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Stroke in Indonesia: An epidemiological overview

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ABSTRACT

Introduction: Stroke is a major cause of illness and death in Indonesia. Understanding its risk factors is essential for effective prevention. This study aimed to identify risk factors associated with stroke incidence in Indonesia.
Methods: This study utilized a literature review approach and analyzed data from national health surveys from year of 2007, 2013, and 2018 and data from Indonesian health profile from year of 2023. The stroke risk factors and sociodemographic variables were examined descriptively to identify regional trends and urban-rural disparities. Additionally, bivariate analysis was conducted using *Chi*-square test to assess relationships between stroke incidence and various risk factors.
Results: Stroke cases increased from 2007 to 2018 but decreased in 2023. In contrast, diabetes mellitus prevalence increased in 2023, suggesting no direct correlation with the observed decrease in stroke cases (p-value > 0.050).
Conclusion: The findings underscore the necessity of targeted public health interventions to decrease stroke incidence in Indonesia through early detection, lifestyle modifications, and enhanced awareness at both individual and community levels. The outcomes of this review offered a basis for subsequent public health research and strategies focused on decreasing the incidence of stroke in Indonesia.

Keywords: epidemiology, public health, risk factors, socioeconomic status, stroke.
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INTRODUCTION

Stroke is a neurological disorder affecting cerebral blood vessels and is a leading cause of disability worldwide.[1,2] It impacts approximately 13.7 million people and causes around 5.5 million deaths annually.[3] In developed countries such as the United States, stroke accounts for one in every 21 deaths equivalent to one death every 3 minutes and 17 seconds. Beyond its high mortality rate, stroke is also a major cause of long-term disability.[4]

Stroke, or cerebrovascular accident (CVA), is a leading cause of mortality and morbidity in Indonesia.[5] Compared to other Southeast Asian countries, Indonesia has the highest age- and sex-standardized mortality rate and the greatest loss of disability-adjusted life years.[6] Reducing stroke incidence is key to lowering stroke-related disability.[7]

Stroke pathophysiology involves disrupted cerebral blood flow, leading to oxygen and nutrient deprivation and resulting in neuronal damage.[8] This insufficiency is generally classified as either ischemic caused by arterial blockage from thrombi or emboli or hemorrhagic, due to intracranial bleeding. Ischemic stroke, the most common type, often stems from atherosclerosis or thromboembolism.[9] Hemorrhagic stroke, though less frequent, has a higher mortality rate and is typically associated with hypertension or aneurysm rupture. Post-stroke neurological deficits vary depending on the affected brain region and may include impairments in motor function, sensation, language, cognition, and emotional regulation.[10]

Stroke results from non-traumatic cerebral circulation problems that impair nerve function, leading to motor, sensory, and cognitive deficits.[11] Vascular insufficiency to the brain, commonly caused by thrombus, emboli, or hemorrhage, underlies this neurological event.[12] Modifiable risk factors such as diabetes, high blood pressure, and cardiac disorders can predispose individuals to stroke, suggesting that reducing these factors can lower its incidence.[13,14] Therefore, this study aimed to investigate the correlation between the prevalence of specific risk factors in Indonesia to effectively prevent the incidence of stroke.

METHODS

This study employed a literature review methodology to examine sociodemographic conditions and stroke risk factors across Indonesia's regions. Data were obtained from the Indonesian Ministry of Health's national health survey (NHS) reports year of 2007, 2013, and 2018 and the Indonesian health profile (IHP) report 2023. The study involved accessing publicly available reports containing information on the prevalence of key stroke risk factors (hypertension, diabetes mellitus, smoking, obesity, and physical inactivity) and sociodemographic data (age, gender, education level, socioeconomic status, and regional distribution).

The collected data were analyzed descriptively to identify trends in stroke risk factors and sociodemographic characteristics of stroke patients across

Indonesia's regions. This analysis aimed to understand patterns and correlations between risk factors and demographic characteristics in urban and rural areas. Regional variations in stroke risk factors and sociodemographic conditions were compared to highlight disparities between urban and rural areas with differing healthcare access. Based on this analysis, the findings were synthesized to provide an overview of the main stroke risk factors and the impact of sociodemographic characteristics on stroke incidence in Indonesia. Bivariate testing was also employed using *Spearman* correalation test to examine the relationships between stroke incidence and various risk factors. This study was approved by the Health Research Ethics Committee of the Faculty of Medicine, Universitas Negeri Semarang, Indonesia (Registration No. 20/KEPK-RSB/III/25).

RESULTS

Analysis of NHS and IHP data revealed that a rise in stroke incidence between 2007 and 2018, but a slightly decrease in 2023.[15-18] Trends in stroke incidence and associated risk factors like diabetes, hypertension, and heart disorders are summarized in Table 1. Stroke occurrence was also influenced by sociodemographic factors including education level, age, place of residence, and gender.

Figure 1 indicates that hypertension as the dominant risk factor compared to diabetes mellitus and heart disease. However, the trends in stroke incidence did not consistently correlate with fluctuations in these risk factors. Furthermore, a bivariate correlation test revealed no significant relationship (p-values > 0.050) between stroke incidence and hypertension, diabetes mellitus, or heart disease. However, multivariate analysis indicated a significant correlation (p-value < 0.050).

Figure 2 shows a higher prevalence of stroke among individuals with no formal education, a trend that increased from 2007 to 2018 before declining in 2023. Based on the 2023 NHS, stroke prevalence among individuals aged ≥15 years was 8.3 per 1,000 population. Assuming an average post-stroke survival of 10 years, the estimated incidence is approximately 0.83 per 1,000 person-years, or 83 new cases per 100,000 person-years. Throughout this period, the order of prevalence remained consistent: the highest stroke incidence was observed in those with no schooling, and the lowest in

Table 1. The incidence of stroke based on social-demographic condition in 2007, 2013, 2018, and 2023

Data Type	2007	2013	2018	2023
Stroke	6.0	7.0	10.9	8.2
Hypertension Medical Diagnosis	7.2	9.4	8.4	8.0
Diabetes mellitus	0.7	1.5	1.5	1.7
Heart Disease	0.9	0.5	1.5	0.9
Stroke Rates Based on Age				
15-24	1.1	0.2	0.6	0.1
25-34	1.6	0.6	1.4	0.5
35-44	2.9	2.5	3.7	2.0
45-54	8.1	10.4	14.2	8.9
55-64	15.5	24.0	32.4	23.6
65-74	25.0	33.2	45.3	35.4
75+	29.7	43.1	50.2	41.3
Stroke Rates by Gender				
Male	6.1	7.1	11.0	8.8
Female	5.8	6.8	10.9	7.9
Stroke Rates Based on Education Level				
Not/never attended school	11.9	16.5	21.2	14.3
Did not graduate from elementary school	8.2	12.0	18.6	13.1
Graduated from elementary school	5.9	7.8	13.2	11.7
Graduated from junior high school/Islamic	3.7	4.0	6.8	5.1
Graduated from high school/vocational school	3.9	4.0	7.4	5.7
Graduated from D1/D2/D3/College/University	6.2	7.6	9.1	9.1
Stroke Based on Residence				
Rural	5.4	5.7	12.6	9.7
Urban	6.9	8.2	8.8	6.4

Note: The prevalence of stroke is expressed per 1,000 population, while the estimated incidence is presented per 100,000 person-years.

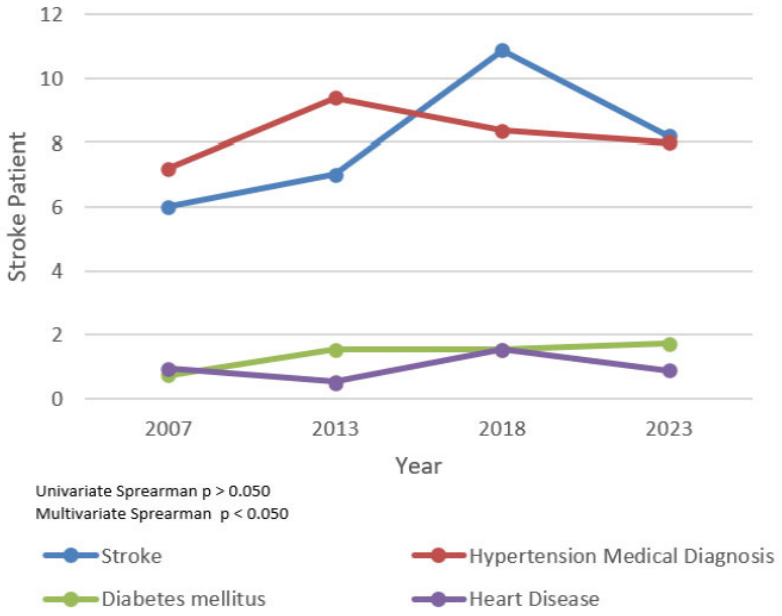

Figure 1. The trend of stroke, hypertension, diabetes, and heart disease incidences in year of 2007, 2013, 2018, and 2023.

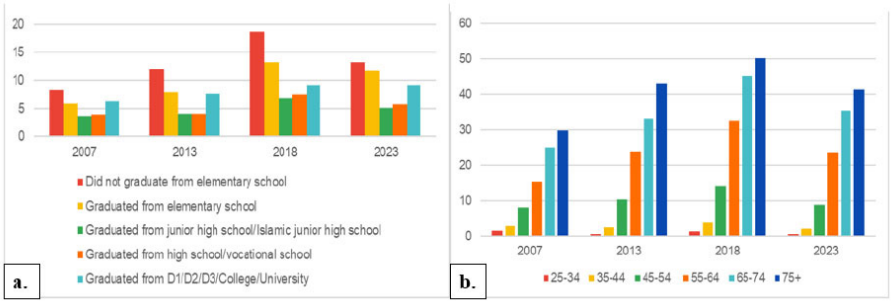

Figure 2. a. Stroke rates based on education level; b. stroke rates based on age.

those who completed junior high school. Overall stroke incidence increased from 2007 to 2018 and then decreased in 2023. The 75 and older age group experienced the highest stroke incidence, while the 25-34 age group had the lowest.

DISCUSSION

Age and education level were the risk factors of stroke. Data showed that individuals aged 75 and older were the most affected, aligning with existing literature that explained age as stroke risk factor possibly due to declining vascular health, multiple comorbidities, hypertension, and diabetes.[19] The low incidence of stroke among individuals aged 25 to 34 suggested they possibly had lower prevalence of risk factors such as hypertension and diabetes. Benefit as young age group was not permanent, but increasing awareness of stroke risks and symptoms essential for early intervention.[20]

The consistent pattern in stroke prevalence underscores a troubling link between low educational attainment and increased stroke risk.[13] Individuals with no formal education exhibit the highest incidence, likely due to limited health literacy, reduced awareness of risk factors, and poorer access to healthcare.[21] This group may also be more prone to unhealthy lifestyles and chronic conditions that elevate stroke risk.[22]

Previous research indicated that education significantly influences various aspects of life.[23] For stroke patients, lower education levels might exacerbate the consequences of established risk factors and increase the risk of recurrent stroke and mortality, especially following ischemic stroke in cardiovascular cases.[24] Data also suggested a higher stroke prevalence among individuals with no formal education, potentially due to limited health literacy regarding lifestyle management (e.g., blood pressure control, smoking cessation, healthy body weight).[25]

Bivariate analysis showed no significant correlation between stroke incidence and individual common risk factors (diabetes, hypertension, heart disease). However, multivariate analysis revealed a significant correlation, suggesting that while single factors may not be strongly associated with stroke in isolation, their combined effect, considering interactions with other variables, does contribute to increased risk. This results highlighted the importance of a comprehensive assessment for stroke condition. For example, education level improvement could foster behavior changes and decreased the risk for the stroke occurance.[26,27] Moreover, individual with high knowledge usually recognized the importance of a healthy lifestyle and tended to prevent the stroke risk factors.[28] Increasing awareness of people using proper education of stroke risk factors, such as healthy diet, physical activity, and avoiding smoking might encourage a lifestyle changes and healthier behaviors.[29]

Educational determinants significantly influenced stroke prevalence.[30] Enhancing health literacy, especially among lower-educated individuals, might be achieved through an health education system of integrated health posts (IHP or *Posbindu*). The IHP involved community participation in the early detection and management of non-communicable disease risk factors, which were strongly associated to the incidence of stroke.[31] IHP remains a potentially effective stroke prevention strategy. Community leader influence and public champain are crucial to promote the importance of IHP and it can foster community engagement in proactive health lifestyles.[32]

The limitations of this study was its reliance on secondary national health survey data, which might lack comprehensive variables or reflect recent changes in stroke risk factors and sociodemographic conditions. Furthermore, the descriptive and bivariate analyses did not establish causality and potential reporting biases or inconsistencies across respondents during. survey years might affect findings accuracy. Future research should utilize primary data collection for comprehensive information on stroke risk factors and sociodemographic variables. Additionally, employing longitudinal and multivariate analyses could establish causal relationships and clarify the dynamic effects between stroke risk factors in diverse populations.

CONCLUSION

Based on study's results, the incidence of stroke was increase from 2007 to 2018, although was slightly decrease in 2023. While age-related risk for stroke is inevitable, the low education level is preventable risk factor by using a public health interventions, such as providing education of healthy lifestyle through IHP and public campaign.

ETHICAL CONSIDERATION

This research received ethical approval from the Health Research Ethics Committee, Faculty of Medicine, Universitas Negeri Semarang, Indonesia (Registration number: 20/KEPK-RSB/III/25).

CONFLICT INTEREST

The authors declare that there is no competing interest regarding the publication of this research.

AUTHORS' CONTRIBUTIONS

GLA contributed to the conception and design of the study, data collection, and drafted the manuscript. WHC was involved in data analysis and interpretation, as well as critical revision of the manuscript for important intellectual content. IZ and IB

assisted in literature review, preparation of data presentation, and administrative support throughout the research process.

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