JOURNAL OF WORLD SCIENCE
https://jws.rivierapublishing.id/index.php/jws
Volume 2 No. 2 February 2023
P-ISSN: 2828-8726
E-ISSN: 2828-9307

EFFECTIVENESS TEST OF STROKE RISK DETECTION APPLICATION MODEL STROKE RISK SCORECARD

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ABSTRACT
Stroke is a disease caused by impaired blood circulation to the brain. This disease is a non-communicable disease that can be prevented by controlling stroke risk factors. STRIC (Stroke Risk Score Card) is a stroke risk detection application resulting from the development of a stroke risk detection model by the National Stroke Association. This study aims to determine the sensitivity, specificity, and accuracy of the application of the early stroke risk detection model (STRIC) in detecting stroke risk. Descriptive analytics by conducting stroke risk assessment using the Stroke Risk Scorecard (STRIC) App. The total sample was 60 people, consisting of 30 post-stroke people and 30 non-stroke people. The sensitivity value of the STRIC application is 91.67% which means that the ability to predict stroke risk for those who have experienced a stroke is very high. The specificity value of the STRIC application was 77.78%; this means that the measurement capability of the STRIC application provides a non-stroke (negative) result of 77.78% or very good. The accuracy value of the STRIC application is 83.33%, which means that the ability of the STRIC application to detect the risk of stroke in all subjects tested correctly is 83.33%. Applying the STRIC application can help prevent stroke and improve the prognosis for high-risk individuals.

Keywords: stric, stroke risk scorecard, stroke risk factors, test sensitivity, specificity, accuracy.

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INTRODUCTION

A stroke is a collection of symptoms where brain damage occurs due to reduced blood supply to parts of the brain (Nuraini, 2015). Stroke is a neurological disease caused by blood vessel disorders in the brain, causing characteristic symptoms (Birawa & Amalia, 2015). According to the American Heart Association, stroke is an attack of hidden infarction and bleeding in the brain, spinal, and retina (Coupland, 2017). Based on the 2020 WHO report, stroke mortality ranks second worldwide after cardiovascular disease and the second cause of disability-adjusted for years of life (UGIA MAY HUDATAMA, 2020). In the United States in 2019 stroke is the third leading cause of death in the world (Yaslina et al., 2019). Stroke cases worldwide are estimated to reach 50 million people, and 9 million experience severe disabilities (Marbun et al., 2016). Based on the 2018 Riskesdas of the Ministry of Health, the incidence of stroke is 10.9%, and every year, as many as 713,783 people experience a stroke (Mongkau et al., 2022).

Someone who has a stroke can result in loss of independence, work, and hopelessness resulting in decreased productivity and quality of life for sufferers (Ananda & Darliana, 2017). This situation can be prevented early by identifying and controlling stroke risk factors. Many factors cause

stroke, including age, gender, hypertension, atrial febrile, diabetes mellitus, cholesterol, obesity, activity, smoking, and family history of stroke (Wayunah & Saefulloh, 2017). To identify and control stroke risk factors, the National Stroke Association (NSA) issued a stroke risk detection model, namely the Stroke Risk Scorecard, which contains eight stroke risk factors and is grouped into three categories, namely high risk, caution, and low risk. Each risk factor is categorized according to the value of the risk factor criteria, and the results are determined based on how many risk factors are in the high-risk, caution, and low-risk groups.

Figure 1. Stroke Risk Scorecard and Risk Scorecard Result

A diagnostic test is carried out to predict whether these risk factors are appropriate, namely a method (tool) to determine whether a person is at high risk of stroke or not based on the presence of signs and symptoms in that person. Diagnostic tests use a screening test, which is a way to determine whether a person is at risk of suffering from a disease or not (Arif, 2017). Without screening, the diagnosis of a disease can only be enforced after signs and symptoms appear, even though a disease has existed long before signs and symptoms appear, which can be known if we do a screening. Screening tests include validation tests and sensitivity and specificity tests. Test validity is the test's ability to correctly (accurately) which individuals are sick and which are not (Siswosudarmo, 2017). The sensitivity and specificity reflect the validity of the test. Sensitivity is the test's ability to show which individuals are sick from the entire population who are sick (Istiqomah et al., 2021). Specificity is the test's ability to show which individuals are not sick from those who are not (Nusahi, 2018).

The NSA stroke risk detection model has been tested for sensitivity, specificity, and accuracy on 231 respondents consisting of 81 post-stroke people and 150 nonstroke people; the results obtained were 74% sensitivity, 76% specificity, and 76% accuracy. It is felt that the sensitivity, specificity, and accuracy of the NSA stroke detection model still need to be optimized so that further development is needed to obtain a more practical value. Development of the NSA stroke risk detection model by adding two stroke risk factors, namely age, and gender, and giving weight to each risk factor. The weight of each stroke risk factor is determined based on the study's results and

then totaled the total score. The total score ranges from 10 to 51 and then determines low risk if the score is less than 20, the moderate risk is 20-29, and the high risk is 30 or more. The result of the next development is an Android-based application called STRIC (Stroke Risk Score Card). A study published in 2021 in the journal Stroke and Vascular Neurology evaluated the effectiveness of STRIC applications in the Chinese population. The study found that STRIC had an accuracy rate of 0.746 in predicting stroke risk in 5 years in the studied population. In addition, it shows that STRIC has a good ability to distinguish between stroke and non-stroke groupsBased on the above background (Chen et al., 2022). So, the purpose of this study is to ascertain whether the STRIC application model is effectively used to detect high risk and requires testing for effectiveness and accuracy by conducting trials in stroke and non-stroke groups.

METHODS

This type of research was descriptive-analytic and was carried out in two different places, namely in the post-stroke group conducted at the Jakarta Brain Center Hospital and the Jakarta I Ministry of Health Polytechnic for the non-stroke group. The number of samples was determined as many as 60 people, divided into 30 samples from the post-stroke group and 30 from the non-stroke group. The method of sampling in the stroke group was carried out using the accidental sampling method; namely post, stroke patients who came to the RSPON outpatient care were sampled until the number of samples was fulfilled, and in the non-stroke group, sampling was carried out randomly. Using the STRIC application on Android, respondents were asked to fill in data, and the results of the respondent's stroke risk will automatically be known whether they are at low, medium, or high risk.

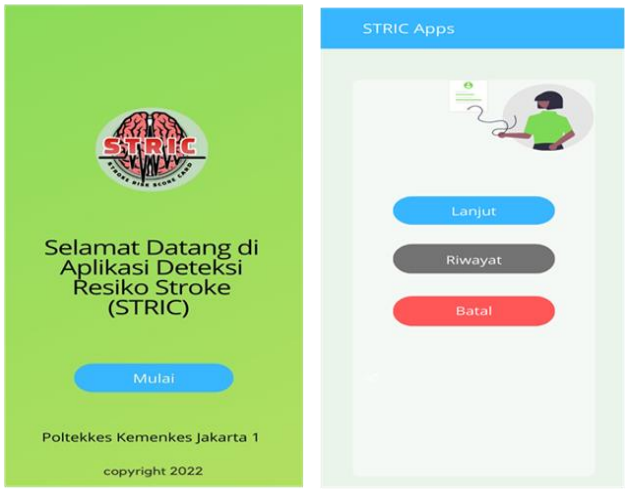

Figure 2. STRIC application

The data obtained is then tested for sensitivity, specificity, and accuracy with the following formula:

Sensitivity $= \frac{a}{a+c}$

Sensitivity $= \frac{d}{b+d}$

Sensitivity $= \frac{a+d}{a+b+c+d}$

Information:
a = true positives
b = false positives
c = false negatives
d = true negatives

RESULTS AND DISCUSSION

Characteristics of Respondents

Based on the gender and age of the respondents can be seen in table 1 below.

Table 1. Frequency distribution of respondent characteristics based on gender and age in the post-stroke and non-stroke groups in 2022

Characteristics	n	Post Strokes		Non-Strokes	
		n	%	n	%
Age					
≤ 59 years	36	10	33,3	26	86.7
≥ 59	24	20	66,7	4	13,3
Gender					
Woman	32	13	43,3	19	63,3
Man	28	17	56,7	11	36,7
Amount	**60**	**30**	**100**	**30**	**100**

The respondents can be seen in table 2 below based on the risk factors for stroke.

Table 2. Frequency Distribution of Respondents' Characteristics Based on Blood Pressure, Heart Rate, Body Weight, Cholesterol and Blood Sugar, Sports Activities, Respondents' Family History, 2022

Characteristics	n	Post-Strokes		Non-Strokes	
		n	%	n	%
Blood pressure					
< 140/90 mm Hg	30	6	20	24	80
>= 140/90mmHg	30	24	80	6	20
Heart rate					
Regular heart rate	52	24	80	28	93,3
Irregular heartbeat	8	6	20	2	6,7
Smoke					
Do not smoke	34	17	56,7	27	90
Smoke	26	13	43,3	3	10
Cholesterol					
<200	38	16	53,3	22	73,3
>=200	22	14	46,7	8	27,7
Blood sugar					
<101	30	9	30	21	70
101-199	24	17	56,7	7	23,3
>= 200	6	4	13,3	2	6,7
Weight Status					
ideal BB	29	16	53,3	13	43,3
Overweight and obesity	31	14	46,7	17	56,7
Sports Activity					
Routine	12	2	6,7	10	33,3

Characteristics	n	Post-Strokes		Non-Strokes	
		n	%	n	%
Rarely or never	48	28	93,3	20	66,7
Family History of Stroke					
There are not any	38	12	40	26	86.7
There is	22	18	60	4	13,3
Amount	**60**	**30**	**100**	**30**	**100**

Respondents' characteristics were based on the risk of stroke in the post-stroke and non-stroke groups.

Table 3. Frequency Distribution of Respondents Based on Stroke Risk Level, The year 2022

Variable	n	Post-Strokes		Non-Strokes	
		n	%	n	%
Stroke Risk Level					
Low	30	3	10	20	66,7
Currently	30	5	16,7	8	26,7
Tall	30	22	73,3	2	6,6
Amount	**60**	**30**	**100**	**30**	**100**

STRIC Application Effectiveness Assessment

Validation and accuracy test results, validation test, consist of sensitivity and specificity tests. Table 4 shows the validation and accuracy results.

Sensitivity $= \frac{a}{a+c}$

Sensitivity $= \frac{d}{b+d}$

Accuracy $= \frac{(a+d)}{(a+b+c+d)}$

PPV $= \frac{a}{(a+b)}$

NPV $= \frac{d}{(c+d)}$.

Table 4. Results of sensitivity, specificity, and accuracy tests on stroke and non-stroke post respondents in 2022

Variable	Results		Total
	High Risk	Low/Moderate Risk	
Stroke Post	22	8	30
Non-Strokes	2	28	30
	24	36	60

Sensitivity = 91.67 **Accuracy = 83.33** **NPV = 93.33**
Specificity = 77.78 **PPV = 73.33**

Results Explanation

The STRIC application is an application developed from previous research conducted by researchers. Unlike the NSA version of stroke risk detection, the application of STRIC in determining stroke risk is through the weight or score of each risk factor. The NSA version of stroke risk detection to determine the degree or level of stroke grouped into three parts, namely low risk, warning, and high risk, with each containing eight stroke risk factors, namely blood pressure, atrial fibrillation, smoking, cholesterol, diabetes mellitus, activity, obesity, and family risk of stroke. High-risk criteria if the high-risk section has more than or equal to 3 risk factors. Determination of warning if the risk factors in the warning section have warning risk factors as many as 4-6 risk factors and determining low risk if in the low-risk column if there are 6-8 risk factors.

In detecting stroke risk, the NSA version does not accommodate age and gender factors. The results showed that male sex factors were 1.4 times more than female. At the age of > 59 years, have four times more risk. Thus, the factors of age and gender become the factors that must be considered as part of the assessment of stroke risk factors. Even so, the issue of gender still has many differences in certain locations or countries. For example, the results of the analysis (Feigin et al., 2017) state that the lifetime risk of stroke is higher for women than men, with a 1 in 4 stroke risk for women after the age of 25; however, the incidence of stroke is higher in women than men for those <30 years, while the stroke risk rate is higher in men than women during midlife (Vyas et al., 2021). The age factor contributes to the occurrence of stroke; this is related to the presence of atheroma, which starts with damage to blood vessels with increasing age. The effect of gender on the incidence of stroke is influenced by the presence of the hormone estrogen, which protects blood vessels by inhibiting arteriosclerosis. Thus it is suspected that men have a higher risk of stroke (Nuraini, 2015).

Another problem in determining risk criteria is high risk if you have > three high-risk factors, warning risk if there are 4-6 risk factors, and low risk if you have 6-8 risk factors. There are eight risk factors in total, so if at high risk, there are two risk factors; moderate risk factors have three risks and low-risk factors have five factors. Thus, no one is included in that category. Thus, it is necessary to develop a more valid stroke risk detection model with high effectiveness and validity.

Sensitivity, specificity, and accuracy tests were carried out to determine the ability of the STRIC application to detect stroke risk. The sensitivity value of the STRIC application is 91.67%, which means that the ability to predict stroke risk for those who have had a stroke is very high. The specificity value of the STRIC application is 77.78%; this means that the ability to measure the STRIC application to provide non-stroke (negative) results is 77.78% or very good. The STRIC application is very valid for measuring stroke risk from these two measurements. A test's validity shows a test's ability (accuracy) to get a value that matches the actual reality. In the world of health, reality is divided into 2, sick and not sick. So that the assessment of validity includes two aspects: the accuracy of assessing diseased conditions is called sensitivity, and the accuracy of assessing non-painful conditions is called specificity. In other words, sensitivity is the ability of a test to state positively about those who are sick, while specificity is the ability of a test to state negatively about those who are not sick (Putra et al., 2016). Thus, the validity of the STRIC application can assess the positive condition of a stroke for those who have a stroke and can say no stroke for those who do not have a stroke

The accuracy value of the STRIC application is 83.33%, which means that the ability of the STRIC application to detect the risk of stroke for all subjects tested correctly is 83.33%. A stroke risk

detection tool requires a high level of sensitivity to guarantee that the tool is used and strengthens the suspicion that there is a stroke risk for subjects who have had a stroke. The sensitivity, specificity, and accuracy values obtained in the STRIC application show that this application is very effective in detecting the risk of stroke.

CONCLUSION

The application of STRIC stroke risk resulted in a sensitivity value of 91.67%, specificity of 77.78%, and accuracy of 83.33%. Thus, the benefit of this good sensitivity is being able to identify individuals with high risk precisely and accurately, so that appropriate and effective precautions can be provided. Thus, applying STRIC can help prevent stroke and improve the prognosis for high-risk individuals. However, STRIC sensitivity is not absolute and there can still be cases that go undetected as high-risk even though they have certain risk factors. Therefore, it is necessary to conduct periodic evaluations and seek additional information related to risk factors in individuals who are not detected by STRIC to ensure that all high-risk individuals have been correctly identified.

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