenis kelamin merupakan variabel faktor risiko stroke yang wajib dikontrol. Apabila kedua variabel ini tidak di matching dan ternyata tidak homogen antara kasus dengan kontrol, serta tidak dikontrol pada analisis Multivariate, maka dipastikan hasil analisis akan bias.

The questionnaire consists of 24 statements. Respondent is said to be smoking if the

respondent is current smoker or former smoker. Current smoker refers to respondent who has smoked 100 cigarettes during lifetime and is still smoking when the data are being collected. Former smoker refers to respondent who has smoked 100 cigarettes during lifetime and has quit smoking when the data are being collected [6].

Respondent is said to have an unhealthy diet if the respondent consumes risky foods (sweet foods/drinks, salty foods, and fatty foods/foods with cholesterol) once or more a day.

Respondent is categorized as active in performing physical activity if the respondent performs heavy and or moderate physical activities. Respondent is said to perform heavy physical activities if the respondent performs a continuous activity for at least 10 minutes until the pulse increases and the respondent breathes faster than the usual for a minimum of three days in a week and total activity time ≥ 1500 MET minute. MET minute of heavy physical activity is the length of time (minutes) of performing an activity in one week multiplied by the weight of 8 calories. Respondent is said to perform moderate physical activities if the respondent performs moderate physical activity (sweeping, mopping, etc.) at least five days or more with the total length of activity is 150 minutes in one week. Activity performance other than the stated above is said to be light physical activity [7].

Respondent is categorized as consuming alcohol if the respondent is consuming or has ever consumed alcohol at least once to three times a month. Respondent is categorized as having past stroke, diabetes, and hypertension if the respondent has ever been diagnosed with at least one of the diseases by a doctor.

All participants were provided with written informed consent approved by Ethics Commission of Faculty of Public Health Universitas Airlangga (certificate number: 536-KEPK).

Collected data were inputted and analyzed using Chi-Square test and logistic regression. Chi-Square analysis was carried out to determine the relation of each variable to stroke incidence, while logistic regression was carried out to determine the influence of each variable. All statistical tests in this study used $p < 0.05$.

Commented [j7]: Kelihatannya penulis belum bisa menjelaskan, mengapa perlu dilakukan analisis multivariat?

Results

Table 1 shows the results of bivariate analysis using chi-square test to determine the relation of each - each variable being examined. Smoking status was related to stroke incidence with p value=0,011 ($p < 0,05$). Respondents who smoked were 2.6 times more likely to suffer a stroke compared with respondents who did not smoke. Past hypertension was related to stroke incidence with p value=0.00 ($p < 0.05$). Respondents with past hypertension were 6 times more likely to suffer a stroke compared with respondents who did not have past hypertension. Past diabetes was related to stroke incidence with p value=0,015 ($p < 0,05$). Respondents with past diabetes were 5.7 times more likely to suffer a stroke compared with respondents who did not have past diabetes. Unhealthy diet was related to stroke incidence with significance value of $p=0.00$ ($p < 0.05$). Respondents with unhealthy diets were 5.7 times more likely to suffer a stroke than respondents with healthy diet. Physical activity was not related to stroke incidence with significance value of $p=1.71$ ($p < 0,05$). Alcohol consumption was not related to stroke incidence with $p=1.88$ ($p < 0.05$).

Commented [j8]: Apakah angka 2.6 ini sudah akurat?

Commented [j9]: Apakah angka 6 ini sudah akurat?

Commented [j10]: Apakah angka 5.7 ini sudah akurat?
Apakah peneliti yakin diabetes ada hubungan dengan stroke?
Mengapa peneliti melakukan analisis multivariat, tetapi hasilnya tidak digunakan?

Commented [j11]: Apakah angka 5.7 ini sudah akurat?

Multivariate analysis was performed to analyze the variables related to stroke incidence. The multivariate analysis was performed by using cognitive regression test to determine the influence of each factor as well as the factor with the greatest influence. Based on Table 2, it can be seen that the factors that influence the incidence of stroke with

a significance level of $p < 0.05$ are smoking, past hypertension, and unhealthy diet. Among the three factors, past hypertension is the factor with the greatest influence compared with other factors.

Table 1. Analysis of the Relation of Smoking Status, Past Hypertension, Past Diabetes Mellitus, Diet, Physical Activity, and Alcohol Consumption to Stroke Incidence

Variables	Case		Control		P	OR	95% CI	
	n	%	n	%			Lower	Upper
Smoking Status								
Smoker	31	47	17	25.8	0.011	2.6	1,226	5,316
Non smoker	35	53	49	74.2				
Past hypertension								
Yes	56	84.8	32	48.5	0.00	6	2,599	13,620
No	10	15.2	34	51.5				
Past diabetes mellitus								
Yes	10	15.2	2	3	0, 0 15	5.7	1,201	27,192
No	56	84.8	64	97				
Unhealthy Diet								
Yes	40	60.6	14	21.2	0.00	5.7	2,647	12,335
No	26	39.4	52	78.8				
Physical Activity								
Not active	4	6.1	1	1.5	1.71	4.2	0.4560	38,5650
Active	62	93.9	65	98.5				

Alcohol Consumption

Yes	7	10.6	3	4.5	1.88	2.5	0.615	10,087
No	59	89.4	63	95.5				

Table 2. Results of multivariate analysis of stroke risk factors

Independent Variable	B	OR	95% CI	Sig (P)
Exposed to cigarette smoke	1.034	2,811	1,121 - 7,052	0.028
Past hypertension	2,037	7,670	2,930 - 20,083	0,000
Unhealthy diet	1.637	5,138	2,155 - 12,250	0,000

Commented [j12]: Sebaiknya semua variabel masuk ke multivariat, supaya pembaca tahu mana yang signifikan dan mana yang tidak.
Signifikansi tidak hanya berdasarkan statistik saja, tetapi harus diingat signifikansi secara substansi juga lebih penting.

Discussion

Stroke is the leading cause of death in the last 15 years [2]. Therefore, it is necessary to do preventive efforts to reduce the prevalence of stroke so that the number of deaths due to stroke can be lowered.

Previous studies have suggested that there is a significant influence of smoking status on stroke incidence with a risk of 1.67. It means that smokers have a greater risk of stroke 1.67 times compared with non-smokers [8]. Smokers have a greater risk of stroke at least two to four times compared with non-smokers or ones who have quit smoking for more than 10 years. Smoking can cause intracerebral hemorrhage by damaging artery wall that leads to rupture of blood vessels. One study found that smoking was one of the primary risk factors for bleeding [9]. The risk of smoking is greater for women than for men compared with nonsmokers [10]. Cigarettes contain nicotine which can increase blood pressure [11].

Similar studies showed that past hypertension had a significant influence on stroke

Commented [j13]: Diskusi harus membahas semua variabel yang ada di tujuan penelitian....
Ada banyak variabel faktor risiko stroke yang belum dibahas, including smoking status, past hypertension, past diabetes, diet, alcohol consumption, and physical activity.

Commented [j14]: Discussion should be more elaborated especially in factors influenced (for each factor had been studied in the study)

Commented [j15]: Kelihatannya peneliti tidak paham makna "insiden" dan "prevalen"

incidence between in men and women in urban populations [12]. Most stroke patients had hypertension. High blood pressure can damage the arteries throughout the body and make the arteries rupture or clog more easily. Weak arteries in the brain due to high blood pressure make hypertensive patients at high risk of stroke [13].

Diabetes is a long-term chronic disease that makes the body unable to convert food into energy to be utilized by the body [14]. People who suffer from diabetes have a risk of suffering a stroke two to four times greater than people who do not suffer from diabetes. Diabetics are also at risk of heart disease and stroke at an earlier age compared with non diabetics. Diabetics have too much glucose in their blood while their cells do not get enough energy. This glucose can cause increased fat or clots in blood vessel walls. These clots or fat may narrow or block the blood vessels and cause stroke [15].

Diet is a modifiable risk factor for stroke [16]. Low fiber diet is significantly related to earlier stroke incidence [17]. Many evidences suggest that high salt intake and hypertension may increase the risk of stroke. In addition, consuming high-calorie diet can lead to high risk of obesity [18]. Previous studies conducted to middle-aged Korean women showed that obesity is closely related to hypertension and arterial stiffness [19]. Sugar or sweet drinks are also contributors to increased sugar intake and weight gain and can lead to increased risk of stroke. Diet high in grains, fruits, and vegetables can help reduce weight and can help reduce chronic illness and stroke [18].

Physical activity is not one of the direct risk factors that can cause a stroke. However, physical activity supports several stroke risk factors such as obesity, cholesterol, and high blood pressure. Good physical activity can help maintain weight, lower cholesterol level, and maintain blood pressure [11].

Alcohol consumption can indeed increase the risk of stroke but the risk is not a direct

Commented [j16]: Diabetes dibicarakan, tetapi hanya dari sisi telaah pustaka saja, tidak disinggung bagaimana kaitanya dengan hasil studi ini?

Jika ingin bicara faktor risiko stroke, maka semua variabel yang diteliti harus dibahas.
Jangan hanya membahas yang disukai saja dan mengabaikan variabel lain.

one but through other factors such as hypertension [20]. Consuming alcohol can increase hypertension and hypertension may increase the risk of stroke [11] .

Table 2 illustrates that past hypertension, smoking, and unhealthy diet are factors that influence stroke incidence. Past hypertension is factor with the greatest influence compared with other risk factors. Previous studies also suggested that stroke and hypertension are the leading causes of death and long-term disability [21]. Maintaining normal blood pressure by having regular blood pressure examination and avoiding various factors that can cause hypertension is necessary to avoid a stroke. In addition, not smoking and limiting the consumption of sweet foods and drinks, salty foods, and fatty foods/foods with cholesterol are also necessary.

Conclusion

Based on the results of this study, can be concluded that past hypertension, unhealthy diet, and smoking cause a stroke. Among the three factors, past hypertension is factor with the greatest influence compared with other factors.

References

1. Mackay J, Mensah G. The Atlas of Heart Disease and Stroke [Internet]. Geneva: WHO; 2004. [cited 2017 July 12]. Available from: http://www.who.int/cardiovascular_diseases/resources/atlas/en/.
2. The top 10 causes of death [homepage on the Internet]. Geneva: WHO; 2017 [update 2017 January 12; cited 2018 July 12]. Available from: <http://www.who.int/mediacentre/factsheets/fs310/en/>.
3. Kochanek KD, Murphy SL, Xu J. Deaths : Final Data for 2014. National Vital

Commented [j17]: Pembahasan itu harusnya berisi penjelasan tentang mekanisme dan kontribusi faktor risiko stroke. Dan perbandingan hasil penelitian dengan peneliti lain. Serta rekomendasi supaya stroke bisa dicegah/dikurangi.

Commented [j18]: Sebelum simpulan, peneliti harus menjelaskan apa saja kelebihan dan kekurangan studi ini.

Terutama kekurangannya adalah tidak dikontrolnya umur dan jenis kelamin. Sehingga hasil analisis ini belum akurat.

- Statistics Reports [serial on the Internet]. June 2016. [Cited 2017 July 12]; 65(4). Available from: <https://stacks.cdc.gov/view/cdc/40133>.
4. Feigin VL, Forouzanfar MH, Krishnamurthi R, Mensah GA, Connor M, Bennett DA, et al. Global and regional burden of stroke during 1990 – 2010 : findings from the Global Burden of Disease Study 2010. National Institutes of Health [serial on the Internet]. January 2014. [Cited 2017 July 15]; 383(9913). Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4181600/>.
 5. CDC [homepage on the Internet]. Geneva : National Center for Chronic Disease Prevention and Health Promotion, Division for Heart Disease and Stroke Prevention; 2016 [updated 2016 December 28; cited 2017 July 8]. Available from: <https://www.cdc.gov/stroke/about.htm>.
 6. CDC [homepage on the Internet].Geneva : CDC-National Center for Health Statistics [updated 2017 August 29; cited 2017 July 8]. Available from: https://www.cdc.gov/nchs/nhis/tobacco/tobacco_glossary.htm.
 7. Badan Penelitian dan Pengembangan Kesehatan RI. Riset Kesehatan Dasar 2013 [monograph on the Internet]. Jakarta: Kementerian Kesehatan RI; 2013. [Cited 2017 July 20]. Available from: [www.depkes.go.id/resources/download/general/Hasil Riskesdas 2013.pdf](http://www.depkes.go.id/resources/download/general/Hasil_Riskesdas_2013.pdf).
 8. Donnell MJO, Chin SL, Rangarajan S, Xavier D, Liu L, Zhang H, et al. Global and regional effects of potentially modifiable risk factors associated with acute stroke in 32 countries (INTERSTROKE): a case-control study. Lancet [serial on the Internet]. July 2016. [Cited 2017 July 15]; 388(10046). Available from: [http://dx.doi.org/10.1016/S0140-6736\(16\)30506-2](http://dx.doi.org/10.1016/S0140-6736(16)30506-2).
 9. Shah RS, W CJ. Smoking and stroke: the more you smoke the more you stroke.

- National Institutes of Health [serial on the Internet]. July 2010 . [Cited 2017 July 20]; 8(7). Available from: <https://www.ncbi.nlm.nih.gov/pubmed/20602553>.
10. Peters SAE, Huxley RR, Woodward M. Smoking as a Risk Factor for Stroke in Women Compared With Men. Journal Of The American Heart Association [serial on the Internet]. October 2013. [Cited 2017 August 20]. Available from: <http://stroke.ahajournals.org/content/44/10/2821.long>.
 11. CDC. [homepage on the Internet]. Geneva : National Center for Chronic Disease Prevention and Health Promotion, Division for Heart Disease and Stroke Prevention; 2017 [updated 2017 January 17; cited 2017 Jul 8]. Available from: <https://www.cdc.gov/stroke/behavior.htm>.
 12. Turin TC, Okamura T, Afzal AR, Rumana N, Watanabe M, Higashiyama A, et al. Hypertension and lifetime risk of stroke. Journal Hypertension [serial on the internet]. January 2016 [Cited 2017 July 8]; 34(1). Available from: <https://www.ncbi.nlm.nih.gov/pubmed/26556566>.
 13. American Heart Association. [homepage on the Internet]. Dallas : 13. American Heart Association; 2017 [updated October 2016; cited 2017 Jul 20]. Available from: <http://www.heart.org/>.
 14. CDC [homepage on the Internet]. Geneva : Centers for Disease Control and Prevention; 2017 [updated 2017 June 1; cited 2017 Jul 9]. Available from: <https://www.cdc.gov/diabetes/basics/diabetes.html>.
 15. National Stroke Association [homepage on the Internet]. Centennial: National Stroke Association; 2013. Available from: <http://www.stroke.org/sites/default/files/resources/DiabetesBrochure.pdf>.
 16. Hankey GJ. The Role of Nutrition in the Risk and Burden of Stroke: An Update of

- the Evidence. *Stroke Journal Of The American Heart Association* [serial on the Internet]. November 2017 [cited 2017 August 8]; 44(5). Available from: <https://www.ncbi.nlm.nih.gov/pubmed/28939673>.
17. Threapleton DE, Greenwood DC, Evans CEL, Cleghorn CL, Nykjaer C, Woodhead C, et al. Dietary Fiber Intake and Risk of First Stroke A Systematic Review and Meta-Analysis. *Stroke Journal Of The American Heart Association* [serial on the Internet]. May 2013 [cited 2017 August 8] ;44(5). Available from: <https://www.ncbi.nlm.nih.gov/pubmed/23539529>.
 18. Medeiros F, Casanova MDA, Fraulob JC, Trindade M. How Can Diet Influence the Risk of Stroke ? *International Journal of Hypertension* [serial on the Internet]. April 2012 [cited 2017 August 8]; 2012. Available from: <https://www.hindawi.com/journals/ijhy/2012/763507/>.
 19. Son W, Kim D, Kim Y, Ha M. Effect of Obesity on Blood Pressure and Arterial Stiffness in Middle-Aged Korean Women. *Osong Public Health Research Perspectives* [serial on the Internet]. November 2017 [cited 2017 August 13] ;8(6). Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5749481/>.
 20. Hillbom M, Saloheimo P, Juvela S. Alcohol Consumption, Blood Pressure , and the Risk of Stroke. *Springer* [serial on the Internet]. June 2011 [cited 2017 August 20]; 13(3). Available from: <https://www.ncbi.nlm.nih.gov/pubmed/21327566>.
 21. Liu M, Wu B, Wang W, Lee L, Zhang S, Kong L. Stroke in China : epidemiology , prevention, and management strategies. *Lancet* [serial on the Internet]. May 2007 [cited 2017 August 25]; 6(5). Available from: <https://www.ncbi.nlm.nih.gov/pubmed/17434100>.



[Lihat detail keamanan](#)

Dear Aulia imanda,

Thank you for submitting in **Kesmas**: National Public Health Journal, before **manuscript** will be reviewed, please do some revisions as attached.

Revision can be sent to editor no later than 14 days after receiving this email through your submission system in AUTHOR VERSION (upload here).

Regards,

Kesmas: National Public Health Journal

Kesmas: National Public Health Journal
D303 Building D 3th Floor
Faculty of Public Health Universitas Indonesia
Kampus Baru **UI** Depok 16424
Mobile phone: 0815-1141-6600
Email: jurnalkesmas.ui@gmail.com /
jurnalkm@ui.ac.id
Website: <http://jurnalkesmas.ui.ac.id/index.php/kesmas>



2261.doc

