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Blood Glucose and Systolic Blood Pressure as predictors of Hospital Length of Stay in Patients with Coronary Heart Disease

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Introduction: According to WHO, coronary heart disease (CHD) is the leading caused of death. Blood glucose and systolic blood pressure were essential indicators for an effective prognosis. The purpose of the study was to determine the relationship between blood glucose levels and systolic blood pressure on the length of stay of CHD patients at Nganjuk Hospital in 2021. **Method:** This study uses a quantitative approach with a retrospective survey method. The research has been carried out in the emergency department and intensive care unit room at Nganjuk Hospital by taking medical record data. The population of this study was all coronary heart disease patients from Juli until December 2021. The sample size was 164 respondents selected using a simple random sampling technique. The independent variables were systolic blood pressure (X1) and blood glucose levels (X2), while the dependent variable was the length of stay (LOS) in CHD patients (Y). Data analysis using multiple linear regression. **Results and Discussions:** The multivariate analysis results with linear regression showed a relationship between blood glucose levels (p-value: 0,00) and systolic blood pressure (p-value: 0,00) with the length of stay of CHD patients at Nganjuk Hospital in 2021. **Conclusions:** Patients with CHD can used blood glucose level and systolic blood pressure as predictor of LOS.

Keywords: *Blood Glucose, Coronary Heart Disease, Length of Stay*, *Systolic Blood Pressure*

Introduction

Non-communicable diseases are the number one cause of death worldwide every year. Heart disease contributes a lot in both high and low-income countries. All deaths caused by cardiovascular disease, which occupies the first place, are coronary heart disease. Therefore coronary heart disease is the leading cause of death in the world and Indonesia

Data of the World Health Organization (WHO), from 1999 to 2020 in developing countries, the mortality rate due to coronary heart disease is predicted to increase by 137% in men and 120% in women (1). The incidence of coronary heart disease in Indonesia is estimated at 15 out of 1,000 Indonesians who have suffered from coronary heart disease, and coronary heart disease can cause the death of approximately 510,840 people. Patients with coronary heart disease on the island of Java, more precisely, East Java, ranked 15th in Indonesia in 2018, with a total of 1.6% of people (2).

The LOS in hospital is a crucial performance measuring and monitoring indicators, according to WHO. Longer than necessary LOS in the ICU can results in the use of resources, staff time, and medical equipment (3). The increase in LOS from the medical aspect is considered a form of poor quality medical performance because patients have to be treated longer. In contrast, from the economic part for patients, it will increase the cost of care to be paid (4).

Length of stay is the period of stay of a patient in the hospital calculated from the time the patient enters the hospital and leaves the hospital in a healthy condition and mortality, influenced by age, comorbidities, organ failure, nutritional deficiency, and severity. Length of stay in the hospital is an indicator that shows the quality and effectiveness of medical care in hospitals when the type of illness the patient suffers is considered for the length of therapy (5)

Hyperglycemia triggered by pain in patients with coronary heart disease (CHD) has received much attention regarding the role of blood glucose levels as a risk factor for death in coronary heart disease (CHD). Blood glucose levels are one of the factors that influence the incidence of the length of stay associated with poor clinical outcomes and an increased risk of death in hospitalized patients. The state of acute hyperglycemia is related to many effects that can exacerbate coronary heart disease (CHD) (6). Hyperglycemic stress will cause the release of cytokines, induce the formation of free radicals, changes in cardiovascular metabolism, and changes in coagulation and apoptosis of myocardial cells. High glucose was associated with the length of stay in hospitalization (7).

Blood pressure is vital in the length of stay in hospitalization in patients with coronary heart disease (CHD). A person's blood pressure is determined based on the average of two or more blood pressure test results. If the systolic or diastolic blood pressure is in a different classification category, then the blood pressure is determined based on the higher blood pressure (8)

Based on the description above, it has been explained that there are many cases of coronary heart disease, so the authors are interested in researching " *Blood Glucose* and Systolic Blood Pressure as predictors of Hospital Length of Stay in Patients with Coronary Heart Disease."

Methods

This kind of study use a retrospective survey research methodology. The design used in this study uses a quantitative analysis approach. The sample of this study was 164 patients with coronary heart disease treated in the Intensive Care Unit (ICU) of Nganjuk Hospital. The data taken is secondary data recorded in the medical records of Nganjuk Hospital using a simple random sampling technique with the criteria of patients entering the emergency room and being treated directly in the ICU room with a diagnosis of

coronary heart disease. The independent variables in this study were blood glucose levels and systolic blood pressure, and the dependent variable was the length of stay in the hospital. The study use multiple linear regression to analyze the data. This study was approved after an ethical review by Nganjuk Hospital with reference number 893/ 04/ 411. 701/2022.

Results and Discussion

Table.1 Characteristics of the respondents

Characteristics	n=164
Sex Categories, n (%)	
Male	86 (52.4)
Female	78 (47.6)
Age, n (%)	
Mature	35 (29.2)
Elderly	73 (44.5)
Old Elderly	52 (31.7)
Marital status, n (%)	
Married	157 (95.7)
Not married	1 (6)
Widow	4 (2.4)
Widower	2 (1.2)
Educational status, n (%)	
Primary school	80 (52.8)
Junior high school	32 (19.5)
High school	41 (25)
Bachelor	11 (6.7)
Job experience, n (%)	
Private Company	34 (20.7)
PNS (Government employees)	15 (9.2)
Farmer	39 (23.8)
Entrepreneur	13 (7.9)
Non-Job	63 (38.4)

Table 1 shows that most respondents were male, 52.4% of the sample population. In addition, the majority of respondents aged >were elderly (44.5%), married (95.7%), in primary school (52.8%), and non-job (38.4%).

Table. 2 Characteristics of variable in the study

Variable	Mean	Median	Mode	Min	Max	Std. Deviation
Blood glucose levels	204.22	187.50	234	100	447	84.942
Systolic blood pressure	164.22	154.00	130	100	289	39.427
Length of stay in hospital.	4.48	4.00	3	3	10	1.492

Table 2 shows that the mean blood glucose level was 204.22, the mean systolic blood pressure was 164.22, and the mean length of stay in the hospital was 4.48

Table 3 Effect of blood glucose levels and systolic blood pressure on patient length of stay in hospital

Variable (n=164)	β	p-value	R Square	Uji Anova	
				Uji F	Pvalue
Constant	0,232	0,571	0,505	82,183	0,000
Blood glucose levels	0,012	0,000			
Systolic blood pressure	0,012	0,000			

Source: multiple linear regression analysis

Based on the table above, from the T-test, we can get that blood sugar and systolic blood pressure influence the length of stay in the hospital (p-value 0.000)—multiple determination values of all independent variables with dependents. Using the table above as a guide, the R Square = 0.505 means a moderate correlation. Using the table above as a guide, the R Square = 0.505 means that blood glucose levels and systolic blood pressure can explain the length of patient care by 50.5 percent while the rest (49.5%) is defined by various other factors not studied. From the T-test, we can see that blood sugar and systolic blood pressure influence the length of stay in the hospital (p-value 0.000). In the simultaneous F test, based on the significant value of the ANOVA output, it was obtained 0.000 (<0.05) which means that blood sugar levels and systolic blood pressure simultaneously affect the duration of hospitalization of patients

Increased blood glucose levels will be a factor in the length of stay in the hospital for CHD patients because the patient will experience blood clots and narrowing of the blood vessels (9). As a result, the blood cannot flow normally, resulting in patients undergoing more extended treatment and possibly experiencing mortality and morbidity (10). Blood glucose was also an indicator related to mortality in patients with coronary heart disease (11) (12) (6). There is a strong relationship between blood glucose levels with the length of stay of CHD (13) (14). It follows research (14) which states that increased glucose levels will affect the duration of medication for heart patients. Patients with high blood glucose was associated with prolonged length of stay in hospital (9). It was related to the time of insulin action, which ranges from 18-24 hours. Still, the average work of insulin will depend on the physiological condition of the patient's body, so controlling blood glucose levels will help reduce the hospital stay and the length of treatment. Other

studies support that people with cardiovascular disease with a history of glucose levels will also affect the length of hospital stay. It suggests that elevated glucose levels significantly contribute to the higher length of hospital stay for patients with CHD and non-CHD (9) (15). High blood glucose requires more intensive treatment to monitor and normalize blood glucose again (13). Indicators that can predict the length of hospital stay in individuals with coronary heart disease include blood glucose levels.

There was a relationship between systolic blood pressure and the length of hospital stay (11)(5)(16). The continuous increase in systolic blood pressure causes damage to the arterial system slowly. Due to fatty deposits on the artery walls, these arteries stiffen, reducing the blood vessel lumen and resulting in CHD. In addition, the left ventricle's resistance to pumping blood increase with rising systemic blood pressure from hypertension, increasing the work load on the heart (17). According to the data obtained, the average value or mean is 164.22 mm/Hg. This value is included in the category of stage II hypertension.

An increase in systolic blood pressure will be one of the causes for patients to experience long days of stay in the hospital because of a long-term history of the disease. The increased pressure will cause heart disease, and damage to the heart occurs due to too high a vascular load due to an increased pulse rate for a long time. It shows that high systolic blood pressure is associated with the incidence of CHD, where respondents who suffer from it are 2,667 times more at risk of systolic blood pressure (18).

Other studies also argued that increased systolic blood pressure is a significant factor in patients with cardiovascular disease. Increased systolic blood pressure will cause an increase in peripheral blood pressure, thickening of blood vessels, and hypertrophy of the heart muscle, so systolic blood pressure will affect the duration of the disease (19). Systolic blood pressure was associated with length of stay (11) but there was also studied that showed no relationship systolic blood pressure with length of stay (20). Higher systolic blood pressure is associated with a shorter stay in the hospital because it may respond better to receiving treatment than low systolic blood pressure (11). Higher systolic blood pressure overrelatively short periods to follow up (21). Patients with low systolic blood pressure are at high risk of mortality (22) (12). Indicators that can predict the length of hospital stays in individuals with coronary heart disease include systolic blood pressure.

This study found that blood glucose levels and systolic blood pressure can explain the length of patient care by 50.5 percent. At the same time, the rest (49.5%) is defined by various other factors not studied. In addition, Age, employment, marital status, previous admission hystory, patient condition at discharge, payment method, and kind of therapy are just a few clinical and non clinical variables that can have an impact on LOS (4).

Conclusion

This study shows that blood glucose levels and systolic blood pressure can determine the length of stay in the hospital. To protect against CHD and other hypertension problems, monitoring blood pressure is more crucial than selecting an antihypertensive medication. The finding imply that methods for lowering blood glucose levels in diabetics may reduce the prevalence of heart disease.

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