

Ecological Analysis of Stroke in Indonesia in 2018

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Abstract

Stroke is one of the significant causes of disability and death worldwide and is classified as a catastrophic disease in Indonesia. The study aims to analyze ecologically the factors related to the prevalence of stroke in Indonesia. The authors conduct a research using secondary data from the 2018 Indonesia Basic Health Survey that used all the provinces as samples. Apart from the prevalence of stroke, four other variables analyzed as independent variables were diabetes mellitus, the prevalence of hypertension, the prevalence of obesity, and the percentage of the population with alcohol consumption in the past month. Data were analyzed using a scatter plot. The study results found that the higher the prevalence of diabetes mellitus, hypertension, and obesity in a province, the higher the prevalence of stroke. However, the higher the population percentage with alcohol consumption, the lower the prevalence of stroke in that province. The three variables, which are the prevalence of diabetes mellitus, hypertension, and obesity, were positively related to the prevalence of stroke in Indonesia. The population percentage with alcohol consumption was negatively associated with the majority of stroke in Indonesia.

Keywords: *ecological analysis, degenerative disease, health behavior, stroke, secondary data.*

Introduction

Stroke is defined as a neurological deficit attributed to an acute focal injury of the central nervous system (CNS) by a vascular cause, including cerebral, spinal, and retinal infarction, intracerebral hemorrhage (ICH), and subarachnoid hemorrhage (SAH). It is a major cause of disability and death worldwide^{1,2}. Stroke was among the top 18 diseases contributing to years lived with disability (YLDs) in 2010, and it requires the survivors to adapt and need other people's continuous support to survive^{3,4}. Common complications after stroke include both short-term complications, such as seizures, DVT, PE, urinary infection, aspiration pneumonia, decubitus ulcers, and constipation, as well as chronic sequelae including pain syndromes, pseudobulbar affect, depression and anxiety, cognitive impairment and dementia, epilepsy, gait instability, and falls and fractures⁵.

Based on GBD 2016 result, the global prevalence of ischemic stroke was 67.6 million, which was high in countries of Eastern Europe, Central Asia, and East Asia, and that of hemorrhagic stroke was 15.3 million, which was the highest prevalence rates found in countries of Eastern Europe, Central Asia, and East Asia⁶. Moreover, 63% of ischemic strokes and 80% of hemorrhagic strokes occurred in low and middle-income countries⁷.

The prevalence of stroke in Indonesia is 10.9%, which means as many as 10.9 per 1,000 Indonesians have a stroke, with the highest prevalence in East Kalimantan Province (14.7%) and the lowest in Papua Province (4.1%)⁸. Stroke is classified as a catastrophic disease because it has a broad economic and social impact. According to BPJS Kesehatan (Healthcare and Social Security Agency) data in 2016, health services of stroke cost 1.43 trillion IDR, increased to 2.18 trillion Rupiah in 2017, and reached 2.56 trillion IDR in 2018⁹.

By analyzing data from the 2013 GBD Study, it can be concluded that more than 90% of the stroke risk could be attributed to modifiable risk factors, such as

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HBP, obesity, hyperglycemia, hyperlipidemia, and renal dysfunction, and 74% could be attributed to behavioral risk factors, such as smoking, sedentary lifestyle, and an unhealthy diet¹⁰. However, stroke knowledge is lowest for those living in communities with greater economic need and sociodemographic distress, and lower school performance¹¹. Based on this background, this study is needed to analyze ecologically the factors related to the prevalence of stroke in Indonesia; hence appropriate promotive, preventive, curative, and rehabilitative efforts could be implemented.

Material and Methods

The authors designed the study using an ecological analysis approach. Ecological studies focus on comparisons between groups, not individuals. The analyzed data is aggregate data at a particular group or level, which in this study is the provincial level. The purpose of the ecological analysis in epidemiology is to make biological inferences about individual risk effects or make ecological inferences about the impact on groups. Its variables can be aggregated measurements, environmental measurements, or global measurements^{12,13}.

The authors conduct the study using secondary data from the 2018 Indonesia Basic Health Survey report issued officially by the Ministry of Health of the Republic of Indonesia. The unit of analysis in this study

is the province. The study analyzed all provinces in Indonesia as a sample (34 provinces).

The dependent variable in this study was the prevalence of stroke. Stroke was recorded based on the doctor's diagnosis history. There were four independent variables analyzed in this study: prevalence of diabetes mellitus, prevalence of hypertension, prevalence of obesity, and the percentage of the population with alcohol consumption in the past month.

Data were analyzed bivariate using a scatter plot. The study used the linear fit line to determine the tendency of the relationship between the prevalence of stroke and the independent variables. The research carried analysis in this with SPSS 26 software.

Results and Discussion

Table 1 presents descriptive statistics of the prevalence of stroke and other variables analyzed in this study. The information presented informs that the lowest prevalence is 4.1%, while the highest prevalence is 14.7%. The range of prevalence of stroke among provinces in Indonesia are relatively narrow, which is 10.6%. The number is quite similar to the prevalence range of hypertension and the population with alcohol consumption. Meanwhile, the prevalence range of diabetes mellitus has the smallest number, and the percentage range of obesity has the biggest one.

Table 1. Descriptive Statistics of Prevalence of Stroke and Related Variables by Province in Indonesia, 2018

Descriptive Statistics	Prevalence of Stroke	Prevalence of Diabetes Mellitus	Prevalence of hypertension	Percentage of obesity	Percentage of Population with Alcohol Consumption in the Past Month
N	34	34	34	34	34
Mean	10.08	1.38	8.18	21.70	3.58
Median	10.50	1.30	8.25	21.05	3.10
Mode	8.30	1.30	-	24.40	1.70
Std. Deviation	2.71	0.50	1.88	4.28	2.26
Range	10.60	2.00	8.82	19.90	8.40
Minimum	4.10	0.60	4.39	10.30	0.40
Maximum	14.70	2.60	13.21	30.20	8.80

Source: The 2018 Indonesia Basic Health Survey

Figure 1 is a scatter plot of the prevalence of stroke and diabetes mellitus by the province in Indonesia. It can be seen that the relationship between the two variables shows a positive trend. The result means that the higher the prevalence of stroke in a province, the higher the prevalence of diabetes mellitus.

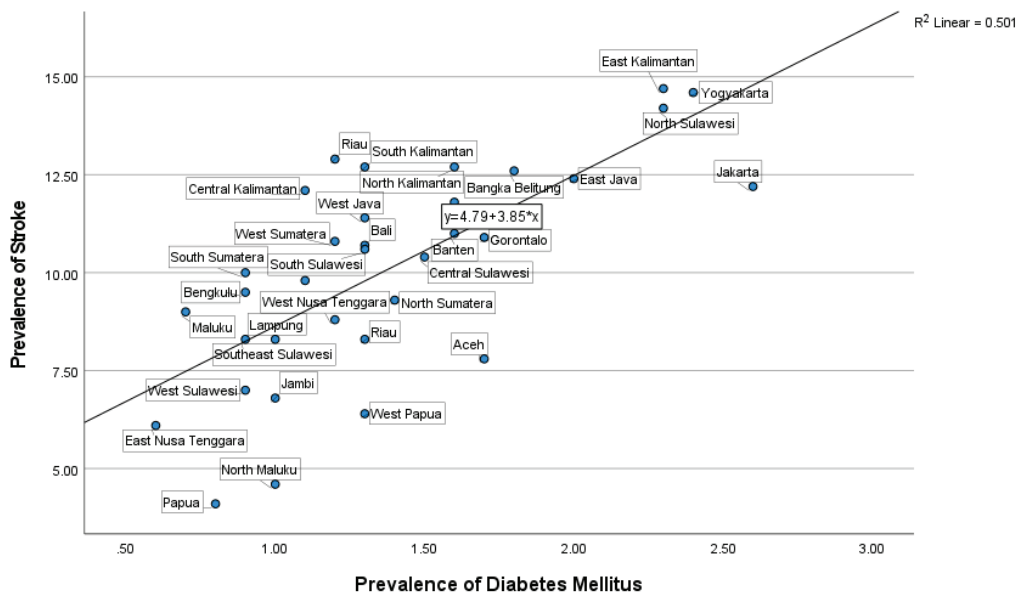


Figure 1. Scatter Plot of Prevalence of Stroke and Prevalence of Diabetes Mellitus by Province in Indonesia, 2018

Source: The 2018 Indonesia Basic Health Survey

The scatter plot of the prevalence of the population with stroke and the prevalence of hypertension by the province in Indonesia can be seen in Figure 2. The result of the scatter plot indicates that the two variables tend to have a positive relationship. The result means that the higher the prevalence of the population with stroke in a province, the higher the prevalence of hypertension in that province.

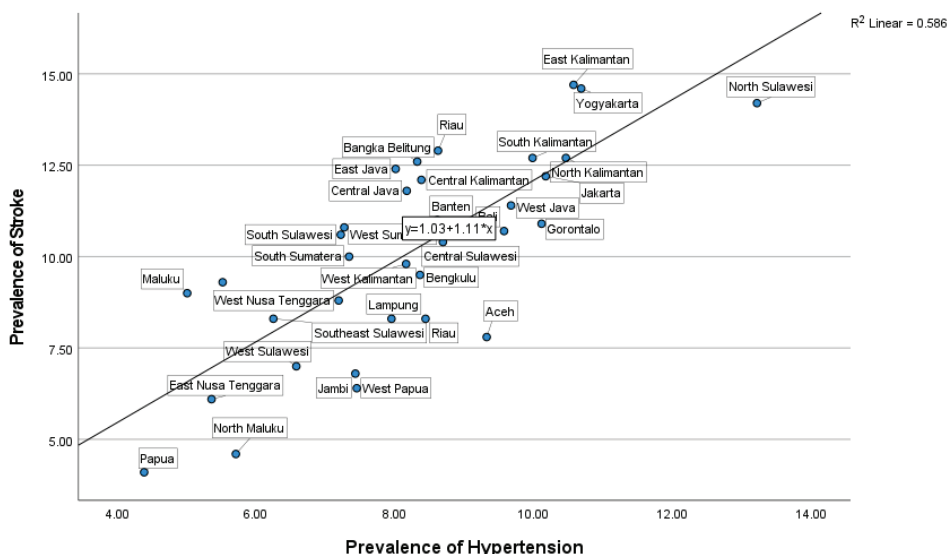


Figure 2. Scatter Plot of Prevalence of Stroke and Prevalence of Hypertension by Province in Indonesia, 2018

Source: The 2018 Indonesia Basic Health Survey

Moreover, Figure 3 is the scatter plot of the prevalence of stroke and obesity by the province in Indonesia. Based on the scatter plot result, we show the relationship between the two variables shows a positive trend. The work means that the higher the prevalence of stroke in a province, the higher the prevalence of obesity.

However, Figure 4 shows the scatter plot of the prevalence of stroke, and the percentage of population with alcohol in the past month shows a negative trend. It means the higher the prevalence of stroke in a province, the lower the population percentage with alcohol.

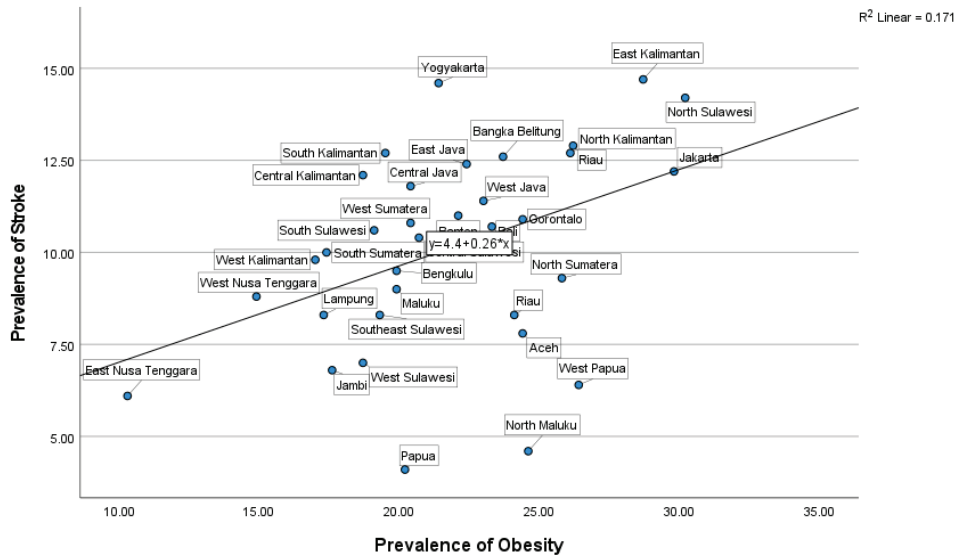


Figure 3. Scatter Plot of Prevalence of Stroke and Prevalence of Obesity by Province in Indonesia, 2018

Source: The 2018 Indonesia Basic Health Survey

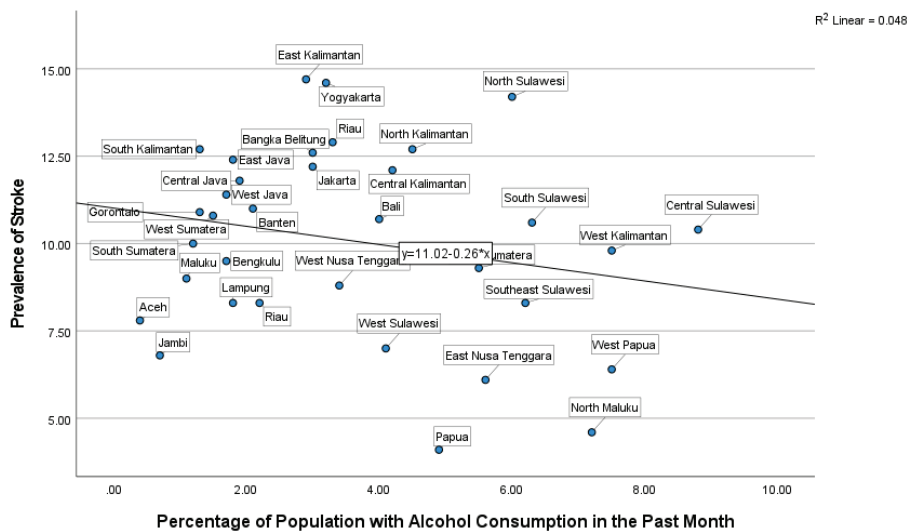


Figure 4. Scatter Plot of Prevalence of Stroke and Percentage of Population with Alcohol Consumption in the Past Month by Province in Indonesia, 2018

Source: The 2018 Indonesia Basic Health Survey

Based on the scatter plot presented above, the ecological analysis results of stroke in Indonesia are in line with global research, which states that diabetes mellitus, hypertension, and obesity are risk factors for stroke. These three variables show a positive trend in each province; therefore, if the prevalence of diabetes mellitus, hypertension, and obesity in a province is high, then the prevalence of stroke in that province is high.

Diabetes is a well-known risk factor for stroke, affecting up to two-thirds of patients with acute stroke^{14,15}. Patients with diabetes mellitus were more likely to have a stroke, about four times higher than those without diabetes^{16,17}. Stroke patients with diabetes mellitus have higher morbidity and mortality¹⁵⁻¹⁷. Meanwhile, according to American Heart Association, blood pressure is the robust determinant of risk for stroke. Therefore, blood pressure control is essential as hypertension is independently associated with a higher risk of stroke¹⁷. Controlling hypertension by significantly lowering blood pressure was associated with a significant reduction, around 44%, in stroke^{5,16,18}. Several studies also report obesity to increase stroke risk, especially ischemic stroke, in younger individuals in various race-ethnic groups^{16,19,20}. We suggest weight-loss as a primary strategy to prevent obesity, thus preventing stroke occurrence as well^{21,22}.

While the other three variables show a positive trend, a negative trend result is found in the scatter plot between stroke prevalence and the percentage of the population with alcohol consumption in the past month. This result is acceptable since the relationship between alcohol intake and stroke remains debatable. A genetic study in China population was conducted to assess the relationship between alcohol intake and cardiovascular disease. It shows that alcohol intake, around 280 g per week, increases blood pressure by five mmHg, 15% in ischaemic stroke, and 30% in intracerebral haemorrhage²³. UK Stroke Association also recommends people not to drink too much since excessive alcoholic drinks have high calories, thus creating obesity problems, can trigger atrial fibrillation which linked to an increased risk of stroke, and can damage the liver important in the process of blood clotting²⁴.

Other arguments suggest that different doses of alcohol consumption might have a different effect on a different stroke type. There was a decreased risk of ischaemic stroke observed in people with moderate alcohol consumption²⁵⁻²⁸. However, heavy drinking was associated with an increased risk of hemorrhagic stroke^{25,28-30}. Perhaps because of the antithrombotic effects of alcohol or different mechanisms, this different phenomenon underlie associations with the different stroke types^{29,31}. To better explain the result observed in Figure 4, other factors such as age and personal habit need to be considered. There is an opinion stated that alcohol consumption might be an age-varying risk factor for stroke³².

Indonesia's Government should control associated risk factors of stroke such as diabetes mellitus, hypertension, and obesity as effective methods to prevent stroke, mainly in the provinces with a high prevalence of stroke. Moreover, further research is needed to elucidate the actual relationship between stroke and alcohol consumption in Indonesia by considering other possible factors to implement proper programs.

Conclusions

Based on the results of the study, the authors concluded that the three independent variables analyzed ecologically were positively related to the prevalence of stroke in Indonesia. Those three variables are the prevalence of diabetes mellitus, hypertension, and obesity. Whereas one variable, which is the population percentage with alcohol consumption, was negatively related to the prevalence of stroke in Indonesia.

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Conflict of Interests: Nil

Ethical Clearance: The study conducted using secondary data from published reports. Ethical clearance is therefore not required in the conduct of this study.

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