# Effect of Hypertension on Stroke Events
# At the National Brain Center Hospital Jakarta 2017

## Yenni Syafitri[*], Prof. Sudijanto Kamso[**]

[*] Postgraduated Student Biostatistica and Population Studies Department, Universitas Indonesia
[**] Biostatistica and Population Studies Department, Universitas Indonesia

*Abstract-* Stroke is a deadly non-communicable disease. The high incidence of stroke in Indonesia shows that stroke is a health problem that is dangerous and needs special attention. Hypertension is the main risk factor that affects the incidence of stroke. The higher a person's blood pressure, the greater the likelihood that the person will experience a stroke. As a risk factor that can be changed and can be prevented, of course hypertension can be modified and detected so that it can reduce the risk of stroke events. This study was a cross-sectional that examined the effects of hypertension on stroke events. The population studies was stroke patients treated at the National Brain Center Hospital Jakarta in 2017 as many as 1,931 patients. The sample was chosen based on the inclusion criteria of patients treated with stroke (ischemic/hemorrhagic) as the primary diagnosis, the stroke that is now being experienced is the first (non-recurring) stroke and completes the patient's medical file according to the specified variable. The sample chosen was 309 respondents divided into 232 ischemic stroke patients and 77 hemorrhagic strokes. Data analysis was performed in univariable, bivariable using chi square and multivariable tests using multiple logistic regression analysis. The results showed that hypertension significantly affected the incidence of stroke in the National Brain Center Hospital. P value is 0.001 with odds ratio 0.296 (95% CI 0.141-0.621) which shows that hemorrhagic stroke patients who suffer from hypertension will be 0.296 times suffering from stroke compared to patients who are not hypertension after being controlled by age and diabetes mellitus.

*Index Terms*- *Hypertension, stroke, ischemic, hemorrhagic, effect*

## I. INTRODUCTION

Stroke is a non-communicable disease caused by disruption of the blood supply to the brain which can be caused by a blockage (ischemic stroke) or rupture of a blood vessel (hemorrhagic stroke) [1]. As a neurological disease, stroke remains one of the most devastating, which often causes death or physical and mental damage. With the epidemiological transition occurring in many countries around the world, there has been a drastic change in the prevalence of stroke prevalence [2]. There is a difference in the incidence of stroke in developed and developing countries. Feigin, et al (2009) concluded that the incidence of strokes globally experienced inequality namely in developed countries experienced a decline of 42% while in developing countries increased by 100%. This can occur due to massive urbanization, changes in risk factors and the lack of prevention and treatment of stroke in developing countries [3].

The American Stroke Association (2017) mentions risk factors for stroke include hypertension, smoking habits, diabetes mellitus, high cholesterol, obesity, lack of physical activity, carotid artery disease, etc [4]. The National Stroke Association (2018) states that stroke risk factors are divided into 3 namely the first risk factors based on lifestyle namely diet and nutrition, physical activity, smoking and tobacco use and alcohol consumption, both medical risk factors consist of hypertension, atrial fibrillation, hypercholesterolemia, diabetes mellitus, circulatory problems, carotid artery disease, and the third, risk factors that cannot be modified include age, sex, race, family history of stroke, previous stroke history, fibromuscular dysplasia, patent foramen ovale and ischemic transient attack [5]. Based on the results of the Riskesdas 2013 data released by the Health Research and Development Agency of the Indonesian Ministry of Health, data on stroke prevalence based on diagnosis of health personnel were 7 per mile and those diagnosed with health personnel or symptom based were 12.1 per mile. This figure is increased when compared with the 2007 Riskesdas data, namely the prevalence of stroke based on the diagnosis of health workers amounting to 6 per 1000 population and which can be detected by health workers at 8.3 per 1000 population [6]

Ghani, Mihardja, and Delima (2016) in their research on the dominant risk factors for stroke in Indonesia stated that the prevalence of hypertension in stroke was 3.1% [7]. After being controlled by sociodemographic variables and biological factors, hypertension will increase 2.87 times to stroke. Kulshreshtha (2012) also stated in his systematic review that from several studies conducted in Southeast Asia, hypertension was the most frequent risk factor in the incidence of stroke [8]. The results of Sofyan, Sihombing, and Hamra [9] and Sari [10] research showed that from 77 people in the study sample of stroke patients, 68 patients (88.3%) had hypertension and 9 patients (11.7%) had no hypertension. Based on the analysis results p = 0,000 which means that there is a significant relationship between hypertension and ischemic stroke. In line with the study, the results of a study conducted by Sari (2015) stated there was a significant relationship between hypertension and the incidence of recurrent stroke, indicated by a P value of 0.022 [10].

Hypertension is a stroke risk factor that can be changed. Often referred to as the silent killer/silent killer because hypertension increases the risk of stroke as much as 6 times. Hypertension is said if the blood pressure is greater than 140/90 mmHg. The higher the patient's blood pressure the greater the likelihood of a stroke, because of the damage to the walls of the blood vessels making it easier

to block and even rupture the blood vessels in the brain. If a stroke occurs many times, the chances of recovery and survival will be smaller. By knowing the effect of hypertension on the incidence of ischemic stroke and hemorrhagic stroke, it is hoped that it can prevent the occurrence of ischemic stroke and hemorrhagic stroke and repeat stroke [11].

The increase in prevalence in national data was followed by an increase in the incidence of ischemic stroke in the inpatient room at the Jakarta Central Otak Hospital. In accordance with the mandate of Presidential Regulation of the Republic of Indonesia No. 29 of 2014, the National Brain Center Hospital is one of the vertical units within the Directorate General of Health Services of the Ministry of Health. As a national referral hospital, patients diagnosed with stroke in this hospital are patients from various regions in Indonesia. The incidence of new cases of stroke at the National Brain Center Hospital experienced a very significant increase from 2015 to 2017. The number of patients diagnosed with ischemic stroke who were treated in the inpatient ward of the National Brain Hospital in 2015 was 664 people, increasing in 2016 to 987 people and continuing increased in 2017 to as many as 1317 people.

Stroke will be a threat and nightmare for sufferers and their families, given the threat of disability that can persist in patients until the death that may be experienced. But basically some risk factors, especially hypertension, are risk factors that can be changed or modified. So it can indirectly reduce the risk of stroke [12]

## II. DATA COLLECTION METHOD

This study was an observational analytic type using a cross sectional study design. Cross-sectional research is a descriptive study in which the variables used in the study are inflicted once on the subject of the study and then the relationship of the variables is only based on just one moment's observation [13]. The study was conducted using medical record data of stroke patients who were admitted to the national brain center hospital during 2017 with a total of 1931 patients. The study sample was stroke patients who were admitted to the stroke ward who met the inclusion criteria of 309 respondents divided into 232 ischemic stroke patients and 77 hemorrhagic stroke patients with the criteria of patients treated with stroke (ischemic / hemorrhagic) as the main diagnosis, stroke what is experienced is now the first stroke (not recurring) and the complete medical file of the patient according to the specified variable.

Data analysis began with the translation of univariable distribution, bivariable analysis, and multivariable analysis. Univariable distribution will describe the incidence of ischemic and hemorrhagic strokes based on the variables studied, among others, the independent variables namely hypertension and covariate variables, namely age, sex, diabetes mellitus and obesity using the frequency distribution table (proportion). after knowing the characteristics of each eating variable will be followed by bivariable analysis to determine the relationship between the dependent variable (stroke) and the independent variable (hypertension) after being controlled by covariate variables (age, sex, diabetes mellitus and obesity). the analysis used is the chi square test because the data connected are categorical with categorical data. chi square test will be able to conclude whether there is a difference in proportions between groups or in other words we can only conclude whether there is a relationship between two categorical variables but cannot explain the degree of relationship between these two variables. for multivariable analysis, researchers will conduct multiple logistic regression tests, namely mathematical models commonly used to analyze the relationship of one or several independent variables with one categorical dependent variable [14].

The dependent variable of this study is the incidence of stroke categorized into two, including bleeding / hemorrhagic stroke (code = 0) and blockage / ischemic stroke (code = 1). The stroke included in the inclusion criteria was a stroke that was diagnosed for the first time by RSPON doctors. The independent variable is hypertension (high blood pressure) which is defined into two categories, namely code 0 for patients who have systolic blood pressure below 140 mmHg or diastolic below 90 mmHg and code 1 for patients who have blood pressure greater than 140 mmHg or more diastolic from equal to 90 mmHg. This study uses a risk factor method, so that a variable covariate or intruder is needed. The covariate variables used were age, gender, diabetes mellitus status and obesity status. Age categories are divided into 2, 0 for ages less than 60 years and 1 for ages above 60 years. The sex category is divided into 2, namely 0 for women and 1 for men. The diabetes mellitus category is divided into two, namely 0 for not suffering from diabetes mellitus and 1 for diabetes mellitus. While the obesity category is divided into 4 categories, 0 for underweight, 1 for normal, 2 for overweight and 3 for obesity. For diabetes variables with more than 2 categories, a variable dummy is made with 0 (underweight) as a comparison.

## III.STUDY FINDINGS

### A. Univariable Distribution

The sample distribution of stroke patients consisting of 232 ischemic stroke patients and 77 hemorrhagic stroke patients based on the main independent variables (hypertension) and covariate variables (age, sex, diabetes mellitus and obesity) can be seen in the following table:

**Table 3.1. Sample Frequency Distribution Based on Independent Variables and Covariate Variables Which Affects Stroke Events**

| Variable | Stroke | | | | Total | |
| | Ischemic stroke | | Hemorrhagic stroke | | | |
| | n | % | n | % | n | % |
|---|---|---|---|---|---|---|
| **Hypertension** | | | | | | |
| No | 69 | 87,3 | 10 | 12,7 | 79 | 100,0 |
| Yes | 163 | 70,9 | 67 | 29,1 | 232 | 100,0 |
| **Age** | | | | | | |
| Under 60 year | 101 | 68,7 | 46 | 31,3 | 147 | 100,0 |
| More than the same as 60 year | 131 | 80,9 | 31 | 19,1 | 162 | 100,0 |
| **Sex** | | | | | | |
| Women | 94 | 78,3 | 26 | 21,7 | 120 | 100,0 |
| Men | 138 | 73,0 | 27 | 27,0 | 189 | 100,0 |
| **Diabetes Melitus** | | | | | | |
| No | 169 | 69,0 | 76 | 31,0 | 245 | 100,0 |
| Yes | 63 | 98,4 | 1 | 1,6 | 64 | 100,0 |
| **Obesity** | | | | | | |
| Underweight | 6 | 85,7 | 1 | 14,3 | 7 | 100,0 |
| Normal | 131 | 74,9 | 44 | 25,1 | 175 | 100,0 |
| Overweight | 77 | 75,5 | 25 | 24,5 | 102 | 100,0 |
| Obesity | 18 | 72,0 | 7 | 28,0 | 25 | 100,0 |

Based on the table 3.1, it can be seen that out of 232 hypertensive people, 163 people (70.9%) had ischemic stroke and of 79 people who did not suffer from hypertension, 69 people (87.3%) suffered from ischemic stroke. In the age group of less than 60 years of 147 people there were 101 people (68.7%) who suffered from ischemic stroke while the age group of more than 60 years, there were 131 people (80.9%) who suffered from ischemic stroke. Of the 189 male patients there were 138 people (73.0%) who suffered from ischemic stroke, while from 120 female patients there were 94 people (78.3%) suffering from ischemic stroke. Of the 245 people who did not suffer from diabetes mellitus, 169 people (69.0%) suffered from ischemic stroke while 64 of the people suffering from diabetes mellitus had 63 (98.4%) who suffered from ischemic stroke. For the obesity variable, from 7 people who were underweight, 6 people (85.7%) suffered from an ischemic stroke. Patients with normal BMI totaling 175 people were 131 people (74.9%) who suffered from ischemic stroke. 102 overweight patients had 77 people (75.5%) who suffered an ischemic stroke and of the 25 obese people there were 18 people (72.0%) who suffered from ischemic stroke.

In the group of hemorrhagic strokes can be described the following results: of 232 people with hypertension, there are 67 people (29.1%) suffering from hemorrhagic stroke and of 79 people who are not hypertensive, 10 people (12.7%) suffer from hemorrhagic stroke. In the age group of less than 60 years of a total of 147 patients there were 46 people (31.3%) who suffered from hemorrhagic strokes while the age group was more than 60 years, of the total 162 patients there were 31 people (19.1%) suffering from a hemorrhagic stroke. Of the 189 patients who were male there were 27 people (27.0%) who suffered hemorrhagic strokes, while of 120 people who were female there were 26 people (21.7%) who suffered from hemorrhagic strokes. Of the 245 people who did not suffer from diabetes mellitus, 76 people (31.0%) suffered from hemorrhagic strokes, while 64 people who had diabetes mellitus had only one person (1.6%) who suffered a hemorrhagic stroke. For the obesity variable, from 7 people who were underweight, 1 person (14.3%) suffered a hemorrhagic stroke. Patients with normal BMI totaling 175 people were 44 people (25.1%) who suffered hemorrhagic strokes. 102 overweight patients had 25 people (24.5%) who suffered hemorrhagic strokes and of the 25 people who were obese there were 7 people (28.0%) who suffered from hemorrhagic strokes.

### B. Bivariable Analysis

After doing the description of the characteristics, a bivariable analysis was carried out. Bivariable analysis was performed to see the effect of each of the main variables (hypertension) and covariate variables (age, sex, diabetes mellitus and obesity) on the incidence of ischemic stroke and hemorrhagic stroke, which can be seen in the following table:

**Table 3.2 Effect of hypertension and covariate variables on the incidence of stroke in National Brain Center Hospital**

| Variable | P | OR | 95% CI |
|---|---|---|---|
| **Hypertension** | 0,006 | 0,353 | 0,171 - 0,726 |
| **Age** | 0,020 | 1,925 | 1,139 - 3,251 |
| **Sex** | 0,358 | 0,748 | 0,436 - 1,285 |
| **Diabetes Melitus** | 0,001 | 28,331 | 3,858 - 208,073 |
| **Obesity** | 0,905 | - | - |

Based on table 3.2, the odds value of the hypertension ratio is 0.535 with a p value of 0.006. This shows that patients suffering from hypertension will experience 0.353 times the incidence of hemorrhagic stroke means that patients who have hypertension will be more likely to have an ischemic stroke (95% CI 0.171-0.726). This result is in line with Anwar's research conducted at Dr. RSUP Wahidin Sudirohusodo Makassar who got the results of p (0.026)> α (0.050) and CI (1,120; 3,571). People with a history of hypertension are more at risk of having a 2,000 stroke greater than people who have no history of hypertension [15]. Strengthened by the results of Alfica Agus Jayanti's research which states that people with hypertension have a risk of having a stroke of 17.92 times (14.05-22.86) than people who do not suffer from hypertension [16]

Age factor as confounding variable displays p value 0.020 with OR 1.925. The value of p indicates a difference in stroke incidence between the two categories of hypertension. the value of 95% CI obtained 1,139-3,251. This number passes number 1 so age is not necessarily a risk factor for stroke events. These results are not in line with previous studies by Zhang in China that age increases the incidence of ischemic stroke with OR = 2.122 (95% CI 1,335-3,374) [17].

Gender in this study received a p value of 0.358 with OR 0.748 which means that gender factors cannot be considered as risk factors for stroke at the National Brain Center Hospital. There are several studies that are appropriate and not in accordance with the results of this study. Sofyan's research states that gender is not related to the incidence of stroke with a p value of 0.308 [9]. Another study conducted by Puspita showed different results, namely that sex was associated with the incidence of stroke with the risk of stroke occurring in male sex by 4.375 times compared to women [18].

The next variable is diabetes mellitus which has a p value of 0.001 with OR 28,331 which means there is a significant relationship between diabetes mellitus and the incidence of stroke. A very high OR value indicates that diabetes mellitus is the most dominant factor affecting hypertension in the event of a stroke at the National Brain Center Hospital. The results of this study are in line with Usrin's study which found that diabetes mellitus affect the incidence of stroke with a p value of 0,0001 and OR 0.29 which means that patients suffering from diabetes mellitus will have 0.29 times to experience a stroke compared to those without diabetes mellitus [19].

The last factor in this study was obesity which obtained p value of 0.905 which means there was no significant relationship between obesity and the incidence of stroke in the National Brain Center Hospital. The results of this study are not in line with Atmaja's research (2014) which concluded that a person with a body mass index> 25 had a stroke risk 10 times compared to a body mass index <25 [20]. The way to calculate body mass index is to divide the body weight (in kilograms) by the square height (in meters). Some new studies link obesity (especially central obesity) with an increased risk of stroke.

### c. Multivariable Analysis

Based on bivariable analysis, the multivariable model candidates were obtained, namely hypertension, age and diabetes mellitus variables. Then a multivariate analysis is performed to create a model that describes the relationship between independent variables together with one dependent variable, and by controlling several confounding variables. After obtaining a multiple logistic regression model, then an interaction check and confounding examination were carried out, so that the results of multivariate analysis were obtained as follows:

**Table 3.3 Final Model of Multiple Logistic Regression**

| Variable | B | Exp(B) | SE | P | 95% CI |
|---|---|---|---|---|---|
| **Hypertension** | -1,217 | 0,296 | 0,378 | 0,001 | 0,141 – 0,621 |
| **Age** | 0,616 | 1,851 | 0,284 | 0,030 | 1,060 – 3,232 |
| **Diabetes Melitus** | 3,475 | 32,294 | 1,020 | 0,001 | 4,372 – 238,554 |
| **Constant** | 1,445 | 4,243 | 0,369 | 0,000 | |

The above model was obtained after the interaction test and it was found that there was no interaction between hypertension as the main independent variable with other covariate variables, age and diabetes mellitus. Confounding test is not done because there is no variable with a p value greater than 0.05 so the final model is without interaction and confounding as seen in table 3.3. The results of multivariable analysis showed that hypertension significantly affected the incidence of stroke. The confounding factors included in the final model were age and status of diabetes mellitus, while the factors that were not proven to be confounding were gender and obesity. the above assessment is determined by considering the p value in the final model which is <0.05.

Based on multiple logistic regression analysis it can be concluded that the risk of hemorrhagic stroke incidence in hypertensive patients is 0.296 times compared to patients who are not hypertension after being controlled by age and diabetes mellitus (OR = 0.296, 95% CI 0.141-0.6621).

## IV. DISCUSSIONS

Hypertension is a risk factor for the incidence of stroke in the National Brain Center Hospital. Hypertension can accelerate the hardening of the arteries so that it causes the destruction of fat in smooth muscle cells which can accelerate the process of atherosclerosis through the effect of suppressing endothelial cells in the arterial wall resulting in faster blood vessel plaque formation. The higher blood pressure, the greater the chance of having a stroke. If a stroke occurs many times, the chances of recovery and survival will be smaller [21]. Next variabel is age. Age is a risk factor for ischemic stroke that cannot be changed. the incidence of new cases of ischemic stroke increases with age. Hemorrhagic and ischemic stroke are often regarded as diseases that only appear in old age, but now there is a tendency for younger age groups (<40 years) to suffer. This can be caused by changes in the lifestyle of modern urban youth, such as consuming fast food containing high fat, smoking habits, drinking alcoholic beverages, excessive work, lack of exercise and stress. In this study gender did not significantly influence the incidence of stroke in the National Brain Center Hospital. This is because women have a higher risk of various complications such as thromboembolism with atrial fibrillation and cardioembolism [22]. Diabetes mellitus has a significant effect on stroke at the National Brain Center Hospital. This happens because diabetes mellitus will accelerate the occurrence of atherosclerosis in both small blood vessels and large blood vessels throughout the blood vessels including the blood vessels of the brain and heart. So that it will expand infarction (dead cells) because the formation of lactic acid causes anaerobic glucose metabolism to damage brain tissue [19]. Obesity factors did not significantly influence the incidence of stroke at the National Brain Center Hospital. Central obesity is defined as waist circumference> 102cm in men or> 88cm in women. Central obesity increases the risk of stroke through hypertension, diabetes and dyslipidemia which states that obesity is 10 times more likely to suffer a stroke than patients who do not suffer from obesity [23].

## V. CONCLUSION

This study shows that the risk factors for stroke in the National Brain Center Hospital are hypertension after controlled by age and diabetes mellitus. These results are in line and in accordance with various literature and results of research related to stroke. Many ways to prevent stroke can be done, namely by increasing public awareness and changing lifestyle towards a healthier one. Primary prevention that can be done is activities to stop or reduce risk factors for hypertension before hypertension occurs, through health promotion such as a healthy diet by eating enough vegetables, low salt and fat, diligently doing activities and not smoking [24].

## REFERENCES

[1] J. Mackay and G. A. Mensah, "Risk Factors," in *The atlas of heart disease and stroke*, Geneva: WHO, 2004.

[2] D. Mukherjee and C. Patil, "Epidemiology and the global burden of stroke," 2011.

[3] V. L. Feigin, C. M. Lawes, D. A. Bennett, S. L. Barker-Collo, and V. Parag, "Worldwide stroke incidence and early case fatality reported in 56 population-based studies: a systematic review," *Lancet Neurol.*, vol. 8, no. 4, pp. 355–369, 2009.

[4] American stroke association, "Risk factors of stroke," 2017. [Online]. Available: https://www.strokeassociation.org/idc/groups/stroke-public/@wcm/@hcm/documents/downloadable/ucm_309713.pdf. [Accessed: 03-Apr-2018].

[5] National Stroke Association, "Understand Stroke," *American Heart Association*, 2018. [Online]. Available: https://www.stroke.org/understand-stroke/preventing-a-stroke/uncontrollable-risk-factors/.

[6] Badan Penelitian dan Pengembangan Kesehatan, "Riset Kesehatan Dasar," Jakarta, 2013.

[7] L. Ghani, L. K. Mihardja, and Delima, "Faktor Risiko Dominan Penderita Stroke di Indonesia," *Bul. Penelit. Kesehat.*, vol. 44, no. 1, pp. 49–58, 2016.

[8] A. Kulshreshtha, L. M. Anderson, A. Goyal, and N. L. Keenan, "Stroke in south asia: a systematic review of epidemiologic literature from 1980 to 2010," *Neuroepidemiology*, 2012.

[9]     A. M. Sofyan, I. Y. Sihombing, and Y. Hamra, "Hubungan Umur, Jenis Kelamin, dan Hipertensi dengan Kejadian Stroke," Universitas Haluoleo, 2013.

[10]    I. P. Sari, "Faktor-faktor yang berhubungan dengan terjadinya stroke berulang pada penderita pasca stroke," 2015.

[11]     dr. I. Junaidi, *Stroke, Waspadai ancamannnya*. Yogyakarta: CV Andi Offset, 2011.

[12]    G. G. Wahyu, *Stroke; hanya menyerang orang tua?* Yogyakarta: B First, 2009.

[13]    A. Wibowo, *Metodologi Penelitian Praktis Bidang Kesehatan*, 1st ed. Jakarta: PT RajaGrafindo Persada, 2014.

[14]    S. P. Hastono, *Analisis Data Pada Bidang Kesehatan*, 1st ed. Depok: PT Rajagrafindo Persada, 2017.

[15]    M. Hafid, "Hubungan Riwayat Hipertensi Dengan Kejadian Stroke di RSUP Dr. Wahidin Sudirohusodo Makassar 2012," *Kesehatan*, vol. VII, no. 1, p. 6, 2012.

[16]    A. A. Jayanti, "Hubungan hipertensi dengan kejadian stroke di Sulawesi Selatan tahun 2013," Universitas Syarif Hidayatullah Jakarta, 2015.

[17]    J. Zhang, "Clinical factors in patients with ischemic versus hemorrhagic stroke in East China," *World J. Emerg. Med.*, vol. 2, no. 1, p. 18, 2011.

[18]    M. R. Puspita and G. Putro, "Hubungan Gaya Hidup Terhadap Kejadian stroke di Rumah Sakit Umum Daerah Gambiran Kediri," *Bul. Penleitian Sist. Kesehat.*, vol. 11, no. 11, p. 263, 2008.

[19]    I. Usrin, E. Mutiara, and Y. Yusad, "PENGARUH HIPERTENSI TERHADAP KEJADIAN STROKE ISKEMIK DAN STROKE HEMORAGIK DI RUANG NEUROLOGI DI RUMAH SAKIT STROKE NASIONAL (RSSN) BUKITTINGGI TAHUN 2011," *Media Neliti*, 2013.

[20]    R. Atmaja, "Hubungan Obesitas dengan Kejadian Stroke," Universitas Muhamadiyah Yogyakarta, 2014.

[21]    S. Setiawati, I. Alwi, and A. W. Sudoyo, *Buku Ajar Ilmu Penyakit Dalam*. Jakarta: Interna Publishing, 2016.

[22]    H. M. Ignatius Eka P W, Arinta P, "Perbedaan Jenis Kelamin Sebagai Faktor Risiko Terhadap Keluaran Klinis Pasien Stroke Iskemik," *J. Kedokt. Diponegoro*, vol. 6, no. 2, pp. 655–662, 2017.

[23]     dr. R. Pinzon and  dr. L. Asanti, *Awas Stroke! Pengertian, Gejala, Tindakan, Perawatan dan Pencegahan*, 1st ed. Yogyakarta: CV Andi Offset, 2010.

[24]    Kementerian Kesehatan, "Masalah Hipertensi di Indonesia," 2012. [Online]. Available: http://www.depkes.go.id/article/print/1909/masalah-hipertensi-di-indonesia.html. [Accessed: 26-Jun-2019].

AUTHORS

**First Author** – Yenni Syafitri, Postgraduate Students of the Faculty of Public Health, Universitas Indonesia, yennisya1806@gmail.com.

**Second Author** – Sudijanto Kamso, Professor of the Faculty of Public Health, Universitas Indonesia,sudijanto.kamso@yahoo.com .

**Correspondence Author** –Yenni Syafitri, yennisya1806@gmail.com, yenni.syafitri71@ui.ac.id,+62878-3989-4930.