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# ASSESSMENT OF THE FRAMINGHAM RISK SCORE TO PREDICT THE RISK OF CORONARY HEART DISEASE IN PATIENTS WITH TYPE II DIABETES MELLITUS

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***Abstract****. Coronary Heart Disease (CHD) is a leading cause of morbidity and mortality worldwide, including in Indonesia. Type II Diabetes Mellitus is an important risk factor because it increases the likelihood of cardiovascular events by 2–4 times through mechanisms such as chronic hyperglycemia, diabetic dyslipidemia, and endothelial dysfunction. Risk assessment using the Framingham Risk Score (FRS) is essential, as it can estimate the 10-year risk of CHD based on age, blood pressure, lipid profile, smoking status, and the presence of diabetes. The increase in DM cases at Raden Mattaher Hospital Jambi from 92 in 2023 to 125 in 2024 highlights the need for early cardiovascular risk detection. This study aimed to describe CHD risk in Type II DM patients using the FRS through a descriptive quantitative design involving 62 respondents. The results showed that 46 respondents (74.2%) were in the low-risk category, emphasizing that the FRS is useful in supporting clinical decision-making and planning preventive interventions for diabetic patients.*

**Abstrak:** Penyakit Jantung Koroner (PJK) merupakan penyebab utama morbiditas dan mortalitas di dunia, termasuk di Indonesia. Diabetes Mellitus Tipe II menjadi faktor risiko penting karena meningkatkan peluang kejadian kardiovaskular hingga 2–4 kali lipat melalui mekanisme hiperglikemia kronis, dislipidemia diabetik, dan disfungsi endotel. Penilaian risiko menggunakan Framingham Risk Score (FRS) penting dilakukan karena mampu memperkirakan risiko PJK dalam 10 tahun berdasarkan usia, tekanan darah, profil lipid, status merokok, dan kondisi diabetes. Peningkatan jumlah pasien DM di RSUD Raden Mattaher Jambi dari 92 kasus pada 2023 menjadi 125 kasus pada 2024 menunjukkan perlunya deteksi dini risiko kardiovaskular. Penelitian ini bertujuan menggambarkan risiko PJK pada pasien DM Tipe II menggunakan FRS melalui desain deskriptif kuantitatif dengan 62 responden. Hasil menunjukkan bahwa 46 responden (74,2%) berada pada kategori risiko rendah, menegaskan bahwa FRS bermanfaat dalam mendukung keputusan klinis dan perencanaan intervensi pencegahan pada pasien diabetes.

## INTRODUCTION

Cardiovascular disease is a group of conditions affecting the heart and blood vessels, including Coronary Heart Disease (CHD). This disorder arises from abnormalities in the coronary arteries that cause an imbalance between oxygen supply and demand. Based on its clinical manifestation, CHD is classified into two main forms: Chronic Coronary Syndrome (CCS) and Acute Coronary Syndrome (ACS). CCS describes a reversible oxygen imbalance associated with ischemia, a history of myocardial infarction, or the presence of coronary artery plaque detectable through catheterization or computed tomography angiography. Meanwhile, ACS occurs when atherosclerotic plaque ruptures due to changes in plaque composition and thinning of the fibrous cap, triggering platelet aggregation and increasing the risk of vascular obstruction and heart attack (Sawu, 2022).

CHD remains a major contributor to morbidity and mortality both globally and nationally (Iskandar et al., 2022). According to the World Health Organization (WHO), CHD is one of the cardiovascular diseases with a continuously increasing number of cases, causing approximately 6.7 million deaths each year (Anggraini, 2022). In 2022, an estimated 315 million CHD cases were reported worldwide, with an uncertainty range of 273 to 362 million cases. The age-adjusted global prevalence reached 3,605 per 100,000 population, decreasing by around 18% from 1990, which recorded 4,390 per 100,000 population. Geographically, the highest prevalence in 2022 was found in Central Europe, Eastern Europe, and Central Asia at 8,019 per 100,000 population, while South Asia recorded the lowest at 2,393 per 100,000 population (Stark et al., 2024). In Indonesia, the Ministry of Health reported that CHD caused 245,343 deaths in 2023, with higher incidence in urban areas due to lifestyle changes and poor dietary patterns. The national prevalence of CHD reached 0.85%, while Jambi Province reported 0.47%, totaling 11,588 cases (KEMENKES, 2024).

One of the major risk factors contributing to the development of CHD is Type II Diabetes Mellitus, a chronic metabolic disorder characterized by hyperglycemia due to insulin resistance and/or impaired insulin secretion by pancreatic beta cells (Damara & Ariwibowo, 2021). Individuals with Type II DM have a 2–4 times higher risk of experiencing cardiovascular complications compared to those without diabetes. WHO reported that global diabetes prevalence among adults doubled from 7% to 14%. Among nearly 450 million people over the age of 30 living with diabetes, around 59% were untreated in 2022 (World Health Organization (WHO, 2024). In Indonesia, the number

of diabetes cases is projected to reach 10.7 million by 2030. The 2023 Indonesia Health Survey (SKI) reported a diabetes prevalence of 1.7% across all age groups, with Type II DM being the most common, accounting for 50.2% of 14,953 total cases (KEMENKES, 2024).

The increasing prevalence of diabetes may elevate future CHD cases. The pathophysiological mechanisms linking Type II DM to CHD include chronic hyperglycemia that triggers oxidative stress, reduces nitric oxide production, and causes endothelial dysfunction, all of which increase the risk of vasoconstriction and vascular injury. In addition, diabetic dyslipidemia—characterized by elevated triglycerides, low HDL levels, and the presence of small dense LDL particles—accelerates atherosclerosis (Decroli, 2019). Insulin resistance also contributes to the activation of the renin–angiotensin–aldosterone system, causing hypertension and worsening vascular damage. Pro-coagulant states and impaired fibrinolysis further increase the risk of thrombus formation and myocardial infarction (Pakaya, 2022).

To identify CHD risk among diabetic patients, one widely used method is the Framingham Risk Score (FRS) (Kwon et al., 2021). FRS is a predictive scoring system that estimates 10-year CHD risk based on clinical parameters such as age, sex, systolic blood pressure, hypertension treatment history, total cholesterol, HDL cholesterol, smoking status, and the presence of diabetes (Wulandari et al., 2025). In Type II DM patients, diabetes directly increases the risk score as it is a strong independent factor (Abohelwa et al., 2023). Each variable in FRS carries its own weight; for instance, older age or higher total cholesterol increases the score, as do uncontrolled hypertension and low HDL levels (Wulandari et al., 2025). The total score classifies individuals into low, moderate, or high risk (Abohelwa et al., 2023). FRS is considered simple, non-invasive, and applicable in primary healthcare settings using routinely collected clinical data. For diabetic patients, FRS is valuable in identifying individuals requiring intensive interventions, including stricter glycemic control, blood pressure management, and lipid therapy. Moreover, FRS-based stratification supports patient education and risk-based clinical decision-making (Kwon et al., 2021).

A preliminary study at Raden Mattaher Hospital Jambi reported an increase in diabetes cases from 92 in 2023 to 125 in 2024. This upward trend suggests a potential rise in CHD burden in the coming years. Therefore, research on FRS profiles among Type II DM patients in this hospital is highly necessary to provide relevant local data. Such data can serve as an important foundation for planning targeted promotive and preventive

strategies to reduce cardiovascular complications. By identifying CHD risk distribution using FRS, interventions can be tailored more accurately according to the patients' actual risk levels. This study aims to assess CHD risk in Type II DM patients using the Framingham Risk Score (FRS).

## METHOD

This study is a descriptive quantitative research. The population in this study consisted of all patients diagnosed with Type 2 Diabetes Mellitus in the Internal Medicine inpatient ward of Raden Mattaher Hospital Jambi, totaling 125 patients in the year 2024. The sample comprised 62 patients selected using a purposive sampling technique. Data were collected using the Framingham Risk Score (FRS) instrument, and the data were then analyzed using descriptive statistics.

## RESULTS AND DISCUSSION

### Results

**Table 1. Frequency Distribution of Framingham Risk Score (FRS) Assessment for Predicting Coronary Heart Disease Risk in Patients with Type II Diabetes Mellitus**

| Risk Category | Frequency (f) | Percentage (%) |
|---|---|---|
| Low | 46 | 74,2 |
| Moderate | 12 | 19,4 |
| High | 4 | 6,5 |
| **Total** | **62** | **100** |

Based on Table 4.2, the results of the FRS assessment show that most respondents fall into the low-risk category, totaling 46 individuals (74.2%). This indicates that the majority of respondents have a low risk of developing coronary heart disease.

The findings from 62 patients with Type II Diabetes Mellitus reveal that most respondents were classified as having a low risk (<10%) according to the Framingham Risk Score (FRS). This suggests that the study population has a relatively low probability of experiencing cardiovascular events within the next 10 years, even though diabetes is theoretically considered a cardiovascular risk equivalent that increases susceptibility to atherosclerosis and coronary heart disease (Whelton et al., 2018). This situation may indicate adequate control of major risk factors such as blood pressure, total cholesterol, HDL levels, and smoking status, or it may reflect that some patients are still in the early stages of diabetes, where the cumulative effects of chronic hyperglycemia on vascular damage have not fully developed. Theoretically, FRS is a risk prediction model derived from the Framingham Heart Study, first introduced by Wilson et al. and later updated by

D'Agostino et al. into the general cardiovascular risk profile. This model identifies age, systolic blood pressure, antihypertensive therapy, total cholesterol, HDL cholesterol, and smoking habits as the most influential predictors of cardiovascular risk. Therefore, although diabetes is included as a risk variable, its contribution to the total score may be smaller when these dominant factors fall within normal or controlled ranges (Wilson et al., 1998). Pathophysiologically, chronic hyperglycemia accelerates atherosclerosis through the formation of advanced glycation end products (AGEs), activation of the protein kinase C pathway, increased oxidative stress, and endothelial dysfunction. These mechanisms are progressive and strongly influenced by the duration of hyperglycemia, meaning that cardiovascular risk in diabetic patients typically increases as disease duration lengthens and glycemic control worsens (Lloyd-Jones, 2010).

The findings of this study are consistent with Cheraghian et al., who reported that most FRS participants were categorized as low to moderate risk, particularly among outpatients with adequate risk-factor control (Cheraghian et al., 2023). However, the results contrast with those of Joshi et al., who found that more than one-third of Type II DM patients were at high risk. These differences are influenced by older age, longer disease duration, poor glycemic control, and higher rates of central obesity and hypertension. This demonstrates that cardiovascular risk in diabetic patients is strongly affected by demographic characteristics, clinical status, and the quality of healthcare received (Joshi et al., 2024).

The implications of these findings indicate that although most respondents fall into the low-risk category, this should not reduce clinical vigilance. Atherosclerosis in diabetic patients is cumulative and progressive, meaning the risk may increase with advancing age and disease duration. Therefore, consistent risk-factor management is necessary, including blood pressure regulation, lipid profile improvement, weight control, increased physical activity, and optimal glycemic management (Whelton et al., 2018). From a healthcare perspective, the results highlight the need to strengthen outpatient services for comprehensive risk-factor management. Moreover, interpreting FRS in the Indonesian population should be done cautiously, as the model was developed using Western populations and may yield prediction variations when applied to populations with different characteristics (D'Agostino et al., 2008). Thus, routine cardiovascular risk assessment, accompanied by an understanding of clinical conditions and disease progression, is crucial to prevent cardiovascular complications in patients with Type II Diabetes Mellitus.

In this study, the moderate-risk group represents a clinically important transitional category, as nearly one-fifth of patients have already demonstrated signs of increased risk despite not yet reaching the high-risk category (Batmunkh et al., 2024). Theoretically, the moderate-risk group is considered a vulnerable phase as described in the FRS prediction model by Wilson and D'Agostino, in which traditional variables such as age, blood pressure, lipid profile, and smoking status strongly influence score elevation; thus, even small changes can rapidly shift an individual into the high-risk category (Wilson et al., 1998). From a pathophysiological standpoint, Brownlee's unifying mechanism explains that chronic hyperglycemia triggers molecular pathways such as the formation of AGEs, activation of protein kinase C, and oxidative stress, all of which lead to endothelial dysfunction and accelerate atherosclerosis. These mechanisms become more prominent in individuals who are already demonstrating early increases in cardiovascular risk (Lloyd-Jones, 2010). Furthermore, the atherogenic inflammatory theory emphasizes that chronic vascular inflammation interacting with dyslipidemia and central obesity accelerates plaque formation, making individuals in the moderate-risk group particularly susceptible to worsening cardiovascular outcomes if contributing factors are not addressed (Grundy et al., 2019). The study by Batmunkh et al., which found a moderate-risk proportion of 45.9% among patients with longer diabetes duration, reinforces the view that the moderate-risk category serves as an "early warning" for healthcare providers to intensify interventions. Based on empirical evidence and clinical understanding, this group requires follow-up interventions such as additional screening, intensified lifestyle modification, nutritional adjustments, and optimization of pharmacological therapy to prevent progression to the high-risk category, particularly in patients with central obesity or low HDL, which are strong predictors of cardiovascular events (Batmunkh et al., 2024; D'Agostino et al., 2008).

Meanwhile, although the number of patients in the high-risk category is relatively small, this group requires greater clinical attention due to its significant contribution to cardiovascular morbidity and mortality. Numerous studies have demonstrated that diabetic patients with high FRS scores have a substantially increased risk of cardiovascular events compared to those in the low-risk category (Gang et al., 2020). Theoretically, this mechanism aligns with the FRS model by Wilson and D'Agostino, in which high scores typically reflect a combination of traditional factors such as older age, uncontrolled hypertension, atherogenic lipid profiles, and smoking habits, all of which cumulatively elevate the likelihood of cardiovascular events (Wilson et al., 1998).

Pathophysiologically, Brownlee explains that uncontrolled chronic hyperglycemia leads to the formation of AGEs, activation of protein kinase C, oxidative stress, and endothelial dysfunction, which accelerate atherosclerosis progression. Consequently, patients with poor metabolic control or existing diabetic complications tend to fall into the high-risk category and experience more rapid disease progression (Whelton et al., 2018). The findings of Gang et al. further strengthen the clinical significance of a high FRS score by demonstrating markedly increased hazard ratios for cardiovascular events among high-risk patients. Although small in number, this group contributes disproportionately to clinical burden and the need for intensive interventions (Gang et al., 2020). Practically, high-risk patients require intensive medical management, including additional examinations such as ECG, HbA1c measurement, renal function tests, complete lipid profiling, and referral to a cardiologist for consideration of preventive therapies such as antiplatelets, statins, and aggressive antihypertensives to reduce the risk of myocardial infarction and stroke (Gang et al., 2020). From a nursing and public health perspective, the predominance of low and moderate-risk groups provides a substantial opportunity for population-level preventive efforts, whereas the high-risk group requires a multidisciplinary approach integrating education, nutritional therapy, increased physical activity, and optimization of pharmacological treatment. Additionally, risk assessment should consider sex-specific factors and clinical history, as conditions such as prior pregnancy-related complications may increase cardiovascular risk in women and influence intervention priorities (Nguyen et al., 2024).

Overall, this study shows that the cardiovascular risk profile of Type II DM patients at RSUD Raden Mattaher Jambi is dominated by the low-risk category, with a considerable proportion in the moderate-risk category, and a smaller portion in the high-risk category. Viewed from the perspectives of facts, theory, opinion, and implications, it is evident that although most patients appear relatively well-controlled, cardiovascular risk remains dynamic and may change over time. Therefore, the use of FRS as a risk-stratification tool should be conducted periodically to monitor changes in risk and determine appropriate interventions for those who need them most. The findings of this study underscore the importance of strengthening non-communicable disease prevention and control programs, particularly for patients in the moderate and high-risk categories, to prevent severe cardiovascular events such as myocardial infarction, heart failure, and stroke.

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## CONCLUSION

Based on the Framingham Risk Score (FRS) assessment in patients with Type II Diabetes Mellitus, most respondents were categorized as having a low risk of developing coronary heart disease within the next 10 years. This indicates that although Type II DM is an important risk factor, the majority of patients in this study still have a low probability of experiencing major cardiovascular events. The application of the FRS can continue to be used to support more accurate clinical decision-making, particularly in determining the need for primary and secondary preventive interventions.

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