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Prevalence and Factors Associated with Coronary Artery Disease (CAD) and Its Associated Factors among People Aged 35 Years and Over in Thailand: A Cross-Sectional Analysis

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ABSTRACT

Background: Coronary artery disease (CAD) is a significant public health problem. CAD remains the leading cause of death worldwide, estimated 85% occurring in low-income and middle-income countries, and act as the number one cause of death in all ages and from all races. While CAD is a significant cause of death and disability, it is preventable.

Objectives: The aim of this study was to assess the prevalence and factors associated with CAD among people aged 35 years and over in Thailand.

Methods: The data for this cross-sectional study was extracted from the Health Data Center (HDC) of Thailand's Ministry of Public Health between 2016-2021 were used. The outcome, defined as having CAD diagnosed previously by a physician. This study comprised a total of 128,065 participants who matched the HDC inclusion criteria. Generalized linear mixed model (GLMM) analysis was used to assess independent factors associated with CAD among people aged 35 years and over.

Results: Records of 128,065 participants were included for analysis. The prevalence of CAD among people aged 35 years and over were 30.83% (95%CI=30.57-31.08). In GLMM analysis, being female (Adj.OR=2.57, 95%CI=2.48-2.66), 60 years and higher (Adj.OR=3.22, 95%CI=2.99-3.46), alcohol regularly (Adj.OR=2.74, 95%CI=2.61-2.87), family history of DM (Adj.OR=2.71, 95%CI=2.61-2.82), obesity (≥25 kg/m^2) (Adj.OR= 3.62, 95%CI=3.26-4.02), high blood pressure (>140/>90 mmHg) (Adj.OR= 5.34, 95%CI=5.11-5.58), high FBS (≥126 mg/dL) (Adj.OR= 1.53, 95%CI=1.48-1.58), high LDL (>100 mg/dL)(Adj.OR=7.11, 95%CI=6.84-7.38), low HDL (<40 mg/dL) (Adj.OR=3.69, 95%CI=3.55-3.82), eGFR stage 2 (moderate loss of kidney function) (<60 ml/min/ 1.73 m2) (Adj.OR=2.32, 95%CI=2.22-2.42)

Conclusion: Results of the present research showed that, there is a significant relationship between modifiable risk factors of CAD. The findings of this study will benefit public sectors or related organizations and policymakers' developers to develop efficient measures to control factors of CAD among people aged 35 years and over in the country.

Keywords: Coronary artery disease (CAD), Modifiable risk factors, People aged 35 years and over

1. Introduction

Coronary artery disease is one of the four major non-communicable diseases. That the World Health Organization focuses on and controls urgently [1]. According to the World Health Organization Mortality Report in 2016, approximately 56.9 million people die worldwide each year. Coronary artery disease is the number 1 cause of death estimates [1]. There were 9.2 million deaths, or 16.2%, in Thailand. In adults, the prevalence of CAD worldwide is 2%–3% [2]. The risk of a recurrent cardiovascular event is higher (17% of men and 21% of women) in the following 5 years after the first cardiovascular event in this age group, with a similar risk of heart failure. This translates to a cost of 30 billion dollars per year and 6.8 million years of life lost. The prevalence of CAD equates to a high economic cost with regard to health and impact on population productivity [1].

The report of the Strategic Division and Work Plans of the Ministry of Public Health, 2013–2017, found that the mortality rate from coronary heart disease (I20-I25) per 100,000 populations was 26.9, 27.8, 29.9, 32.3, and 31.8 and was consistent with the coronary heart disease rate (I20-I25) per 100,000 populations of 431.91, 401.70, 501.13, 210.21, and 501.41, respectively, based on data on both mortalities and cardiovascular morbidity. And continues to intensify loss of health years from premature death and disability. The Disability-Adjusted Life Years (DALYs) 2014 found that coronary heart disease was the 4th cause of loss of healthy years in males and the 3rd in females, affecting the quality of life of the population. Incurring economic losses from premature death both at the individual, family, social and national levels (Non-communicable disease division, Department of Disease Control, 2019). According to statistics from the Ministry of Public Health, in 2018, there were 432,943 Thai people suffering from coronary heart disease, with a death rate of 20,855 people per year, or two people per hour. Patients who received treatment with a large number of causing congestion problems in the emergency room which is a public health problem. An estimated 17.9 million people died from coronary heart disease in 2019, accounting for 32.0% of global deaths. Of these deaths, 85% were caused by heart attack and stroke [3].

From the statistical data, it was found that coronary artery disease is associated with many irreversible risk factors, such as age, gender, family history and ethnicity [4], but there are also behavioral risk factors. Which can be modified. Overweight and obesity in Thailand

found that the prevalence of obesity (Body Mass Index, BMI greater than 25 kg per square meter) tends to be higher. Especially females increased from 34.4% to 40.7%, while males increased from 22.5% to 28.4%. A higher BMI affects the incidence of coronary heart disease and high blood pressure. Found a prevalence of 22.0%. Hyperglycemia. Found a prevalence of 6.9% hypolipidemia. The prevalence was 21.7%. Exercise behavior. Not enough exercise Prevalence 18.5%. Smoking behavior in the Thai population. The prevalence was 38.7% and excessive alcohol consumption behavior. Will affect blood pressure (Hypertension Association of Thailand, 2016). Despite being a high-impact disease worldwide, only a few studies have evaluated the risk factors of CAD in the late adult and elderly population in Thailand. Therefore, given the existing information gap, and the importance of epidemiology to implement primary and secondary prevention strategies, this study intends to evaluate the association of CAD factors among people aged 35 years and over in Thailand. The results of the study were used as a guideline for planning the prevention and control of CAD incidence. So that people who are at risk of coronary heart disease can manage themselves by reducing risk factors and adjusting health behaviors to be appropriate.

2. Methods

2.1 Study design and population

This was a cross-sectional study. Quantitative data were analyzed using secondary data from the Health Data Center (HDC) of the Ministry of Public Health. To study the prevalence and identify the relationship of factors associated with coronary heart disease in the Thai population. The population used in this research was people living in all 76 provinces of Thailand. The groups used in this study were people aged 35 years and over, both male and female. With information on coronary artery disease screening and health behaviors From the Health Data Center (HDC) of the Ministry of Public Health, 4,539,677 people (Information and Communication Technology Center Ministry of Public Health, 2021)

2.2 Study procedure and data collection

In this study, the investigators used secondary data from the Health Data Center (HDC) of the Ministry of Public Health. From the fiscal year 2016 to 2021, the sample group in this study was a population aged 35 years and over in all 76 provinces of Thailand, which meant ready-made data that could be used in the analysis process. It can be classified as standard file data according to the standard structure of health information. Ministry of Public Health (43 files). The researcher selected variables in the study from the review of concepts, theories, and

related research. It uses five standard files: according

1. PERSON file collects general information about people in the responsible area. And those who use the service, such as gender, date of birth, marital status, occupation, race, nationality, religion, education level.
2. CHRONIC file is a data collection of patients with chronic and coronary artery diseases. Everyone who lives in the area of responsibility and or those who receive services such as chronic diseases, days of chronic illness first diagnosed hospital.
3. HOME file stores the location and sanitation of households in the responsible area, such as address type, house number, village, sub-district, district, and province.
4. NCDSCREEN file is a record of cardiovascular screening services for those who receive benefits such as smoking history. Alcohol drinking history, History of illness in direct relatives, weight, height, waist circumference, blood pressure, blood sugar.
5. LABFU file is a laboratory examination of the person receiving services, such as laboratory test code. And results of laboratory tests**.**

2.3 Statistical analysis

This study was conducted by using the STATA version 10 program (copyright of Khon Kaen University). Descriptive statistics described personal characteristics such as gender, age, occupation, highest educational level, marital status, and history of diabetes in direct relatives. History of hypertension in direct relatives, smoking, alcohol use, waist circumference, and body mass index. In the case of enumeration data, use frequency distribution statistics (percentage); in the case of continuous data, use statistics, mean, standard deviation, median, maximum, and minimum and use inferential statistics to estimate the prevalence of chronic illnesses. With frequency, percentage, and confidence interval at a 95% confidence level, we then analyze related factors with statistics that can control the clustering effect in each province. The researchers used Generalized Linear Mixed Models (GLMM) statistics with a binomial distribution for provinces in the equation to randomize the effects equations using an Exchangeable correlation structure with Connecting (Link) Logit sub-equations in the (Family) Binomial, the results of which are more suitable than using standard logistic regression equations as follows:

Pairwise analysis Using simple logistic regression analysis, the crude odds ratio and the 95%CI of crude OR were shown to determine the relationship between two variables, one dependent variable. And one independent

variable at a time, regardless of the effect of the remaining variables. Then, multivariate analysis was performed. was imported into the initial model to lead the analysis.

Multivariate analysis using Generalized Linear Mixed Models (GLMM) statistics, starting with all independent variables in the equation and considering the importance of content by the researcher himself. Then look at the relationship between one dependent variable and one independent variable, considering the effects of the remaining variables. Determine the p-value for entry (Pe) < 0.25, the p-value for remove (Pr) > Pe [5]. This study aimed to identify risk factors and to identify models or models for predicting the prevalence of coronary heart disease in different areas. Therefore, the investigator selected only the variables that were significant in studying. Correlated covariates were added to the model and removed by the backward elimination method, and then the suitability of the model was assessed. Then presented as an Adjusted OR and 95%CI at a significance level of 0.05 ($\alpha = 0.05$).

2.4 Ethical Clearance

This study performed secondary data analysis. The investigator submitted details of the study outline and sample tools used in this study to the Human Research Ethics Committee and has been certified ethical by the Human Research Ethics Committee, Khon Kaen University No. HE652004 certified on 22 December 2021.

3. Results

3.1 Demographic Characteristics

General characteristics of the total sample number of 128,065 people, mostly female (57.5%), age group 35-44 years (57.1%), education level, mostly at secondary school/vocational level. (39.1%) Marital status (45.2%) Most occupations are general labor/workers (37.7%) Buddhists (95.8%) No history of diabetes in their immediate relatives (71.9%) No history of hypertension in their immediate relatives Straight (73.63%), habitual smoking behavior (8.4%), regular alcohol drinking behavior (12.6%), physiological factors of the sample Most of them had a normal BMI (54.1%), with a waist circumference above the threshold (56.6%), and most of them were female (41.7%). Blood pressure was normal (81.0%). FBS is normal (54.5%), Creatinine is normal (91.8%), Triglyceride is normal (68.6%), LDL cholesterol is high (51.8%). HDL cholesterol is normal (76.2%), eGFR stage 1, renal impairment (41.3%), and Total cholesterol was high (67.9%), Table 1.

Table**1:** Demographic characteristics of the sample (n=128,065)

Individual characteristics	Number	Percentage
Gender		
Female	73,692	57.54
Male	54,373	42.46
Age group		
35 - 44 years	73,192	57.15
45 - 59 years	47,453	37.05
60 years and over	7,420	5.80
Mean (S.D.)	44.92	(4.01)
Median (Minimum: Maximum)	35	(35:69)
Education level		
Elementary school/not educated	9,476	7.40
Secondary education/vocational	50,042	39.08
Diploma/High Vocational Certificate	44,565	34.80
Bachelor's degree	22,636	17.68
Postgraduate	1,346	1.04
Marital status		
Married	57,927	45.23
Single	55,621	43.43
Widowed/Divorced/Separated	13,023	10.17
Clergyman	1,494	1.17
Occupation		
General Contractor/Worker	48,272	37.69
Agriculture/animal husbandry	28,172	22.00
butler/housekeeper/not working	7,180	5.61
Government officer	13,519	10.56
Product vendor/trading	25,284	19.74
Professional practitioners/private company employees	5,638	4.40
Religion		
Buddhism	122,641	95.76
Christianity	4,740	3.70
Islam	556	0.44
Other/non-religious	128	0.10
History of diabetes in a close relative		
Yes	36,015	28.12
No	92,050	71.88
History of high blood pressure in a close relative		
Yes	33,772	26.37
No	94,293	73.63
Smoking behavior		
Don't smoke	111,888	87.37
Occasionally smoke	5,398	4.21
Smoke regularly	10,779	8.42
Alcohol drinking behavior		
Don't drink	110,137	86.00
Occasional drink	1,745	1.36
Drink regularly	16,183	12.64
Body Mass Index; BMI		
Underweight (<18.5 kg/m^2)	5,416	4.23
Normal (18.5-22.9 kg/m^2)	69,265	54.09
Overweight (23.0-24.9 kg/m^2)	33,457	26.13
Obesity (≥25 kg/m^2)	19,927	15.56
Mean (S.D.)	25.34	(5.70)
Median (Minimum: Maximum)	24.00	(12:54)

Individual characteristics	Number	Percentage
Waist circumference; WC		
Normal	55,604	43.42
Exceed the threshold	72,461	56.58
- Male (>90 cm.)	19,069	14.89
- Female (>80 cm.)	53,392	41.69
Mean (S.D.)	83.76	(10.00)
Median (Minimum: Maximum)	83.00	(48:143)
Blood pressure; BP		
Normal	103,766	81.03
High (>140/ >90 mmHg)	24,299	18.97
Fasting blood sugar; FBS		
Normal	69,160	54.00
High (≥126 mg/dL)	58,905	46.00
Mean (S.D.)	110.09	(32.17)
Median (Minimum: Maximum)	98.00	(55:301)
Creatinine; Cr		
Normal	117,523	91.77
High (>1.5 mg/dL)	10,542	8.23
Mean (S.D.)	1.11	(2.47)
Median (Minimum: Maximum)	0.90	(0.1:95)
Triglyceride		
Normal	87,836	68.59
High (>150 mg/dL)	40,229	31.41
Mean (S.D.)	136.26	(59.74)
Median (Minimum: Maximum)	126.00	(35.0:339.0)
Low-Density Lipoprotein; LDL		
Normal	61,693	48.17
High (>100 mg/dL)	66,372	51.83
Mean (S.D.)	124.72	(39.78)
Median (Minimum: Maximum)	124.00	(33.0:288.0)
High-Density Lipoprotein; HDL		
Normal	97,537	76.16
Low (<40 mg/dL)	30,528	23.84
Mean (S.D.)	51.74	(13.61)
Median (Minimum: Maximum)	50.00	(15.0:117.0)
Estimated Glomerular Filtration Rate; eGFR		
Normal (>90 ml/min/1.73 m^2)	45,374	35.43
Stage 1 Kidney failure (60-89 ml/min/1.73 m^2)	52,840	41.26
Stage 2 Kidney Replacement Therapy (<60 ml/min/1.73 m^2)	29,851	23.31
Mean (S.D.)	76.52	(24.26)
Median (Minimum: Maximum)	80.00	(9.6:154.0)
Total Cholesterol		
Normal	41,007	32.02
High (≥200 mg/dL)	87,058	67.98
Mean (S.D.)	210.19	(51.59)
Median (Minimum: Maximum)	214.00	(52.0:347.0)

3.2 Prevalence of Coronary Artery Disease

From the data analysis, the incidence of coronary artery disease among 128,065 people aged 35 years and over in Thailand was found to be 30.8% (95%CI=30.57–31.08), and females were more likely to develop coronary heart disease than males, 22.4% (95%CI=22.17-22.63), with

the majority of patients suffering from coronary artery disease, 47.9% (95%CI=47.37-48.36), Table 2.

Table 2: Prevalence of Coronary Artery Disease (n= 128,065)

Prevalence of Coronary Artery Disease	Number	Percentage	95%CI
Coronary heart disease			
Non-diseased	88,585	69.17	68.91-69.42
Diseased	39,480	30.83	30.57-31.08
Diseased with Coronary Artery Disease by gender			
Male	10,791	8.43	8.27-8.57
Female	28,689	22.40	22.17-22.63
Coronary Artery Disease by age group			
35-44 years	16,170	12.62	12.44-12.81
45-59 years	18,900	14.76	14.56-14.95
60 years and over	4,410	3.44	3.34-3.54

3.3 Factors associated with CAD of among People Aged 35 Years and over

Table 3 shows the relationship between various factors and coronary artery disease among people aged 35 years and over in Thailand. from the pairwise analysis Using simple logistic regression analysis, it was found that females had a statistically significant risk of coronary heart disease 2.57 (95%CI=2.50-2.64) at p-value<0.001. Compared to those aged 35-44, those aged 45-59 and 60 and over were 2.33 (95%CI=2.27-2.39) and 5.16 (95%CI=4.91-5.42), respectively. Statistically significant at p-value<0.001 for marital status Compared to the married group, single, widowed/divorced/separated, and remarried were 1.11 (95%CI= 1.08-1.14), 1.18 (95%CI=1.13-1.23) and 1.28 (95%CI=1.15-1.43), respectively. As for occupation, compared to the butler/housewife/not working group, it was found that the civil servant group of distributors/trading Professional groups/private employees General Contractor/Workers and agriculture/animal husbandry groups. The potential risks are 1.01 (95%CI=0.94-1.07) and 1.09 (95%CI=1.03-1.16) and 1.10(95%CI=1.01-1.18) and 1.17(95%CI=1.10-1.23) and 1.25(95%CI=1.17-1.31), respectively. P-value <0.001 Compared with the group with primary education/uneducated, it was found that secondary education/vocational education Diploma/High Vocational Education bachelor's degree and postgraduate education level the chances of risk are 1.99 (95%CI=1.69-2.34) and 2.96 (95%CI=2.52-3.48) and 3.64 (95%CI=3.10-4.28) and 4.25 (95%CI=3.60-5.02), respectively. Statistically significant that p-value<0.001, and for the history of diabetes in direct relatives Compared with those without a history of diabetes in their

immediate relatives, it was found that those with a history of diabetes in their immediate relatives There was a risk of 4.44 (95%CI= 4.32-4.56) with statistical significance that p-value<0.001 and for smoking behavior Compared with non-smokers, it was found that the occasional smokers and those who smoke regularly There were 1.48 (95%CI=1.40-1.56) and 2.18 (95%CI=2.10-2.27), respectively, with statistical significance at p-value<0.001. for drinking behavior. Compared with the non-alcoholic group, it was found that the occasional alcoholic drinker and those who drink alcohol regularly were 1.44 (95%CI=1.30-1.59) and 3.31 (95%CI= 3.20-3.42), respectively, with statistical significance. p-value<0.001.

Physiological factors Body mass index: Compared to the underweight group, BMI<18.5 kg/m^2, it was found that the normal weight group, BMI of 18.5-22.9, the overweight group 23.0-24.9 and the obese group ≥25 kg/m^2 were 1.64 (95%CI=1.52-1.78) and 4.02 (95%CI=3.71-4.35) and 6.75 (95%CI=6.22-7.32), respectively, were statistically significant at p-value<0.001 for waist circumference compared to the circumference group. Normal waist found that waist circumference exceeded the threshold. There was a 6.16 (95%CI=5.98-6.34) statistically significant risk at p-value<0.001. In laboratory results, blood pressure values compared to normal blood pressure group found high blood pressure values were at risk of 3.61 (95%CI=3.51-3.72), statistically significant at p-value<0.001 for values. Fasting blood sugar compared to the normal Fasting blood sugar group found that the high Fasting blood sugar group had a statistically significant risk of 2.87 (95%CI=2.80-2.94) at p-value < 0.001 for creatinine compared to normal fasting blood sugar. In the normal creatinine group, it was found that the high creatinine group had a statistically significant risk of 2.20 (95%CI=2.12-2.30) at p-value <0.001. was 1.03 (95%CI=1.00-1.06) statistically significant at p-value<0.001 for Low-Density Lipoprotein (LDL) compared to the normal LDL group, found that the high LDL group had a risk of 3.64 (95 %CI=3.54-3.73) statistically significant at p-value<0.001 High-Density Lipoprotein (HDL) values compared to normal HDL group found that the low HDL group was at risk of 3.25 (95%CI=3.16-3.33) statistically significant at p-value<0.001 eGFR values compared to the normal eGFR group found that Stages 1 and 2 had a risk of 1.50 (95%CI=1.46-1.54) and 2.34 (95%CI=2.27-2.42), respectively, with statistically significant p-value<0.001. For Total Cholesterol, compared to the normal Total Cholesterol group, it was found that the High Total Cholesterol group had a 4.40-fold chance of risk (95%CI=4.26-4.54) with a statistically significant p-value<0.001.

Table 3: Factors associated with coronary artery disease among People Aged 35 Years and over in Thailand by bivariate analysis (n = 128,065)

Factors	Number	%CAD	Crude OR	95%CI	p-value
Gender					<0.001
Male	54,373	19.85	1	1	
Female	73,692	38.93	2.57	2.50-2.64	
Age group					<0.001
35 - 44 years	73,192	22.09	1	1	
45 - 59 years	47,453	39.83	2.33	2.27-2.39	
60 years and over	7,420	59.43	5.16	4.91-5.42	
Marital status					<0.001
Married	57,927	29.40	1	1	
Single	55,621	31.70	1.11	1.08-1.14	
Widowed/Divorced/Separated	13,023	32.98	1.18	1.13-1.23	
Clergyman	1,494	34.87	1.28	1.15-1.43	
Occupation					<0.001
Butler/Housekeeper/not working	7,180	28.11	1	1	
Government officer	13,519	28.29	1.01	0.94-1.07	
Product vendor/Trading	25,284	29.98	1.09	1.03-1.16	
Professional practitioners/Private company employees	5,638	30.06	1.10	1.01-1.18	
General Contractor/Worker	48,272	31.35	1.17	1.10-1.23	
Agriculture/Animal husbandry	28,172	32.76	1.25	1.17-1.31	
Education level					<0.001
Elementary school/not educated	9,476	38.10	1	1	
Secondary education/vocational	50,042	34.51	1.99	1.69-2.34	
Bachelor's degree	22,636	22.38	2.96	2.52-3.48	
Diploma/High Vocational Certificate	44,535	29.99	3.64	3.10-4.28	
Postgraduate	1,346	12.63	4.25	3.60-5.02	
Religion					<0.328
Other/non-religious	128	28.91	1	1	
Islam	4,740	28.97	1.00	0.68-1.47	
Christianity	556	29.50	1.02	0.67-1.57	
Buddhism	122,641	30.91	1.10	0.75-1.61	
History of diabetes in a close relative					<0.001
No	92,050	21.44	1	1	
Yes	36,015	57.81	4.44	4.32-4.56	
History of high blood pressure in a close relative					<0.079
No	94,293	30.69	1	1	
Yes	33,772	31.21	1.02	0.99-1.05	
Smoking behavior					<0.001
Don't smoke	111,888	28.93	1	1	
Occasionally smoke	5,398	37.63	1.48	1.40-1.56	
Smoke regularly	10,779	47.11	2.18	2.10-2.27	
Alcohol drinking behavior					<0.001
Don't drink	110,137	27.17	1	1	
Occasional drink	1,745	35.01	1.44	1.30-1.59	
Drink regularly	16,183	55.27	3.31	3.20-3.42	
Body Mass Index; BMI					<0.001
Underweight (<18.5 kg/m^2)	5,416	14.18	1	1	
Normal (18.5-22.9 kg/m^2)	69,265	21.41	1.64	1.52-1.78	
Overweight (23.0-24.9 kg/m^2)	33,457	39.95	4.02	3.71-4.35	
Obesity (≥25 kg/m^2)	19,927	52.75	6.75	6.22-7.32	
Waist circumference; WC					<0.001
Normal	55,604	11.88	1	1	

Factors	Number	%CAD	Crude OR	95%CI	p-value
Exceed the threshold	72,461	45.37	6.16	5.98-6.34	
Blood pressure (BP; mmHg)					<0.001
Normal	103,766	25.19	1	1	
High (>140/>90 mmHg)	24,299	54.90	3.61	3.51-3.72	
Fasting blood sugar (FBS; mg/dL)					<0.001
Normal	69,160	20.65	1	1	
High (≥126)	58,905	42.78	2.87	2.80-2.94	
Creatinine (Cr; mg/dL)					<0.001
Normal	117,523	29.30	1	1	
High (>1.5)	10,542	47.81	2.20	2.12-2.30	
Triglyceride (TG; mg/dL)					<0.001
Normal	87,836	30.60	1	1	
High (>150)	40,229	31.32	1.03	1.00-1.06	
Low-Density Lipoprotein (LDL; mg/dL)					<0.001
Normal	61,693	17.36	1	1	
High (>100)	66,372	43.35	3.64	3.54-3.73	
High-Density Lipoprotein (HDL; mg/dL)					<0.001
Normal	97,537	24.44	1	1	
Low (<40)	30,528	51.25	3.25	3.16-3.33	
eGFR (ml/min/1.73 m2)					<0.001
Normal (>90)	45,374	23.23	1	1	
Stage 1 Kidney failure (60-89)	52,840	31.30	1.50	1.46-1.54	
Stage 2 Kidney Replacement Therapy (<60)	29,851	41.55	2.34	2.27-2.42	
Total Cholesterol (CHOL; mg/dL)					<0.001
Normal	41,007	12.82	1	1	41,007
High (≥200)	87,058	39.31	4.40	4.26-4.54	87,058

After controlling the clustering effects using a Generalized Linear Mixed Model (GLMM) analysis found the factors related to the CAD among people aged 35 years and over in Thailand, being female (Adj.OR=2.57, 95%CI=2.48-2.66), 45-59 age group (Adj.OR=1.77, 95%CI=1.71-1.84), 60 years and higher age group (Adj.OR=3.22, 95%CI=2.99-3.46), alcohol occasionally (Adj.OR=1.29, 95% CI=1.13-1.48), alcohol regularly (Adj.OR=2.74, 95%CI=2.61-2.87), family history of DM (Adj.OR=2.71, 95%CI=2.61-2.82), normal weight (18.5-22.9 kg/m^2) (Adj.OR=1.57, 95%CI=1.42-1.73), overweight (23.0-24.9 kg/m^2) (Adj.OR=3.24, 95%CI=2.93-3.59), obesity (≥25 kg/m^2) (Adj.OR= 3.62, 95%CI=3.26-4.02), high blood pressure (>140/>90 mmHg) (Adj.OR= 5.34, 95%CI=5.11-5.58), high FBS (≥126 mg/dL) (Adj.OR= 1.53, 95%CI=1.48-1.58), high LDL (>10 0 mg/dL) (Adj.OR=7.11, 95%CI=6.84-7.38), low HDL (<40 mg/dL) (Adj.OR=3.69, 95%CI=3.55-3.82), eGFR stage 1 (mild loss of kidney function (60-89 ml/min/1.73 m^2) (Adj.OR=1.42, 95%CI=1.37-1.48), eGFR stage 2 (moderate loss of kidney function) (<60 ml/min/ 1.73 m^2) (Adj.OR=2.32, 95%CI=2.22-2.42). Table 4

Table 4: Factors associated with coronary artery disease among people aged 35 years and over in Thailand by multivariate analysis (GLMM) (n = 128,065).

Factors	Number	%CAD	Crude OR	Adj. OR	95%CI	p-value
Gender						<0.001
Male	54,373	19.85	1	1	1	
Female	73,692	38.93	2.57	2.57	2.48-2.66	
Age group						<0.001
35 - 44 years	73,192	22.09	1	1	1	
45 - 59 years	47,453	39.83	2.33	1.77	1.71-1.84	
60 years and over	7,420	59.43	5.16	3.22	2.99-3.46	
Alcohol drinking behavior						<0.001
Don't drink	110,137	27.17	1	1	1	
Occasional drink	1,745	35.01	1.44	1.29	1.13-1.48	
Drink regularly	16,183	55.27	3.31	2.74	2.61-2.87	
History of diabetes in a close relative						<0.001
No	92,050	21.44	1	1	1	
Yes	36,015	57.81	4.44	2.71	2.61-2.82	
Body Mass Index; BMI						<0.001
Underweight (<18.5)	5,416	14.18	1	1	1	
Normal (18.5-22.9)	69,265	21.41	1.64	1.57	1.42-1.73	
Overweight (23.0-24.9)	33,457	39.95	4.02	3.24	2.93-3.59	
Obesity (≥25)	19,927	52.75	6.75	3.62	3.26-4.02	
Blood pressure (BP; mmHg)						<0.001
Normal	103,766	25.19	1	1	1	
High (>140/ >90 mmHg)	24,299	54.90	3.61	5.34	5.11-5.58	
Fasting blood sugar (FBS; mg/dL)						<0.001
Normal	69,160	20.65	1	1	1	
High (≥126)	58,905	42.78	2.87	1.53	1.48-1.58	
Low-Density Lipoprotein (LDL; mg/dL)						<0.001
Normal	61,693	17.36	1	1	1	
High (>100)	66,372	43.35	3.64	7.11	6.84-7.38	
High-Density Lipoprotein (HDL; mg/dL)						<0.001
Normal	97,537	24.44	1	1	1	
Low (<40)	30,528	51.25	3.25	3.69	3.55-3.82	
eGFR (ml/min/1.73 m^2)						<0.001
Norma (>90)	45,374	23.23	1	1	1	
Stage 1 (60-89)	52,840	31.30	1.50	1.42	1.37-1.48	
Stage 2 (<60)	29,851	41.55	2.34	2.32	2.22-2.42	

4. Discussion

The prevalence of CAD among people aged 35 years and over in Thailand. In this study, 30.83%, consistent with the 2019 study on the prevalence of cardiovascular disease in Thailand, found that there was a 20% prevalence of the cardiovascular disease. Such as diabetes, high blood pressure, Hyperlipidemia, and kidney disease are found to have a prevalence of cardiovascular disease as high as 40% (Office of the Permanent Secretary, Ministry of Public Health, 2019)

Analysis of relationship factors with CAD among people aged 35 years and over in Thailand When controlling for the influence of various variables, it was found that the individual factors were women with higher levels of CAD than males. Especially at

menopause, up to 38.54% (Nag & Ghosh, 2013), it was found more than 40 years old [6] and was twice as common as sex. Man, In Thailand, the incidence of CAD was found in females aged 40-49 years at a rate of 14.40 per 100,000 and females aged 50-59 at a rate of 53.91 per 100,000 [7]. The increase in morbidity with age increases; therefore, with increasing age, there is an aging change in the cardiovascular system that results in the deterioration of the cardiovascular system as well as other systems. of the body affects the function of pumping blood to nourish various parts of the body [8]. The age group 35 years and older has a higher risk of cardiovascular disease than teenagers. Approximately three times [9].

Health behavioral factors of alcohol use the level of alcohol consumption is associated with negative health effects, particularly CAD. By drinking more than 100 grams of alcohol or 7-10 standard drinks per week (1 standard drink unit equals the amount of 10-14 grams of pure alcohol, or equivalent to 1 can of fewer than 5 degrees of beer, one glass of wine, or one liquor/liquor). Peck/Kong) will continue to increase the overall risk of death for both men and women. and was associated with various types of CAD, including ischemic heart disease (AOR, 1.17 (95% CI, 1.00-1.37)) and other cardiovascular diseases, excluding ischemic heart disease. (AOR, 1.16 Z95% CI, 1.00-1.36)) And aortic aneurysms (AOR, 2.60 (95% CI, 1.15-5.89) [10] from time to time, It was associated with 1.3 times the incidence of cardiovascular disease (95% CI, 1.2-1.4) compared to regular alcohol consumption. It was associated with 1.4 times the incidence of cardiovascular disease (95% CI, 1.1-1.8) [11]. Prolonged use of large amounts of alcohol has been shown to impair cardiac function in both left ventricular diastolic dysfunction and may be detected on echocardiography. In up to 50% of asymptomatic patients, echocardiograms were performed [12]. Left ventricular systolic dysfunction was also impaired. Such can be found on echocardiograms in up to 30% of patients asymptomatic. And with continued drinking, it was found that drinkers were more likely to develop symptoms of dilated cardiomyopathy from heart failure. Alcohol consumption was found to be directly correlated with both the amount of alcohol and the duration of drinking. The likelihood is higher in people who drink more than 7-8 drinks per day. In addition, obesity or body mass index (BMI) in excess is 2-4 times associated with CAD [4]. It can counterbalance the inflammatory reactions that occur in the early stages of cardiovascular disease. This factor mechanizes poor prognosis through enhanced anti-inflammatory [13] and is

associated with several risk factors for cardiovascular disease. This can be directly related to more severe clinical outcomes [14].

Laboratory results associated with CAD, such as high blood pressure. Every 10 mmHg increase in blood pressure was associated with 1.32-fold (95% CI, 1.25-1.40) cardiovascular disease. The incidence of cardiovascular disease was 1.20 times (95% CI, 1.15-1.26). Increased blood pressure was also associated with ischemic heart disease, with every 10 mmHg increase in systolic BP. 1.33-fold association with cardiovascular disease (95% CI, 1.24-1.41), and every 5 mmHg increase in diastolic BP was associated with 1.20-fold cardiovascular disease (95% CI, 1.14- 1.27) [15] Fasting blood sugar (FBS) was associated with cardiovascular disease, with an increase in FBS levels 2.04 times associated with cardiovascular disease (95%). CI, 1.38-3.00) and increased HbA1C were associated with 2.01-fold (95% CI, 1.58-2.55) cardiovascular disease [16]. LDL) increases the risk of CAD, making blood fats more likely to Lud into a slag (Plague) on the island or blocked by the blood vessels, causing the artery wall to be inflexible, causing narrowing easily. Therefore, less blood flows through the organs, causing the development of coronary heart disease, while high HDL-C is associated with a reduction in the risk of small artery occlusion (OR, 0.79; Table 1). 95% CI, 0.67-0.90) [17] and finally estimated the Glomerular Filtration Rate (eGFR). Kidney replacement therapy It was found that every increase in glomerular filtration rate of 1 ml/min/1.73 m2 was associated with 1.17-fold cardiovascular disease (95% CI, 1.04- 1.33) In hemodialysis patients (Fliser D), serum EGFR levels in hemodialysis patients It is associated with the occurrence of cardiovascular disease. Heart attacks were 2.02 times (95% CI, 1.54-2.65) and 12.44 times (95% CI, 6.18-25.06), respectively (Astor et al., 2012) by glomerular filtration stage in patients with stage 3a nephropathy. , 1.66 times (1.00-2.62) stage 3b, and 2.74 times (1.72-4.36) stage 4 compared to patients with kidney disease in stages 1 and 2; 2.57 times (1.50-4.41) [18].

In summary, the occurrence of CAD depends on risk factor control. In particular, behavioral health and physiological risk factors, including body mass index, blood pressure, FBS, LDL, triglyceride, and eGFR, were preventable at the individual level.

The main limitations were the measurement of traditional CAD risk factors based on medical records. The limitations of our study design explain the absence of an association of dietary intake and physical activity in the multivariate analysis since we did not have data results to determine the type of metabolism disorder, and

we lack information on behavioral data, a disorder that can influence the association CAD. We did not observe an interaction between negative behavior or stress that could alter this relationship.

5. Conclusion

We report a high prevalence of factors associated with coronary artery disease and its associated factors among people aged 35 Years and over in Thailand. Female sex, Age, alcohol drinking behavior, history of diabetes in a close relative, BMI, BP, FBS, LDL, HDL, and eGFR were independently associated with coronary artery disease in this study.

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Conflict of interest

No potential conflict of interest relevant to this study was reported.

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