Althea Medical Journal
ISSN Online: 2337-4330
https://doi.org/10.15850/amj.v12n3.4154

Original Article

Determinants of Cardiovascular Disease Risk in the Chronic Disease Management Program at Pasirkaliki Public Health Center, Bandung, Indonesia

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Abstract

Background: Cardiovascular diseases (CVDs) are the leading causes of death worldwide and are influenced by multiple risk factors. Stratifying CVD risk using the World Health Organization (WHO) CVD risk charts for Southeast Asia can support routine management, especially for patients with chronic diseases. This study aimed to assess determinants of CVD risk among patients enrolled in the Chronic Disease Management Program at a Public Health Center.

Methods: This cross-sectional study was conducted in June 2024 at Pasirkaliki Public Health Center, Bandung, Indonesia. Purposive sampling was applied to select medical records and data was extracted, including age, gender, smoking status, history of diabetes mellitus (DM), systolic blood pressure (SBP), and total cholesterol (TC). CVD risk was stratified using WHO CVD risk classification charts for Southeast Asia. Descriptive and correlation analyses were performed.

Results: A total of 124 data patients were collected, with the majority were female adults, non-smokers, had a history of DM with grade 1 hypertension and TC levels between 5.0–5.99 mmol/L. CVD risk stratification showed 43.5% high risk, 25% moderate risk and 16.9% low risk. Interestingly, very high risk was detected in 13.7% and 0.8% was an extremely high risk. Age was strongly correlated with CVD risk ($r=0.708$, $p<0.01$), and SBP showed a moderate correlation ($r=0.646$, $p<0.01$), whereas TC levels were not significantly correlated ($p = 0.064$).

Conclusion: Patient-related factors increase the CVD risk, particularly age and SBP. Routine risk stratification and strengthened chronic disease management program are essential to reduce CVD-related morbidity and mortality.

Keywords: Cardiovascular disease risk, diabetes mellitus, hypertension

Althea Medical Journal.
2025;12(3):154–160

Received: December 24, 2024
Accepted: July 16, 2025
Published: September 30, 2025

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Introduction

Cardiovascular diseases (CVDs) remain a major global health concern due to their high mortality rates. CVDs include coronary artery disease, cerebrovascular disease, peripheral arterial disease, rheumatic heart disease, congenital heart disease, deep venous thrombosis, and pulmonary embolism.[1] The global prevalence of CVD increased from 31 million in 1990 to 55 million in 2019, with most case found in South Asia. Over the same period, CVD-related mortality increased from 12 million to 18 million.[2] According to the Indonesian Health Survey 2023, there were 877,531 individuals diagnosed with CVD, of whom 1.18% lived in West Java.[3]

Multiple risk factors contribute to the development of CVD, including high systolic blood pressure (SBP), elevated low-density lipoprotein cholesterol (LDL-C), high body mass index (BMI), high fasting plasma glucose, kidney dysfunction, poor diet, tobacco use, alcohol consumption, physical inactivity, and air pollution.[4] To address these determinants, the World Health Organization (WHO) developed regional CVD risk charts to estimate 10-year CVD risk, enabling early detection

and prevention strategies. Stratification of CVD risk is especially useful in patients with hypertension, diabetes mellitus (DM), obesity, smoking history, or family history of CVD or kidney disease.[5]

In Indonesia, the Social Security Agency for Health (*Badan Penyelenggara Jaminan Sosial, BPJS Kesehatan*) established the Chronic Disease Management Program (*Program Pengelolaan Penyakit Kronis*, PROLANIS) to improve the health and quality of life of patients with chronic conditions such as hypertension and DM.[6] This program is conducted regularly at Pasirkaliki Public Health Center, Bandung, Indonesia, that serves five urban villages and has been recognized as a public health center for the elderly or a Puskesmas Santun Lansia by the Bandung City Health Office.[7] One of the activities in the PROLANIS is health consultation and monitoring. However, limited evidence exists on how CVD risk stratification can be applied as part of PROLANIS implementation at the primary health care level. This study aimed to assess CVD risk among patients enrolled in the chronic disease management program at Pasirkaliki Public Health Center, Bandung, Indonesia.

Methods

This cross-sectional analytic study was conducted in June 2024 at Pasirkaliki Public Health Center, Bandung, Indonesia, using medical records of patients enrolled in the PROLANIS. Medical records were obtained from the Primary Care (P-Care) BPJS Kesehatan and the *Sistem Informasi Kesehatan Daerah* (SIKDA) of Bandung City. Purposive sampling was used. Inclusion criteria were medical records of PROLANIS participants in June 2024. Exclusion criteria were patients aged <40 years or >74 years, incomplete laboratory examination and medical records. The study protocol was approved by the Health Research Ethics Committee of the Faculty of Medicine, Universitas Padjadjaran, Bandung, West Java, Indonesia No. 1069/UN6.KEP/EC/2024.

Variables included age, gender, smoking status, history of diabetes mellitus (DM), systolic blood pressure (SBP), and total cholesterol (TC) levels. Categorical variables were defined as follows: gender (male or female), smoking status (smokers and non-smokers), and history of DM (yes or no). Age was classified as young (25–44 years), middle-aged (45–60 years), and older adult (61–75 years).8 SBP was divided into optimal (<120 mmHg), normal (120–129 mmHg), high-normal (130–139), grade 1 hypertension (140–159 mmHg), grade 2 hypertension (160–179 mmHg), and grade 3 hypertension (≥ 180 mmHg).[9] TC levels were classified as <4.0, 4.0–4.99, 5.0–5.99, 6.0–6.99, and ≥7.0 mmol/l).[5]

Cardiovascular risk was stratified using the World Health Organization (WHO) laboratory-based CVD risk charts for Southeast Asia. Charts were selected based on gender and history of DM. Risk categories were further determined by smoking status, age group, SBP, and TC levels. Ten-year CVD risk was expressed as a percentage and classified as low (< 5%), moderate (5 – <10%), high (10 – < 20%), very high (20 – < 30%), and extremely high (≥30%).[5]

Data analysis was performed using IBM SPSS® v.26. Descriptive statistics and normality testing were conducted for all variables. Frequencies and percentages were used to describe categorical variables. Spearman's rho and Pearson correlation tests were applied to assess correlations between independent variables and CVD risk. A p-value <0.05 was considered statistically significant.

Results

From 150 medical records screened, one patient was under 40 years, ten were over 74 years, four did not have laboratory examinations, and eleven had incomplete medical records. After applying inclusion and exclusion criteria, 124 medical records were included in this study.

Most patients were female (75.0%), non-smokers (96.0%), and had a history of DM (57.3%). The majority were older adult (61.3%), with grade 1 hypertension (29.0%) and TC levels between 5.0 and 5.99 mmol/l (34.7%) (Table 1).

CVD risk stratification showed that 54 patients (43.5%) were in the high-risk group, followed by moderate risk (n=31; 25.0%), low risk (n=21; 16.9%), very high risk (n=17; 13.7%), and extremely high risk (n=1; 0.8%) (Table 2).

Distribution analysis indicated that high or very high CVD risk was more common among males (48.4%), smokers (50%), and patients with a history of DM (52.1%). CVD risk also increased progressively with age. Half of the patients aged 70–74 years had very high risk, while most patients under 55 years had low or moderate risk. Similarly, higher SBP was associated with greater CVD risk: 61.5% of

Table 1 Characteristics of Patients Enrolled in the Chronic Disease Management Program (n=124)

Parameter	Frequency (n)	Percentage (%)
Gender		
Male	31	25.0
Female	93	75.0
Smoking Status		
Smokers	5	4.0
Non-smokes	119	96.0
History of DM		
Yes	71	57.3
No	53	42.7
Age (years)		
Young (25–44)	1	0.8
Middle (45–60)	47	37.9
Older adult (61–75)	76	61.3
SBP (mmHg)		
Optimal (< 120)	29	23.4
Normal (120–129)	14	11.3
High normal (130–139)	27	21.8
Grade 1 hypertension (140–159)	36	29.0
Grade 2 hypertension (160–179)	13	10.5
Grade 3 hypertension (≥180)	5	4.0
TC levels (mmol/l)		
< 4.0	22	17.7
4.0–4.99	42	33.9
5.0–5.99	43	34.7
6.0–6.99	13	10.5
≥7.0	2	1.6
Total	124	100

Note: DM= Diabetes mellitus, SBP=Systolic blood pressure, TC= Total cholesterol

Table 2 Stratification of CVD Risk (n=124)

Risk Level	Frequency (n)	Percentage (%)
Low (<5%)	21	16.9
Moderate (5 – <10 %)	31	25.0
High (10 – < 20%)	54	43.5
Very high (20 – < 30%)	17	13.7
Extremely high risk (≥30%)	1	0.8

patients with SBP 160–179 mmHg and 60% of those with SBP ≥180 mmHg were classified as very high risk. In contrast, patients with SBP <120 mmHg were more likely to have low risk. TC levels showed no consistent pattern with CVD risk (Table 3).

Correlation analysis demonstrated a strong positive correlation between age and CVD risk ($r=0.708$, $p<0.01$) and a moderate to strong positive correlation between SBP and CVD risk ($r=0.646$, $p<0.01$). In contrast, the correlation between TC levels and CVD risk was not statistically significant ($r=0.165$, $p=0.067$) (Table 4).

Discussion

This study has found that male has a higher risk of CVD risk than female, similar to other studies reported in Indonesia.[10,11] Gender may influence CVD outcomes through multiple mechanisms.[12,13] Females generally experience better outcomes due to differences in autonomic regulation and the protective role

Table 3 Distribution of Patient Characteristics According to CVD Risk Stratification

Characteristics	Risk Level					Total n (%)
	Low n (%)	Moderate n (%)	High n (%)	Very High n (%)	Extremely High n (%)	
Gender						
Male	3 (9.7)	8 (25.8)	15 (48.4)	5 (16.1)	-	31
Female	18 (19.4)	23 (24.7)	39 (41.9)	12 (12.9)	1 (1.1)	93
Smoking status						
Smokers	1 (16.7)	1 (16.7)	3 (50)	-	1 (16.7)	6
Non-smokers	20 (17.0)	30 (25.4)	51 (43.2)	17 (14.4)	-	118
History of DM						
Yes	3 (4.2)	13 (18.3)	37 (52.1)	17 (24.0)	1 (1.4)	71
No	18 (34.0)	18 (34.0)	17 (32.0)	-	-	53
Age (years)						
40–44	1 (100)	-	-	-	-	1
45–49	7 (100)	-	-	-	-	7
50–54	9 (50.0)	8 (44.4)	1 (5.6)	-	-	18
55–59	3 (17.6)	7 (41.2)	7 (41.2)	-	-	17
60–64	1 (4.4)	7 (30.4)	13 (56.5)	2 (8.7)	-	23
65–69	-	9 (28.1)	21 (65.6)	2 (6.3)	-	32
70–74	-	-	12 (46.2)	13 (50.0)	1 (3.8)	26
SBP (mmHg)						
<120	7 (24.1)	12 (41.4)	8 (27.6)	2 (6.9)	-	29
120–139	10 (24.4)	13 (31.7)	18 (43.9)	-	-	41
140–159	4 (11.1)	6 (16.7)	22 (61.1)	4 (11.1)	-	36
160–179	-	-	5 (38.5)	8 (61.5)	-	13
≥180	-	-	1 (20.0)	3 (60.0)	1 (20.0)	5
TC levels (mmol/l)						
<4	2 (9.1)	7 (31.8)	12 (54.6)	1 (4.5)	-	22
4–4.99	10 (23.8)	12 (28.6)	18 (42.9)	2 (4.7)	-	42
5–5.99	7 (16.3)	8 (18.6)	16 (37.2)	11 (25.6)	1 (2.3)	43
6–6.99	2 (15.4)	4 (30.7)	5 (38.5)	2 (15.4)	-	13
≥7.0	-	-	1 (50.0)	1 (50.0)	-	2

Table 4 Correlation between CVD Risk and Age, SBP, and TC levels

Variable	Correlation Coefficient (r)	Significance (p-value)
Age	0.708**	<0.001
Systolic blood pressure	0.646**	<0.001
Total cholesterol	0.165	0.067

of estrogen, which improves lipid metabolism by lowering low-density lipoprotein (LDL) and lipoprotein A, and increasing high-density lipoprotein (HDL).[12]

Smoking is associated with a higher CVD risk, as consistently shown in other studies with global evidence, linking smoking to vascular endothelial damage through oxidative stress and inflammation.[14,15] However, most patients in this study were non-smokers, which may have attenuated the association. Contrasting results may reflect lifestyle changes or low smoking prevalence in those cohort.[11,16] Regardless, evidence consistently demonstrates increased CVD morbidity and mortality among smokers.[14]

Furthermore, DM is also strongly associated with higher CVD risk as evidenced in other studies.[11,17] A systematic review reported that one-third of patients with DM type 2 worldwide develop CVD.[18] CVD is also the main leading cause of comorbidity and death

in patients with DM.[19] Insulin resistance and deficiency contribute to dyslipidemia, impaired triglyceride clearance, and altered HDL function, all of which promote atherogenesis.[20] These mechanisms highlight the importance of glycemic control in CVD prevention.

Another significant determinant is age, with risk increasing sharply in older adult patients, similar to various studies.[11,16,17] This finding is supported by global evidence linking population aging to greater CVD burden.[21] Hormonal decline, frailty, obesity, and the accumulation of comorbidities may contribute to this effect.[22]

Likewise, systolic blood pressure has shown a strong positive correlation with CVD risk.[11,16,17] Progressive increases in ischemic heart disease risk at SBP is above 130 mmHg.[23] Thus, SBP has become one of the leading CVD risks.[24] Most patients in this have grade 1 hypertension, and the risk has increased with higher SBP.[11,17] Furthermore, another study using JAKVAS also reported a high risk of CVD among patients with grade III hypertension.[16] Elevated blood pressure increases levels of matrix metalloproteinase-2 (MMP-2) and matrix metalloproteinase 9 (MMP-9), which are involved in vascular remodeling. These changes can lead to tissue destruction, fibrosis, and matrix weakening, ultimately resulting in vascular damage.[25]

In contrast, total cholesterol (TC) levels are not significantly correlated with CVD risk in this study. This may be due to TC reflecting a composite of HDL, LDL, and very low-density lipoprotein (VLDL), masking the differential roles of lipid subfractions. A study in Africa reported a high prevalence of dyslipidemia among patients with CVD, most commonly characterized by low HDL levels, followed by elevated triglycerides, TC, and LDL levels.[26] LDL in particular, is the main driver of atherosclerosis through arterial wall accumulation and fibrous plaque formation.[27] Previous studies have shown that increases in TC and LDL predict higher CVD risk.[28,29] Future studies should evaluate detailed lipid profiles rather than TC alone to clarify these associations. Overall, nearly half of patients in this study have been classified as high risk for CVD over the next decade, highlighting the importance of integrating risk stratification into routine PROLANIS practice.[10,30]

This study has limitations, including a relatively small sample size restricted to patients enrolled in the chronic disease management program at Pasirkaliki Public Health Center. In addition, there is an imbalance in gender distribution and smoking status, with a predominance of female patients and only five patients who were smokers, which may have influenced the findings. Future studies with larger, more diverse populations and longitudinal designs are recommended to strengthen these findings and provide a more comprehensive understanding of CVD risk factors.

In conclusion, cardiovascular diseases risk is strongly associated with age, systolic blood pressure, smoking, and history of diabetes mellitus, but not with total cholesterol levels. Most patients in the PROLANIS program are classified as high risk. Routine cardiovascular diseases risk assessment and targeted management of hypertension, diabetes, and smoking are essential strategies for reducing cardiovascular diseases burden.

These findings reinforce the importance of integrating structured cardiovascular risk assessment into chronic disease management at the primary care level. Strengthening PROLANIS with personalized risk tools, lifestyle modification, and close monitoring of high-risk patients can promote healthy aging, reduce complications, and support wellness.

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