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Coronary Heart Disease Risk and Associated Risk Factor Among Workers at PT.X in 2023

Jeanita Haldy[1]*, L.Meily Kurniawidjaja[2]

[1]Fakultas Kesehatan Masyarakat, Universitas Indonesia | email: jeanitahaldy23@gmail.com

[2] Fakultas Kesehatan Masyarakat, Universitas Indonesia | email: meily@ui.ac.id

* Corresponding Author: jeanitahaldy23@gmail.com

ABSTRACT

Introduction: Coronary heart disease is also a major cause of death and permanent disability among workers. In Indonesia, the estimated loss due to decreased productivity and treatment costs for CHD is 6.8% of GDP per year. The risk of CHD in industry is increased due to stress from long working hours, shift work affecting work, eating, and sleeping patterns.

Objective: To evaluate the risk of CHD among workers at PT. X, an oil and gas company, and to describe the frequency distribution of CHD risk factors

Method: The research design is descriptive analytics with a cross-sectional design. Sample data was collected from annual health examination data at PT. X in 2023. Framingham risk score (FRS) used to predict the incidence rate of CHD in the next 10 years.

Result: The data of PT. X indicates that man employees comprise 76.2%, age <40 years old 44.9%, 8.8% of employees have hypertension, 2.6% diabetes, and 62.1% obese. The results of CHD prediction risk calculations using Framingham are 0.4% of workers at high risk, 15.9% at intermediate risk. Risk factor of CHD found gender (pvalue = 0,000 ; OR 18,6), age (pvalue = 0,000; OR 54,3), SBP (pvalue = 0,002; OR 3,2), TC (pvalue = 0,032; OR 2,1), HDL (pvalue = 0,017; OR 0,4), fasting blood sugar (pvalue = 0,000; OR 6,5), smoking habits (pvalue = 0,000; OR 4,8), and BMI (pvalue = 0,013; OR 4,2).

Conclusion: The results of predicting the risk of coronary heart disease over the next 10 years using Framingham among PT.X workers indicate that 0.4% of workers have a high risk and 15.9% have a intermediate risk. Gender, age, systolic blood pressure, total cholesterol, HDL, fasting blood sugar, smoking habits, and body mass index (BMI) are significantly associated with the risk of coronary heart disease

Keywords: Coronary Heart Diseasep; Worker; Framingham; Risk Factor

INTRODUCTION

Coronary heart disease (CHD) is the most common cardiovascular disease and its incidence has been increasing over the past decade, making it a leading cause of death in various countries worldwide [1]. It accounts for 16% of total deaths globally [2]. CHD is a multifactorial disease associated with the progression of coronary atherosclerosis, where plaque formation in the coronary arteries reduces oxygenated blood flow to the heart, primarily due to lipid accumulation in the body [3]. Diagnosis of CHD occurs when atherosclerosis is formed at 50% or more [2].

According to the Institute for Health Metrics and Evaluation (IHME), deaths from heart disease contributed to 28.3% of total deaths in Indonesia in 2019 [4]. Information on people who are diagnosed with CHD in Indonesia can be found through data from the Basic Health Research (RISKESDAS), where the prevalence of cases increased by 1% over 5 years (2013-2018) [5]. CHD is also a major cause of death and permanent disability among workers, leading to a decrease in productivity in the working-age population due to lost workdays from illness. In Indonesia, the estimated loss due to decreased productivity and treatment costs for CHD is 6.8% of GDP per year [6].

Physical work, awkward postures, repetitive movements, and long working hours are some occupational factors associated with an increased risk of CHD [7]. PT. X is an oil and gas company where workplace hazards are a major concern in this industry. The risk of CHD in this industry is increased due to stress from long working hours, shift work affecting work, eating, and sleeping patterns [8].

The Ministry of Health of the Republic of Indonesia in its guidelines for controlling coronary heart disease risk factors in 2011, mentions two groups of coronary heart disease risk factors: non-modifiable risk factors such as age, gender, and family history, and modifiable risk factors such as smoking habits, dyslipidemia, hypertension, diabetes mellitus, stress, unhealthy diet, excessive alcohol consumption, lack of physical activity, overweight, and obesity [7].

Therefore, it is important to develop prevention strategies and early diagnosis in the most vulnerable population groups [14]. The study aims to evaluate the risk of CHD among workers at PT. X, an oil and gas company, and to describe the frequency distribution of CHD risk factors, including individual characteristics and other disease statuses that are risk factors for CHD (Hypertension, Diabetes Mellitus, and Hyperlipidemia) [1]. This research is expected to serve as a basis for designing priority health promotion programs at PT. X.

METHOD

The research design used in this study is descriptive analytics with a cross-sectional design. Sample data was collected based on the annual health examination data at PT. X in 2023. The inclusion criteria in this study are all permanent employees of PT. X, with the exclusion criteria are employees with incomplete health examination results and foreign workers.

The minimum sample size was calculated using the hypothesis testing formula for the difference in proportions to examine the relationship between independent and dependent variables [9]. The sample size was determined using the hypothesis testing formula with the independent variable total cholesterol ≥200 mg/dl:

$$n = \frac{\left(z_{1-\alpha/2}\sqrt{2\overline{P}(1-\overline{P})} + z_{1-\beta}\sqrt{P_1(1-P_1)+P_2(1-P_2)}\right)^2}{(P_1-P_2)^2}$$

Remarks:
n = sample size
Z1-α/2 = Z value based on 95% confidence level = 1.96
z1-b = z value at power (1-b) 80% = 0.84
P1 = estimated proportion of the event under study in the first independent group 57.92% MCU data of PT. X 2022)
P2 = estimated proportion of the event under study in the second independent group 28.8% [7]
P = average of P1 and P2

The minimum sample size used in the study with a 10% addition is 100 workers. However, the research was conducted on the entire permanent workforce of PT. X, totaling 227 workers with complete health examination results for the year 2023.

Framingham is one of the methods used to predict the risk of coronary heart disease incidence. FRS is used to predict the incidence rate of CHD in the next 10 years. Parameters used in calculating the Framingham score include age, gender, systolic blood pressure, total cholesterol, HDL, diabetes status, and smoking habits [24]. This value will

then be reclassified as low, intermediate, and high. Low risk if the FRS score is <10%, intermediate risk if 10-19%, and high risk if >20% [8].

RESULTS

Quantitative Research

Univariate Analysis

The quantitative research was conducted using univariate and bivariate analyses. Univariate analysis was performed to observe the frequency distribution of individual respondent characteristics among 227 individuals regarding coronary heart disease risk factors, as shown in Table 1.

Table 1 shows the number of male employees at PT. X greater than females with almost 76.2% of the total and the majority of employees are under 40 years old. Furthermore, 8.8% of employees have hypertension, 2.6% have diabetes, and 62.1% are obese (including obese I and obese II).

Tabel 1. Frequency Distribution of Respondent's Individual Characteristics

Variables	Variable Categories	Quantity	Percentage
Gender	Women	54	23,8
	Men	173	76,2
Age	<40	102	44,9
	40-44	59	26,0
	45-49	31	13,7
	≥ 50	35	15,4
Systolic Blood Pressure (SBP)	Normal	191	84,1%
	Pre-Hipertensi	16	7,0%
	Hipertensi Stage 1	20	8,8%
Total Cholesterol (TC)	Normal	101	44,5%
	Borderline High	85	37,4%
	High	41	18,1%
High-Density Lipoprotein (HDL)	Low	20	8,8%
	Normal	138	60,8%
	High	69	30,4%
Diabetes	Normal	195	85,9%
	Pre-Diabetes	26	11,5%
	Diabetes	6	2,6%
Smoking status	No	166	73,1
	Yes	61	26,9%
Body mass index (BMI)	Underweight	4	1,8%
	Normal	40	17,6%
	Overweight	42	18,5%
	Obese I	102	44,9%
	Obese II	39	17,2%

Framingham Classification Results

Based on the data of individual characteristics, calculations were made to predict the risk of coronary heart disease in the next 10 years using the Framingham method. The results indicate that 0.4% of workers have a high risk, with 15.9% of them having intermediate risk.

Tabel 2. Framingham Classification Results

Framingham Score Classification	Quantity
Low	181
Intermediate	36
High	10

Bivariate Analysis Results with Chi-Square Test

Performed by regrouping for the hypothesis statistical analysis using chi-square in Table 3. Based on the analysis of the relationship between independent variables and the risk of CHD in PT.X workers, it is known that gender, age, systolic blood pressure, total cholesterol, HDL, fasting blood sugar, smoking habits, and body mass

index (BMI) are significantly associated with the risk of coronary heart disease through the Framingham score as they have a p-value <0.05. The analysis was conducted using IBM SPSS Statistics 26, with detailed results as follows:

Tabel 3. Bivariate Analysis Results

Variables	Variable Categories	Quantity		P-Value	OR
		Low N=181	Inter-High N=46		
Gender	Women	53	1	0,000	18,6
	Men	128	45		
Age	<40	99	1	0,000	54,3
	≥40	82	45		
Systolic Blood Pressure (SBP)	Normal	159	32	0,002	3,2
	Tinggi	22	14		
Total Cholesterol (TC)	<200mg/dL	87	14	0,032	2,1
	≥200mg/dL	94	32		
High-Density Lipoprotein (HDL)	40-60mg/dL	103	35	0,017	0,4
	<40 ;>60mg/dL	78	11		
Diabetes	<100mg/dL	166	29	0,000	6,5
	≥100mg/dL	15	17		
Smoking Status	No	145	21	0,000	4,8
	Yes	36	25		
Body mass index (BMI)	<23	41	3	0,013	4,2
	≥23	140	43		

DISCUSSION

The data analysis results indicate that 0.4% of workers have a high risk of coronary heart disease (CHD) in the next 10 years, while 15.9% have an intermediate risk. Therefore, more attention is needed for managing heart health risks in the workplace. The analysis of the relationship between independent variables and CHD risk shows that gender, age, systolic blood pressure, total cholesterol, HDL, diabetic status, smoking habits, and body mass index (BMI) have a significant association with CHD risk.

This finding is consistent with previous research indicating that these factors significantly contribute to CHD risk [20]. This study was conducted on 227 health examination data of workers, with 53 of them being women and the rest being men. Based on the analysis, it was found that age and gender are significantly related to CHD risk, and men are at 18.6 times higher risk of having a high Framingham risk score compared to women. Additionally, all workers in the high-risk category are men. Men are known to have the onset of CHD about 10-15 years earlier than women [10]. However, after entering menopause, the risk of CHD in women increases 2-4 times due to the influence of sex hormone changes, such as estrogen and testosterone [9].

Apart from gender, high CHD risk only occurs in workers aged ≥40. CHD risk will significantly increase with age [10]. The increased CHD risk due to age occurs because of functional changes in the heart and the development of other risk factors such as obesity and hypertension [9].

Moreover, workers with a BMI ≥25 kg/m2 are defined as obese and are also a risk factor for various lifestyle-related diseases such as hypertension, diabetes, and dyslipidemia. Obesity has negative effects on the cardiovascular system such as systolic/diastolic dysfunction and increased atherosclerotic plaque accumulation [17]. Obesity-related CHD risk factors (glucose intolerance, dyslipidemia, hypertension, and others) increase with increasing visceral fat area [16].

Abnormal lipid metabolism, coagulation system, and inflammatory factor stimulation are some risk factors that damage endothelial cells, and promote inflammatory reactions and lipid deposition, thereby accelerating plaque formation [15]. Increased total cholesterol is a strong risk factor for CHD. Recent studies report that when conventional lipid parameters such as HDL-C, LDL-C, and TC apparently normal, other lipid parameters, such as lipid ratios including TC/HDL-C, LDL-C/HDL-C, and TG/HDL-C, are alternative diagnostics that predict CHD risk. Additionally, increased HDL will lower blood cholesterol levels. HDL-C transports cholesterol from peripheral blood vessels and transports it to the liver for excretion into the bile system [2].

Furthermore, worker with high systolic blood pressure has a 3,2 times higher risk of having a high Framingham risk score compared who have normal systolic blood pressure. Blood pressure shows a continuous

independent relationship with the occurrence of several cardiovascular events, including coronary heart disease. This is evident across all ages and ethnic groups. Systolic blood pressure is a stronger predictor than diastolic pressure [11]. CHD risk increases when risk factors are combined, where blood pressure and other risk factors increase the CHD risk score.

To indicate diabetic status, this study used fasting blood sugar data. Fasting blood sugar levels are linearly and significantly related to cardiovascular disease risk. Hyperglycemia directly affects endothelial function and induces atherosclerosis development [19]. Cardiovascular disease can reduce life expectancy by about 15 years earlier in individuals with type 2 diabetes compared to those without the condition [19]. Someone with fasting blood sugar (FBS) ≥100mg/dL is at a 6.5 times higher risk of having a high Framingham risk score compared to someone with FBS below 100mg/dL.

Smoking habits have a significant relationship with the Framingham risk score, where smokers are 4.8 times more likely to have a high Framingham risk score compared to non-smokers. Smoking occurs when someone consumes cigarettes in their daily life, and still smokes at least 1 stick per day in the last month, including electronic cigarettes [12]. The impact of smoking on cardiovascular health is greater in women. Despite having estrogen as a protective factor against cardiovascular disease, smoking can eliminate this protective factor [13].

The significant relationship between certain risk factors and CHD risk emphasizes the importance of prevention and appropriate intervention in the workplace environment. Increased awareness of the importance of a healthy lifestyle [18], stress management, and cardiovascular health programs in the workplace can help reduce CHD risk among workers [14].

However, this study has several limitations. One of them is that the risk assessment was only conducted on a few variables obtained based on secondary data, thus not fully representing individual risk. Therefore, in future research, it would be better to consider other factors that may affect CHD risk, such as work stress [14], physical activity, dietary patterns and family history, sleep patterns, work schedules [21], workplace noise [22], and others. In addition, a comprehensive and sustainable intervention approach needs to be considered to reduce CHD risk in the workplace.

CONCLUSION

This study concludes that out of the 227 workers included, 10 individuals (0.4%) are predicted to have a high risk of CHD, while 36 individuals (15.9%) are predicted to have an intermediate risk. Based on the analysis of the relationship between independent variables and CHD risk among PT.X workers, it is found that gender (pvalue = 0,000 ; OR 18,6), age (pvalue = 0,000; OR 54,3), systolic blood pressure (pvalue = 0,002; OR 3,2), total cholesterol (pvalue = 0,032; OR 2,1), HDL (pvalue = 0,017; OR 0,4), fasting blood sugar (pvalue = 0,000; OR 6,5), smoking habits (pvalue = 0,000; OR 4,8), and body mass index (BMI) (pvalue = 0,013; OR 4,2) are significantly associated with the risk of coronary heart disease through Framingham values, as they have a p-value <0.05.

The significant relationship between specific risk factors and CHD risk underscores the importance of appropriate prevention and intervention in the workplace. Increasing awareness of the importance of healthy lifestyles, stress management, and workplace heart health programs can help reduce CHD risk among workers.

SUGGESTION

Coronary heart disease is a non-communicable disease caused by several factors. This study was conducted through secondary data analysis from workers' medical check up results, thus further research is needed on primary data such as behavioral patterns including work stress, physical activity, dietary habits, family history, sleep patterns, work schedules, workplace noise, and others.

Based on the risk analysis results, with 10 workers at high risk and 36 at intermediate risk so that priority implementation of health promotion programs can be based on the workers' risk levels. Health promotion programs aim for both primary and secondary prevention. Primary prevention can be done by providing sports facilities, education, and monitoring dietary patterns. Meanwhile, secondary prevention can be ensured by ensuring that workers undergo treatment if diagnosed with the disease.

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