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Risk Factors of Coronary Heart Disease in North Sulawesi Indonesia

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A R T I C L E I N F O

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A B S T R A C T

Coronary heart disease (CHD) is caused by multifactorial such as age, gender, blood pressure, blood sugar, and lipid profiles. This study aims to analyze the description of risk factors for CHD at the North Sulawesi, Indonesia. This is a descriptive research conducted at the Cardio Vascular and Brain Center Cardiology Polyclinic, General Hospital Prof. Dr. R. D. Kandou Manado in December 2021 to January 2022. The respondents of this study were CHD patients, totaling 100 people. The variables in this study were age, gender, blood pressure, blood sugar, and lipid profiles. The data was obtained from the patient's medical record data. Data analysis performed univariately. The results showed that the respondents are most distributed in the age group ≥40 years as many as 99 people (99%), and male sex as many as 73 people (73%). Respondents who do not suffer from hypertension are 56 people (56%) more than those who suffer from hypertension, namely 44 people (44%). Respondents with GDP >126 mg/dL were 57 people (57%) more than those with GDP < the same as 126 mg/dL, namely 43 people (43%). Respondents whose total cholesterol level was < equal to 240 mg/dL were more than 60 people (60%) compared to patients with cholesterol levels > 240 mg/dL which were 40 people (40%). It can be concluded that the risk factors for CHD at the North Sulawesi, Indonesia was ≥40 years old, male, more patients with blood pressure <140/90 mmHg, more patients with GDP >126 mg/dL and more patient with total cholesterol level <240 mg/dL

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INTRODUCTION

Non-communicable diseases (NCDs) account for 41 million annual deaths worldwide, or 71% of all fatalities. Between the ages of 30 and 69, more than 15 million people lose their lives to NCDs each year. 77% of fatalities from NCDs take place in low- and middle-income nations. The primary categories of noncommunicable diseases (NCDs) include cancer, diabetes, chronic respiratory conditions including asthma and chronic obstructive pulmonary disease, and cardiovascular diseases like heart attacks and strokes (World Health Organization, 2021).

Worldwide, cardiovascular disease is the primary cause of death. In low- and middle-income nations, cardiovascular disease accounts for more than three-quarters of all deaths. An estimated 17.9 million deaths worldwide in 2019 were attributed to heart disease, accounting for 31% of all fatalities. Heart attacks and strokes were the cause of 85% of these fatalities. (Nelwan et al 2017; Nelwan et al 2022; World Health Organization, 2021).

Non-communicable Disease (NCD) profile data in 2016, shows the number of diagnoses of coronary heart disease (CHD) based on gender is the largest in women 2,600 (1.4%) while in men 2,320 (2.4%), based on the largest age group, namely age 60 years by 2,228 (2.3%) while the age of 35-59 years is 1,934 (1.5%) and the age of 15-34 is 168 (1.1%). Coronary heart disease (CHD) is the seventh rank of PTM in the 2016 PTM Surveillance Information System with a total of 5,019. (Ministry of Health RI, 2018)

The results of 2018 basic health research show that the prevalence of CHD based on doctor's diagnosis in Indonesia is 1.5% with the highest provincial prevalence being North Kalimantan at 2.2% and the lowest being the province of East Nusa Tenggara. Meanwhile, North Sulawesi province is ranked 7th at 1.8%. Based on the highest age group, namely 75 years and over at 4.7%, the highest gender was found in women at 1.6% compared to men at 1.3%. (Ministry of Health, 2019). Riskesdas data from the 2018 North Sulawesi province report, shows the prevalence of heart disease based on doctor's diagnosis for the highest age group, namely 75 years at 5.52%, for female gender it is 1.77% while for male it is 1.76%. (Health Research and Development Agency, 2019)

Research conducted by Sari, et al (2021) showed that from 51 samples, the most age was 50-59 years old, namely 21 people (41.2%), the most gender was women, namely 26 people (51%), hypertension ie 27 people (52.9%), DM were 26 people (51%), obesity were 16 people (31.4%) and hyperlipidemia were 13 people (25.5%). Research conducted by Zahrawardani, D, et al (2013) showed that from 128 samples, the most age was 45 years as many as 107 patients (83.60%), male sex as many as 88 patients (68.80%), total cholesterol 200 mg/dL in 69 patients (53.90%), triglycerides 150 mg/dL in 91 patients (71.10%), hypertension in 89 patients (69.50%), diabetes mellitus in 82 patients (64.10%), The incidence of coronary heart disease was 103 patients (80.50%). Central General Hospital Prof. Dr. R. D. Kandou Manado is a class A hospital and is also a referral center for CHD patients with a Cardio Vascular and Brain Center (CVBC) installation room health facility. CHD patients who came to visit in January-June 2021, namely 4824

patients. The purpose of this study was to analyze the description of risk factors for CHD at the North Sulawesi, Indonesia

LITERATURE REVIEW

Coronary heart disease (CHD) is a heart function issue caused by a loss of blood supply to the heart muscle due to blockage or narrowing of coronary blood arteries caused by damage to the lining of blood vessel walls (Atherosclerosis). Coronary heart disease (CHD) is a cardiac condition caused primarily by narrowing of the coronary arteries as a result of atherosclerosis, spasm, or a combination of the two. Angina pectoris is the classic clinical symptom of coronary heart disease. Some of the symptoms that define when a person has heart disease are feeling in the middle of the chest, arm or back discomfort, neck or jaw discomfort, shortness of breath accompanied or without chest pain, feeling dizzy or cold perspiration, nausea or discomfort in the stomach. (Kemenkes RI, 2020; Purnomo, et al 2017).

Risk factors consist of unmodified risk factors and modified risk factors. Unmodified risk factors such as age and gender. Age is an important determinant in CHD patients and is a predictor of the risk of CHD. The influence of age factors can be seen from research conducted by Ruiz et al. (2012) by dividing 2 age groups less than equal to 65 years and more than 65 years. Research conducted in vivo to assess the characteristics and composition of plaques, the results showed atherosclerosis accelerated with age. In addition, the study explained that with aging, increased plaque, necrotic core and increased calcium levels significantly showed effects associated with the occurrence of atherosclerosis. The influence of old age becomes heavier 2 times causing changes in blood vessel function (Irman et al 2020).

Age has a strong relationship with the development of the atherosclerosis process. Research studies conducted by Rahimic et, al 2013 showed that atherosclerosis detected in the carotid arteries showed an increase in the thickness of the tunica intima with age. In men, the risk of atherosclerosis increases after age 45, while in women, the increase occurs after age 55 (Wihastuti et al 2016).

Women have a lower risk of cardiovascular disease than men. Estrogen is one of the keys to protection from cardiovascular disease in women. Estrogen plays an important role in vascular vasodilation. Estroge receptors are more common in women than men. Another study showed that women can increase HDL levels on a diet with saturated fat, while men do not. It also underlies cardiovascular protective effects in women. Menopausal factors cause women to have the same risk of cardiovascular disease as men of the same age (Wihastuti et al 2016).

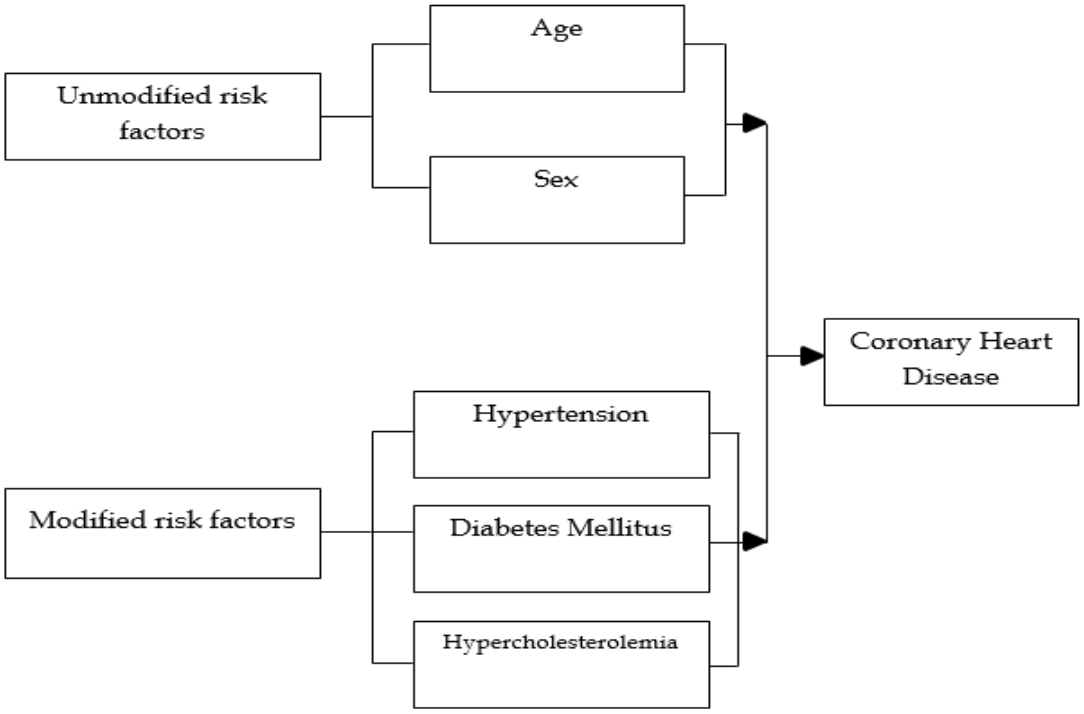
Modified risk factors include hypertension, diabetes, and hypercholesterolemia. The concentration of angiotensin-II rises in persons with hypertension. Angiotensin II is a powerful vasoconstrictor that promotes atherogenesis by stimulating smooth muscle development. This occurs when angiotensin-II binds to particular smooth muscle receptors, activating phospholipase C. This activation raises intracellular calcium levels and stimulates smooth muscle

contraction. Another impact is enhanced lipoxygenase activity, which can enhance the inflammatory response and LDL oxidation. Hypertension can induce an increase in hydrogen peroxide and free radicals, which has an effect on reducing NO in the endothelium, increasing leukocyte adhesion, and raising peripheral resistance. (Wihastuti et al 2016).

Hypertension is called silent disease because there are no symptoms and symptoms only arise after complications arise in the heart with the emergence of a heart attack, in the brain with the onset of stroke, in the eyes causing hypertensive retinopathy, and in the kidneys with the occurrence of hypertensive nephropathy (Purnomo et al 2017).

Diabetes mellitus is a disease or chronic metabolic disorder with multietiology (many causes) characterized by high blood sugar levels accompanied by impaired carbohydrate, fat, and protein metabolism as a result of insufficiency (insufficiency) of insulin function. A person with GDP and/or GD2PP values in the prediabetes range is said to have impaired glucose tolerance. The condition of impaired glucose tolerance cannot be seen as a whole but needs to pay attention to the risk factors for diabetes or risk of heart disease, such as obesity (especially abdominal and visceral obesity), dyslipidemia (high triglycerides and / or low HDL cholesterol), and hypertension (Dewi, 2014).

Hypercholesterolemia (Hyper: high, emia: blood) is one of the abnormalities of fat levels in the blood (dyslipidemia) in the form of increased fasting total cholesterol levels in the blood. Abnormalities in fat levels are not a disease, but are a risk factor for other diseases, especially heart and blood vessel disease. In addition, hypercholesterolemia is also directly responsible for the occurrence of arthrosclerosis. A person is said to suffer from hypercholesterolemia when his total cholesterol level is >240 mg / dL. The impact of increased blood cholesterol levels does not appear just like that and will only be seen after many years. The process of leading to hypercholesterolemia generally begins at a young age due to several factors. (Ruslianti, 2014). Hypercholesterolemia is a fat disorder characterized by elevated blood cholesterol levels. Hypercholesterol is one of the risk factors for coronary heart disease (Purnomo et al 2017).



Picture 1. Conceptual Framework

METHODOLOGY

This is a descriptive research was carried out at the Cardio Vascular and Brain Center (CVBC) installation room Cardiology Polyclinic, Prof. dr. R. D. Kandou Manado. This study was carried out from December 2021 to February 2022. The sample population in this study amounted to 100 patients with a sampling technique, namely the purposive sampling technique. The variables of this study is that age, sex, diabetes mellitus and hypercholesterolemia. Data collected using secondary data, namely incidence data obtained from outpatient medical records. The data obtained was then analyzed univariately.

RESULTS

This section was explains the distribution of respondents based on risk factors such as age, gender, diabetes mellitus and hypercholesterolemia.

Table 1. The Respondent Distribution Based on Age and Sex

Variable	n	%
Age		
< 40 years	1	1
≥ 40 years	99	99
Sex		
Male	73	73
Female	27	27
Total	100	100

The data in the table shows that the most numerous age group is the age group ≥ 40 years with 99 patients, and the most common gender is male with 73 patients. Next can be seen the results of descriptive analysis.

Table 2. Descriptive Analysis

Variable	n	Range	Min	Max	Std. Deviation
Age (year)	100	45	39	84	9,528
Sistole (mmHg)	100	209	71	280	25,916
Diastole (mmHg)	100	54	45	99	12,360
Blood sugar (mg/dL)	100	428	71	499	68,578
Cholesterol (mg/dL)	100	280	64	344	62,333

The data in table 2 shows that the patients are 39-84 years old, systolic blood pressure is 71-280 mmHg, diastolic blood pressure is 45-99 mmHg, sugar levels are 71-499 mg/dL and cholesterol levels are 64-344 mg/dL.

Table 3. Respondent Distribution Based on Hypertension

Hypertension	n	%
Yes	44	44
No	56	56
Total	100	100

The data in table 3 shows that there are more patients with blood pressure <140/90 mmHg, namely 56 patients, compared to patients with ≥140/90 mmHg, namely 44 patients.

Table 4. Respondent Distribution Based on DM

Diabetes Mellitus	n	%
Yes	57	57
No	43	43
Total	100	100

The data in table 4 shows that there are more patients with diabetes mellitus with GDP > 126 mg/dL, namely 57 patients compared to those without diabetes mellitus < 126 mg/dL, namely 43 patients.

Table 5. Respondent Distribution Based on DM Hypercholesterolemia

Hypercholesterolemia	n	%
Yes	40	40
Not	60	60
Total	100	100

The data in table 5 shows that there are 60 patients with total cholesterol levels < 240 mg/dL compared to 40 patients with cholesterol levels > 240 mg/dL.

DISCUSSION

The results of the research at the CVBC Cardiology Polyclinic, Prof. Kandou Dr. R. D. Kandou Manado out of 100 respondents, the most age group is the age group 40 years as many as 99 patients compared to the group <40 years with 1 patient. The results of research conducted by Ghani, L, et al. (2016) which shows that the age group 40 years has a risk of 2.72 times compared to <40 years, increasing age will increase the risk of coronary heart disease. Research conducted by Patriyani &; Purwanto (2016) showed that those aged more than 40 years had a greater risk of experiencing CHD with a total of 30 respondents (75%) while those aged less than 40 years amounted to 10 respondents (25%).

The risk of coronary heart disease increases with age. Age will bring changes to the structure of the human body tissue, including the cardiovascular system. The cardiovascular system will become narrower, the walls of the heart thicken, the weight increases, the heart chambers shrink. Increasing a person's age is often followed by weight gain, increased cholesterol, lack of activity and this is likely to be a factor that influences the risk of coronary heart disease in the elderly. (Rosjidi, 2021) Susceptibility to coronary atherosclerosis increases with age, but serious disease rarely occurs before the age of 40 years, while at the age of 40-60 years, the incidence of myocardial infarction increases fivefold. Age brings uncontrollable changes in the human body, including the cardiovascular system, such as increasing coronary heart disease. (Rochfika, 2019)

Age contributes significantly to the loss in cardiovascular function, which increases the risk of CHD in older persons. The prevalence of CHD has also been found to rise with age in both men and women, as has the prevalence of atherosclerosis, stroke, and myocardial infarction. According to the American Heart Association (AHA), the incidence of coronary heart disease (CHD) in men and women in the US is approximately 40% in those aged 40-59, 75% in those aged 60-79, and 86% in those over 80. Due to the high frequency of CHD, older persons pose a significant strain on the current US health system. (Rodgers JL, J.J., 2019).

The burden of CHD is directly connected with higher mortality, morbidity, and frailty in affected individuals, resulting in significant overall health-care costs. Given that the US aging population is predicted to double or triple by 2050, there is an urgent need for a better understanding of the pathogenesis of CHD in older persons. Functional alterations in the heart of aging

people have been identified, including reports of diastolic and systolic dysfunction, as well as electrical abnormalities, such as the development of arrhythmia. Both functional and electrical abnormalities contribute to a high prevalence of heart failure, atrial fibrillation, and other cardiovascular disorders in aging patients. (Rodgers JL, J.J., 2019).

The high incidence of CHD in the elderly has been linked to a variety of variables, including increased oxidative stress, inflammation, apoptosis, and total myocardial damage and degeneration. Increased production of reactive oxygen species (ROS) is known to occur with advancing age, and is connected with persistent inflammation and the development of chronic disease states, such as CHD. (Rodgers JL, J.J., 2019).

Cardiac aging is characterized by elevated levels of proinflammatory markers, such as IL-6, TNFα, and CRP (CRP). The production of inflammatory agents and other mediators contributes to cardiac remodeling, particularly considerable extracellular matrix (ECM) remodeling caused by poor ECM turnover. In the aging heart, dysregulation of MMP and TIMP expression levels is commonly related with increased collagen deposition and the development of cardiac hypertrophy and fibrosis. Fibrosis and hypertrophy are both substantial anatomical alterations that induce heart dysfunction in elderly people. Fibrosis, due to reduced ECM turnover, has been observed to occur in the atria of aged people, causing atrial fibrillation in many of these patients. (Rodgers JL, J.J., 2019).

From the results of this study, it was found that the male sex was more numerous with a total of 73 patients compared to the female sex with a total of 27 patients. The results of research conducted by Kurnia and Prayogi (2015) which showed that more than 50% occurred in males 53.5% compared to female sex, the results were 46.5%. The results of research conducted by Mala, S, et al. (2019) which showed that the distribution of CHD sufferers was highest in the male sex group of 60% (18 people) compared to the female sex group of 40% (12 people).

Men have a greater tendency to have cardiovascular disease than women, women are more likely to be immune to cardiovascular disease until the age of menopause, then become as susceptible as men, after menopause. This is due to the effect of estrogen which increases immunity. The hormone estrogen is able to protect women from degenerative diseases, one of which is CHD (Rochfika, 2019).

This estrogen hormone can provide a protective effect on the mechanism of blood flow to and from the heart. This estrogen hormone is able to increase high density lipoprotein (HDL) or good cholesterol, and reduce low density lipoprotein (LDL) or bad cholesterol which can cause calcification in the blood vessels which will then block blood flow when it enters the blood vessels towards the heart. The process of menstruation in women secretes ferritin (a kind of protein) which is a risk factor for coronary heart disease. This ferritin is regularly released with menstruation that women experience (Rochfika, 2019).

The results shows that there are more patients with blood pressure <140/90 mmHg, namely 56 patients, compared to patients with ≥140/90 mmHg, namely

44 patients. The results of Kamila &; Salim's research, (2018) showed that hypertension had nothing to do with coronary heart disease because only a small number of respondents had hypertension.

Epidemiological evidence indicates a robust link between blood pressure and cardiovascular disease, morbidity, and mortality. The risk of stroke, myocardial infarction, angina, heart failure, renal failure, or premature mortality from cardiovascular causes is closely connected to blood pressure. (Nelwan and Sumampouw 2019; Suhadi, R, et al, 2016).

The risk of cardiovascular disease doubles for every 20/10 mm Hg increase in blood pressure. Even those with prehypertension are at a higher risk of cardiovascular disease. Isolated systolic hypertension occurs when DBP is less than 90 mmHg and SBP is ≥140 mmHg. Isolated systolic hypertension is caused by pathophysiological changes in the arteries that occur as people age. These modifications impair the flexibility of the artery wall, raising the risk of cardiovascular morbidity and mortality. Pulse pressure is the difference between SBP and DBP and is important for assessing the amount of atherosclerotic disease in the elderly as well as measuring increased arterial stiffness. Higher pulse pressure readings are associated with an increased risk of cardiovascular death, particularly in people with isolated systolic hypertension (Suhadi, R, et al, 2016). The results suggest that there are more patients with diabetes mellitus with GDP > 126 mg/dL, precisely 57 patients, than those without diabetes mellitus < 126 mg/dL, which is 43 patients. The findings of this study are consistent with research conducted by Rahmawati, I., et al. (2020) at the Cardiac Polyclinic at Dr. M. Yunus Bengkulu, which included 292 patients. There were 173 diabetics (59.2%) and 119 non-diabetics (40.8%). Diabetes mellitus is a collection of metabolic illnesses defined by hyperglycemia caused by abnormalities in insulin secretion, action, or both. Diabetes' persistent hyperglycemia is linked to long-term damage, reduced function, and organ failure, particularly in the eyes, kidneys, nerves, heart, and blood vessels. (Andrianto, 2021)

The results of Husni &; Hardhana's research (2018) at the Ulin Hospital in Banjarmasin with a total sample of 440 people consisting of 220 cases and 220 controls. The results obtained from 220 cases were 102 people (46.4%) who had diabetes mellitus and from 220 controls there were 73 who did not suffer from diabetes mellitus. Patients with diabetes mellitus have 2 times the risk of suffering from CHD compared to patients who do not have diabetes mellitus. Research conducted by Faudi (2019) showed that 32 respondents (53.33%) had diabetes mellitus and 28 respondents (46.67%) did not have diabetes mellitus. Respondents with diabetes mellitus will have a greater proportion of coronary heart disease with STEMI.

The incidence of coronary heart disease is higher in patients with metabolic syndrome with diabetes than without diabetes. Diabetes increases the risk of thickening of the blood vessel walls so that they become narrower. Diabetes also damages the structure of blood vessels so that blood vessels can no longer widen. People with diabetes who have heart disease do not complain of chest pain. This is called a silent infarction because the nerves that transmit pain have been damaged. Do regular checks of heart function. Controlling the levels

of bad and good fats in the blood is important because an inappropriate ratio between the two can increase the risk of coronary heart disease. High blood sugar for a long time can damage heart muscle cells and cause heart failure. According to Prof. Dr. Peter Kabo, people with diabetes mellitus have a 2-6 times higher risk of dying from coronary heart disease. (Torawoba et al 2021; Prihaningtyas, 2013) The results of the research from secondary data at the CVBC Cardiac Polyclinic at RSUP Prof. Dr. R.D. Kandou Manado showed that there were more patients with total cholesterol <240 mg/dL, namely 60 patients, compared to patients with cholesterol levels >240 mg/dL, namely 40 patients. Based on their density and size, there are 5 main types of lipoproteins namely chylomicrons, very-low-density lipoprotein (VLDL), intermediate-density lipoprotein (IDL), low-density lipoprotein (LDL), and high-density lipoprotein (HDL). Abnormalities in one of the lipoprotein metabolisms can cause an increase in cholesterol and triglyceride levels which play a role in blood vessel disease (Ruslianti, 2014).

Another major risk for CHD is cholesterol. People often do not realize that cholesterol levels in their blood are increasing. Sometimes there are those who feel symptoms such as a sore throat when their blood cholesterol increases. However, these symptoms are not specific and are experienced by everyone. Cholesterol sticks to the inner surface of the blood wall like rust that gets thicker in the grooves of an iron pipe. Gradually it will harden and clog the heart arteries, causing coronary heart disease. (Ruslianti, 2014).

CONCLUSIONS AND RECOMMENDATIONS

The conclusion of this study is that the most numerous age group is the age group ≥ 40 years as much as 99% and the most frequent sex is male sex as many as 73 patients. Furthermore, it was found that there were 56 patients with coronary heart disease with risk factors for hypertension, namely more patients with blood pressure <140/90 mmHg, namely 56 patients and patients with blood pressure ≥140/90 mmHg, namely 44 patients. The results obtained in coronary heart disease patients with diabetes mellitus risk factors were more with GDP > 126 mg/dL, namely 57 patients and those who did not suffer from diabetes mellitus with GDP <126 mg/dL, namely 43 patients. The results obtained in patients with coronary heart disease with risk factors for hypercholesterolemia were more patients with total cholesterol levels < 240 mg/dL, namely 60 patients with patients with cholesterol levels > 240 mg/dL, namely 40 patients.

FURTHER STUDY

Coronary heart disease (CHD) is one of the important non-communicable diseases in the world, including Indonesia. Many cases of death are caused due to this disease. This disease is a chronic disease that cannot be cured where the patient must always take medication and control to the doctor during life. This disease can cause a decrease in the quantity of life of sufferers, therefore efforts are needed to improve the quality of life of sufferers so that life becomes better and useful. One of the efforts that can be done is to examine factors related to the quality of life of heart patients so that strategies can be obtained in an effort to improve the quality of life of CHD patients.

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