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Prevalence and Factors Associated with a 10-year Cardiovascular Risk among Elderly with Hypertension in Northern Rural Thailand

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ABSTRACT

Objective: *The purpose of this study was to investigate the prevalence and factors associated with the 10-year cardiovascular risk level among elderly with hypertension patients.* ***Method:*** *A community-based analytical cross-sectional study was carried out on 615 samples drawn in Chiang-Rai Province, Northern Region, and Thailand from December 2018-July 2019 through a multistage random sampling technique consisting of a cluster, proportional and systematic random sampling technique. A binary logistic regression was used for the univariate and multivariate analyses to investigate factors associated with cardiovascular risk.* ***Result:*** *A total of 615 elderly with hypertension were recruited into the study, of which 59.20 were female. The average age was 67.16, 43.70% had a family history with hypertension, 22% with diabetes. The prevalence of a 10-year Cardiovascular Disease (CVD) risk of elderly with hypertension was high-risk level about 30.90%. Factors associated with CVD risk were 70-79 groups of age (AOR=6.34, 95%CI=3.56-11.32), male (AOR=2.78, 95%CI=1.49-5.18), with diabetes (AOR=5.12, 95%CI=2.87-9.14), Systolic Blood Pressure (SBP) (AOR=1.09, 95%CI=1.07-1.11), High-Density Lipoprotein (HDL) (AOR=0.91, 95%CI=0.89-0.94), and current smoking (AOR=5.37, 95%CI=2.40-11.98).* ***Conclusion:*** *The primary prevention and control of CVD recommended for elderly with hypertension patients to identify high-risk individuals' factors concerned are in middle older age, male, with diabetes and smoker, especially the intervention program should be promoted to reduce High-Density Lipoprotein (HDL) cholesterol*

Keywords: Cardiovascular risk, Elderly, Epidemiology, Risk factors, Hypertension patients

INTRODUCTION

Cardiovascular Disease (CVD) describes multitudinous conditions that affect the functioning of the heart/cardiovascular [1]. According to the high rate of disease morbidity, CVD has become the leading cause of mortality around the world [2]. An increasing CVD incident rate and its risk factors in developing countries are receiving extensive global concern [3]. Original research from the past 10 years describing the age-specific associations of blood pressure variables in large observational research with the initial presentation of a wide range of cardiovascular disease [4]. For those aged ≥ 80-years old, an SBP ≥ 160 mmHg was not significantly associated with increased mortality, whereas a DBP ≥ 100 mmHg was associated with a 95% increased risk for CVD mortality, and an 88% increased risk for expanded-CVD mortality [5].

In 2012-2015, five major non-communicable diseases in Thailand, including ischemic heart disease, diabetes, cerebrovascular disease, chronic obstructive pulmonary disease, and hypertension [6]. Furthermore, the highest rates of hypertension were found in the age group over 60 years, with an average of 4,057.19 per 100,000 populations [7]. In older persons, the vessel changed and loss of function blood flow that reflected wave travels a lot faster than in the young persons and reaches the central aorta in late systole, thus augmenting the central Systolic Blood Pressure (SBP) leading to increase and effect to CVD, chronic heart disease, stroke, heart failure, and kidney disease [8]. Previous studies presented that ethnic groups have differences in CVD risk and underserved patients have a low perception of risk and cardiovascular knowledge [9,10].

In 2016, the 56.9 million deaths all countries of the world, and more than half (54%) were due to the top 10 causes.

Ischemic heart disease and stroke are the world's biggest killers, accounting for a combined 15.2 million deaths in 2016. These diseases have remained the leading causes of death globally in the last 15 years [11]. In 2016, public health statistics reported that mortality rate of ischemic heart disease and high blood pressure from 23.4, 5.7 to 32.3, and 12.2 per 100,000 populations in Thailand, respectively. However, there are not yet the associated factors of CVD reported in Thailand. Thus, this implies that CVD in Thailand is going to pose a substantial burden in the next 20-30 years [12]. The CVD situation should be concerned, but the causes of CVD are multifactorial. For example, the rate of progression of atherosclerosis is influenced by cardiovascular risk factors: tobacco use, an unhealthy diet, and physical inactivity (which together result in obesity) elevated blood pressure (hypertension), abnormal blood lipids (dyslipidemia), and elevated blood glucose (diabetes) [13].

A systematic review informed that there were strong associations between multiple behavioral risk factors: smoking, alcohol consumption, physical activity, and dietary behavior, and increased risk of cardiovascular diseases [14]. Furthermore, some environment of hypertension patients effects to blood pressure control and risk for CVD. Another external effect from the environment, for instance, environmental factors, such as the built environment, noise, ambient temperature, neighborhood green spaces, and proximity to major roadways or co-exposure to other pollutants and toxins may be the cause for CVD. Individuals who often have exposure to these factors have been found to have increased CVD risk as reflected by incident hypertension [15]. Longer-term exposure over a few years further increases the risk of cardiovascular mortality and decreases life expectancy by months to years [16]. Investigating the prevalence of CVD risk factors and factors related to aggregated score predicting CVD occurrence, especially knowledge relevant to CVD risk factors will help develop strategies for the underserved population. Framingham Risk Score (FRS) is widely used as a means to quantify the realistic risk of CVD [10].

Chiang-Ria Province, Northern region reported increasing the incidence rate of CVD from 2015-2018 [17]. In 2018, 4.1% of the elderly were cardiovascular disease in Doi Luang with a total population of 3,093 persons while 9.58% death from cardiovascular disease [18]. Consequently, prevention of the disease is the critical destination for disease progression. Recently, there is much information about hypertension such as socio-demographic factors, genetic, behavior data, laboratory reports, and incidence rate of CVD complication, but less gathering these data to analyze actual risk factor to alter any factors in the field area. To develop and implement an effective strategy for preventing CVD in older, we must have a more comprehensive understanding of a wide range of CVD risk factors and cultural/contextual factors salient to this population. Once significant CVD risk factors and their prevalence are identified among this underserved ethnic minority group in Thailand, researchers and clinicians will be able to develop and implement effective intervention strategies. The purpose of this study was to examine the prevalence of CVD risk factors among older with hypertension. CVD risk factors measured in the study by Thai Cardiovascular risk scoring on the website of Ramathibodi Hospital, Mahidol University included gender, age, SBP, Low-Density Lipoprotein (LDL), High-Density Lipoprotein (HDL) cholesterol, total cholesterol, diabetes, and smoking status [19]. Besides, we examined a variety of socioeconomic and behavioral factors that have been associated with increased risks for CVD.

MATERIAL AND METHODS

Study Design and Sampling

A cross-sectional analytical study design was conducted in Chiang-Rai province, Thailand. The population was 1,149 elderly more than 60 years of age with hypertension patients, the respondents who continued medical adherence, living in Doi-Luang hospital responsible area at least 6 months. Participants who move out of the area, more than 80-year old, and unable to communicate with the Thai Language were excluded. The outcome of measurement was a 10-year risk of CVD in elderly between 60-79 of age with hypertension. The sample size was calculated by proportional estimate formula considering 80% power with 95% confidence, frequency of outcome factors in the population (p:42% ± 5) from the prior study were 42%, and design effected for cluster surveys were 2 (DEFF:2) [20]. The required sample size was 615. Sampling selection of participants was multi-stage sampling technique including proportional from all four sub-districts and each village and followed by systematic random sampling.

Data Collection and Measurement

Data were collected at household during December 2018-July 2019 by cooperation with researchers and community hospital and support by District Health Offices and 4 health promoting hospitals. Measurement tools were collected by 2 parts of instrument including questionnaires and laboratory test report from Doi Luang Hospital with 4 parts of questionnaires selected in this study including first, general information including age, gender, member, marital status,

education level, income, diabetes, Body Mass Index (BMI) classified according to WHO Asia pacific guidelines (Overweight if BMI>23, obese if BMI>25) and stress level [21,22]. Second, self-care behavior composes of food consumption, medicine, physical activity assessment, stress management, and smoking behavior. The rating scale was applied into 3 scales: never done or rarely, sometimes, always. There are positive and negative statements; never done or, rarely=1, sometime=2 and always=3. Mean ± SD was used to be criteria of the category into "low," "moderately" and "high." Third, psychological composes of 5 items of ST-5 were rated on low stress (0-4), moderate stress (5-7), high stress (8-9), highest stress (10-15) [23]. Last, laboratory report including the last blood pressure level on the patient's medical book was measured by blood pressure monitor of Doi Luang community hospital. Blood test result: total cholesterol, High-Density Lipoprotein (HDL), Low-Density Lipoprotein (LDL) was gathered by no communication disease clinic required from the laboratory of Doi Luang hospital. The results were calculated with Thai CV risk score developed by the Faculty of Medicine Ramathibodi Hospital on the web, 2015 calculated based on SEAR-D specific WHO-ISH Risk prediction charts assess the risk of cardiovascular in the next 10 years [24]. The CVD risk score was interpreted by the rating of CV risk calculated percentage including <10%=low risk, 10%-<20%=moderate risk, 20%-<30%=high risk. In this study, we used 2 categories as low or moderate and high level. The main associated factors for calculation were gender, age, smoking behavior, diabetes, systolic blood pressure, and laboratory test including total cholesterol, LDL, and HDL.

Statistical Analysis

Descriptive statistics as a percentage means standard deviation to describe the general character and separated score into categorical data. To explore the main factors of CVD risk scores such as SBP, total cholesterol, LDL, and HDL was used an independent t-test for two categories of the dependent variable, and a one-way ANOVA test for 3 or more groups of dependent variables. Finally, a binary logistic regression was used for the multivariate analyses to investigate factors associated with the research outcome. The Odds Ratio (OR) with their corresponding Confidence Intervals (CIs) was presented for all variables. Except otherwise noted, p-values and CIs were set at <0.05 and 95% respectively.

Ethical Consideration

This research study was approved by The Ethics in Human Research Committee of Mae Fah Luang University, Chiang-Rai, Thailand by No 114/2560. Patient records and information were anonymized and re-identified before analysis.

RESULTS

As shown in Table 1, most of (5.20%) of the 615 samples studied were females. The average age was 67-year-old; 68.8% were 60-69 years of age. Education characteristics: 61.30% were primary school or higher, 69% were married status, Family history with hypertension diseases characteristic; 56.30% had a family with hypertension diseases, and 20% with diabetes. Most of them had a low-stress level, and more than 30% had overweight. The average Systolic Blood Pressure (SBP), total cholesterol, LDL, and HDL were 136.13 mmHg, 193.80 mg/dl, 111.39 mg/dl, and 50.04 mg/dl respectively. An exploratory of the 4 main factors predicting CV risk score including SBP, cholesterol, LDL, HDL associated with personnel characteristics found that average systolic blood pressure was higher in males and 70-79 years of age. Low-Density Lipoprotein (LDL) was a different average of gender, educational level, BMI level, and HDL had a different average of gender, family history of hypertension, with diabetes, and BMI level.

Table 1 Sample characteristics of elderly with hypertension patients compared to 4 major CVD risk factors

Factors	Total	SBP (mmHg)	Total Cholesterol (mg/dl)	LDL (mg/dl)	HDL (mg/dl)
	N (%)	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Total	615 (100)	136.13 ± 17.06	193.80 ± 42.52	111.39 ± 32.96	50.04 ± 14.31
Socio-demographic					
Age (Mean ± SD)	67.16 ± 5.37				
60-69	423 (68.80)	134.89 ± 16.66**	423.11 ± 194.72	112.27 ± 32.78	49.63 ± 14.59
70-79	192 (31.20)	138.87 ± 17.65	192.23 ± 191.78	109.46 ± 33.65	50.92 ± 13.67

Gender					
Male	251 (40.80)	139.15 ± 16.90**	187.24 ± 39.85**	106.93 ± 32.01*	48.53 ± 13.76*
Female	364 (59.20)	134.06 ± 16.88	198.32 ± 43.75	114.47 ± 33.29	51.08 ± 14.61
Marital status					
Single/Divorce/ widow	187 (30.40)	136.04 ± 18.02	188.28 ± 39.789*	106.13 ± 31.24*	51.16 ± 13.15
Married	428 (69.60)	136.18 ± 16.64	196.21 ± 43.48	113.69 ± 33.46	49.54 ± 14.78
Educational Level					
Illiterate	238 (38.70)	135.98 ± 17.73	191.07 ± 41.88*	108.98 ± 31.43*	50.09 ± 13.83
Primary School or higher	377 (61.30)	136.23 ± 16.64	195.52 ± 42.88	112.92 ± 33.84	50.00 ± 14.63
Family's history with HT					
Yes	269 (43.70)	135.41 ± 16.92	197.48 ± 42.53	113.84 ± 33.34	51.88 ± 15.07*
No	346 (56.30)	136.70 ± 17.17	190.93 ± 42.35	109.49 ± 32.58	48.60 ± 13.54
With Diabetes					
Yes	135 (22.00)	137.56 ± 16.35	195.79 ± 44.52	111.89 ± 32.73	46.70 ± 13.53*
No	480 (78.20)	135.74 ± 17.25	193.24 ± 41.96	111.25 ± 33.06	50.98 ± 14.40
Stress Level					
Low	539 (87.60)	135.83 ± 16.91	193.97 ± 43.09	111.42 ± 33.41	50.09 ± 14.53
Moderate	50 (8.10)	138.88 ± 17.74	195.04 ± 37.30	112.10 ± 28.72	51.54 ± 13.34
High or highest	26 (4.20)	137.23 ± 19.00	187.85 ± 40.89	109.35 ± 32.19	46.04 ± 10.77
Body Mass Index (BMI)					
<22.99 Kg/m^2	307 (49.90)	135.82 ± 17.36	190.35 ± 44.43	107.77 ± 32.37*	51.67 ± 14.84*
23.00-24.99 Kg/m^2	102 (16.60)	134.98 ± 15.84	199.02 ± 38.34	114.85 ± 31.12	47.49 ± 12.26
≥ 25.00 Kg/m^2	204 (33.20)	137.13 ± 17.29	196.46 ± 41.47	115.38 ± 34.11	48.67 ± 13.92
* p-value<0.05, ** p-value<0.001					

Behavior characteristics, most of them had a high level of medication behavior, moderate dietary behavior, and stress management level, about 30% had a former smoker and 12% were current smoking, and most of them had some time or always physical activities. Average of SBP were statistically significant difference smoking status, an average of LDL was a statistically significant difference in the frequency of physical activities, and an average of HDL was a statistically significant difference in the frequency of medical behavioral level and smoking status as shown in Table 2.

Table 2 Behavior characteristic of elderly with hypertension compared to 4 major CVD risk factors

Factors	Total	SBP (mmHg)	Total Cholesterol (mg/dl)	LDL (mg/dl)	HDL (mg/dl)
	N (%)	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Total	615 (100)	136.13 ± 17.06	193.80 ± 42.52	111.39 ± 32.96	50.04 ± 14.31
Medication behavior					
Low	109 (17.70)	136.16 ± 14.43	195.32 ± 41.82	112.97 ± 32.82	47.82 ± 14.36*
Moderate	219 (35.60)	136.35 ± 18.88	191.97 ± 43.38	109.71 ± 32.74	49.00 ± 14.13
High	287 (46.70)	135.97 ± 16.57	194.62 ± 42.21	112.08 ± 33.23	51.67 ± 14.30
Dietary Behavior level					
High	290 (47.20)	134.88 ± 17.55	192.07 ± 41.56	109.63 ± 32.35	50.38 ± 15.24
Moderate	292 (47.50)	136.83 ± 16.22	194.97 ± 43.10	113.12 ± 33.50	49.57 ± 13.56

Low	33 (5.40)	141.09 ± 19.13	198.64 ± 46.12	111.58 ± 33.62	51.15 ± 12.43
Stress Management Level					
High	105 (17.10)	134.12 ± 18.00	199.30 ± 45.30	115.74 ± 36.45	49.49 ± 15.20
Moderate	261 (42.40)	137.04 ± 17.21	193.33 ± 41.75	110.98 ± 31.64	51.06 ± 14.20
Low	249 (40.50)	136.03 ± 16.48	191.97 ± 42.08)	109.99 ± 32.75	49.20 ± 14.13
Smoking					
Never smoke	348 (56.60)	134.60 ± 16.44*	196.59 ± 43.27	112.73 ± 32.77	51.34 ± 15.02*
Former Smoking	195 (31.70)	138.13 ± 18.19	191.40 ± 43.16	110.53 ± 34.66	48.08 ± 13.11
Current Smoking	72 (11.70)	138.14 ± 16.27	186.81 ± 35.95	107.26 ± 28.90	49.00 ± 13.37
Physical Activity					
Never/ Rarely	236 (38.40)	136.83 ± 17.20	196.99 ± 44.42	114.64 ± 32.70*	48.85 ± 14.73
Sometime/ Always	379 (61.60)	135.70 ± 16.95	191.81 ± 41.22	109.37 ± 33.00	50.77 ± 14.02
* p-value<0.05, ** p-value<0.001					

As shown in Table 3 and Table 4, both univariate and multi-variate test characteristics of CVD risk factors according to the level of personal factors and level of the CVD risk level. The prevalence of high-risk level was 38.89%. In the univariate test in detecting factors associated with the high-risk level of CVD 10 personal factors were found to be associated: age groups, male gender, family with hypertension, with diabetes status, SBP and, HDL. Moreover, the multivariate test found that age groups, male gender, with diabetes status, SBP and, HDL have associated with a high-risk level. The participants who had 70-79 years of age were 6.34 times more likely to be at a high-risk level of CVD (95%CI=3.56-11.32) than those 60-69 groups of age, participants who had male gender were 2.78 times more likely to be high -risk level than female. Participants who had diabetes were 5.12 times more likely to be high -risk level comparable to those who did not have, and participants who had higher SBP were more likely to have higher CVD risk (95%CI=1.07-1.11, p-value<0.001) than those who had lower, and participants who had high HDL were more likely to have low-risk level than those who had lower (95%CI=0.89-0.94, p-value<0.001).

Table 3 Sociodemographic factors associated with a 10-year cardiovascular disease risk

Factors	Low or Moderate 425 (69.11)	High 190 (38.89)	COR	95%CI	p-value	AOR	95%CI	p-value
	n (%)	n (%)						
Age								
60-69	325 (76.80)	98 (23.20)	1					
70-79	100 (52.10)	92 (47.90)	3.05	2.12-4.38	<0.001	6.34	3.56-11.32	<0.001
Gender								
Female	278 (76.40)	86 (23.60)	1					
Male	147 (58.60)	104 (41.40)	2.29	1.61-3.24	<0.001	2.78	1.49-5.18	0.001
Marital status								
Married	293 (68.50)	135 (31.50)	1					
Single/Divorce/ widow	132 (70.60)	55 (29.40)	0.9	0.62-1.32	0.599	1.34	0.76-2.36	0.305
Educational Level								
Primary School or higher	266 (70.60)	111 (29.40)	1					
Illiterate	159 (66.80)	79 (33.20)	1.19	0.84-1.69	0.33	0.94	0.56-1.58	0.808

Family's history with HT								
Yes	201 (74.70)	68 (25.30)	1					
No	224 (64.70)	122 (35.30)	1.61	1.13-2.29	0.008	1.18	0.71-1.95	0.516
With Diabetes								
No	357 (74.40)	123 (25.60)						
Yes	68 (50.40)	67 (49.60)	2.86	1.93-4.24	<0.001	5.12	2.87-9.14	<0.001
Stress Level								
Low	376 (69.80)	163 (30.20)	1					
Moderate	34 (68.00)	16 (32.00)	1.09	0.58-2.02	0.8	0.46	0.18-1.17	0.103
High or highest	15 (57.70)	11 (42.30)	1.69	0.76-3.76	0.2	1.3	0.44-3.88	0.638
Body Mass Index (BMI) (Kg/m^2)								
<22.99	217 (70.70)	90 (29.30)	1					
23.00-24.99	66 (64.70)	36 (35.30)	1.32	0.82-2.11	0.258	1.39	0.69-2.79	0.358
≥ 25.00	140 (68.60)	64 (31.40)	1.1	0.75-1.62	0.62	0.93	0.53-1.64	0.8
COR: Crude Odds Ratio; AOR: Adjust Odds Ratio								

Table 4 Personal factors associated with a 10-year cardiovascular disease risk

Factors	Low or Moderate	High	COR	95%CI	p-value	AOR	95%CI	p-value
	Mean ± SD	Mean ± SD						
Systolic Blood Pressure (SBP)	131.1 ± 14.42	147.4 ± 17.15	1.07	1.06-1.08	<0.001	1.09	1.07-1.11	<0.001
Total cholesterol	193.48 ± 42.86	194.5 ± 41.84	1.00	1.00-1.01	0.784	1.01	0.99-1.02	0.246
LDL	109.2 ± 3.26	115.1 ± 10.35	1.00	1.00-1.01	0.062	1.00	0.99-1.02	0.727
HDL	52.57 ± 14.85	43.43 ± 10.35	0.94	0.93-0.96	<0.001	0.91	0.89-0.94	<0.001
HDL: High-Density Lipoprotein; LDL: Low-Density Lipoprotein; COR: Crude Odds Ratio, AOR: Adjust Odds Ratio								

As shown in Table 5, both univariate and multi-variate test characteristics of CVD risk factors according to the level of behavior factors and level of the CVD risk level. In the univariate test in detecting factors associated with the high-risk level of CVD; 2 behavior factors were found to be associated: medication behavior level and smoking status. Participants who had low and moderate medication levels had 1.70 and 1.50 times more likely to have high-risk than those who were high levels (95%CI=1.08-2.78 and 1.02-2.20). Participants who were current and former smoking had 3.90 and 1.85 times more likely to have high-risk than those who did not smoke (95%CI=2.30-6.59 and 1.26-2.71). Moreover, the multivariate test found that only smoking behavior was associated with a high-risk level of CVD. Participants who were current and former smoking had 5.37 and 1.38 times more likely to have high-risk than those who did not smoke (95%CI=2.40-11.98 and 2.44-2.58).

Table 5 Behavioral factors associated with a 10-year cardiovascular disease risk (N=615)

Factors	Low or Moderate 425 (69.11)	High 190 (38.89)	COR	95%CI	p-value	AOR	95%CI	p-value
	n (%)	n (%)						
Medication Behavior								
High	213 (74.20)	74 (25.80)	1					

Moderate	144 (65.80)	75 (34.20)	1.5	1.02-2.20	0.039	1.38	0.79-2.41	0.263
Low	68 (62.40)	41 (37.60)	1.74	1.08-2.78	0.021	1.6	0.82-3.13	0.172
Dietary Behavior Level								
High	210 (72.40)	80 (27.60)	1					
Moderate	193 (66.10)	99 (33.90)	1.03	0.48-2.20	0.488	0.67	0.22-2.05	0.479
Low	22 (66.70)	11 (33.30)	0.76	0.35-1.64	0.099	1.09	0.65-1.81	0.752
Stress Management Level								
High	72 (68.60)	33 (31.40)	1					
Moderate	192 (73.60)	69 (26.60)	0.78	0.48-1.29	0.336	0.68	0.34-1.38	0.288
Low	161 (64.70)	88 (35.30)	1.19	0.73-1.94	0.479	0.5	0.25-1.02	0.058
Smoking								
Never	267 (76.70)	81 (23.30)	1					
Former	125 (64.10)	70 (35.90)	1.85	1.26-2.71	0.002	1.38	2.44-2.58	0.316
Current	33 (45.80)	39 (54.20)	3.9	2.30-6.59	<0.001	5.37	2.40-11.98	<0.001
Physical Activities								
Always or Sometime	154 (65.30)	82 (34.70)	1					
Rarely or Never	271 (71.50)	108 (28.50)	0.75	0.52-1.06	0.103	0.97	0.59-1.58	0.9
COR: Crude Odds Ratio; AOR: Adjust Odds Ratio								

DISCUSSION AND RECOMMENDATION

To our knowledge, this is the first community study to examine overall CVD risk among an older rural area with hypertension in the Northern region, Thailand. The result of the present study representative sample of the general rural population in the district was 55%. The study indicates that the elderly with hypertension had low, moderate, high, and higher CVD risk level 27.60%, 41.50%, 21.70%, and 10.20% respectively similarly to prior study that about 30% of elderly groups had a high level of CVD risk [25]. Even though the direct comparison is difficult because of the differences in sample characteristics, the prevalence of age groups, gender, BMI, with diabetes, dyslipidemia and behaviors especially smoking.

According to socio-demographic factors, age and gender were strong associated with the CVD risk level. Prevalence of high-risk level in 70-79 groups was 47.90% higher than 60-69 groups (23.20%), and the male had prevalence Most of the major factors calculate CVD percent in this study in 70-79 of age had higher average SBP compare to the 60-69 groups and in male was found the average of SBP, total cholesterol higher than female and both average LDL and HDL of the male were lower than female. Males are a high-risk group to CVD when compared with females. Corresponding with systematic review found that the prevalence of individuals categorized as high risk was higher in males compared to females (18.8% versus 8.2%), while only 42.8% of the male were classified as low risk versus 73.7% of female [26]. The prevention of cardiovascular disease and treatment recommendations should be associated with quantification of total cardiovascular risk which could be estimated from several different models. The impact of age on risk is so strong that young adults (particularly women) are unlikely to reach high-risk levels even when they have more than one major risk factor and a clear increase in relative risk. By contrast, many elderly men (e.g., >70 years) reach a high total risk level whilst being at very little increased risk relative to their peers [27].

The multivariate test showed SBP and HDL had a strong association with CVD risk similar to Lin, et al. found that SBP was a statistically significant difference between males and females, and different groups of age [28]. SBP was higher in males than females and 70-79 group of age higher than 60-69 group. Primary prevention of CVD in older adults should apply statin therapy and blood pressure control that reduce the risk of myocardial infarction and stroke. [29]. Surprisingly, family history with hypertension was in association with CVD risk when calculated by the univariate test. Patients who didn't have a family history of hypertension were more likely to have high-risk than those who had a family history of hypertension. Family history with hypertension has a higher average of HDL than those who had no family history of hypertension. Participants who were with diabetes (DM) patients had 5.2 times more

likely to have CVD high-risk level than those who had not. We found the average of HDL in DM patients higher than those who were not. Marital status, stress level, and BMI had no association with the CVD risk level. Moreover, we found both marital status and educational level had statistic significant with an average of total cholesterol and LDL, BMI had statistic significant with an average of LDL and HDL.

According to behavior factors in multivariate of the study, only smoking factor had been associated with the high-risk level. Participants who were current and former smoking had 5.37 and 1.38 times more likely to have high-risk than those who did not smoke, while observed the relationship with four main factors calculated CVD percent was found the difference of co-factors both SBP and HDL. It was interesting that the medication behavior level had a significant difference in the average HDL. The highest average HDL was found in the high level of medication behaviors. Dietary, stress management, and exercise had no association with the CVD risk level. Otherwise, physical activity had higher LDL in never or rarely groups.

A combination of factors might be concerned by authorities in public health on prevention and control CVD risk factors such as high blood pressure and smoking cessation were induced patients to CVD risk. Moreover, there is a moderate level of CVD risk among elderly with hypertension patients in a rural area that replied to that hypothesis of the study. 45.10% of moderate risk level was a wide prevalence that public health personnel should concern to prevent CVD progression. According to a WHO report, effective reduction of CV mortality should be based on three key points: surveillance (mapping and monitoring the epidemic of CVDs), prevention (reducing exposure to risk factors), and management (equitable health care for people with CVD [30]. Related to our study that age increasing is a risk to CVD, other researchers described that Physical activity associated with CVD risk in age 55-65 and over 65 years. Doing some physical activity had a lower CVD risk compared to people who were inactivity [31]. Conversely, based on our finding was different from any study; we found that exercise activity was not associated with CVD risk in age over 60 years, although, there is exercise behavior associated with CVD risk. However, differences in physical activity measurements; type of exercise questionnaires in our study, and heart rate measuring instrument in another finding may indicate different CVD risk levels. Also, our study found that older smokers are at higher risk of CVD than non-smokers.

According to a previous study, smoking was a risk factor for CVD and the blood vessels, especially those with high blood pressure, and its effects depend on the underlying vascular resistance of the arteries [32]. Furthermore, exposure to tobacco smoke is a major risk factor for cardiovascular disease as mentioned in the epidemiological study, smoking 20 cigarettes per day had a risk of 1.78 times cardiovascular disease compared with those who smoked 1 cigarette per day [33]. The last finding was low blood pressure controlled was a chance to predict CVD risk. Long-term follow-up from epidemiological studies has consistently shown that many young adults and middle-aged people with SBP levels above 160 mmHg may have a high risk during 20 years of follow-up period [34]. Supported by other studies described that the risk of major cardiovascular events seems lower in persons with more-intensive BP control who met the SPRINT goals than in those with less-intensive BP control or uncontrolled BP, although fewer hypertension patient meets SPRINT goals than 2014 recommendation goals [35]. Karmali and Lloyd recommended that on-treatment patient's age over 60 years with or without diabetes and chronic kidney disease would recommend blood pressure level $\leq$ 140/90 mmHg [36].

CONCLUSION AND RECOMMENDATION

The result of this study showed that blood pressure control affects CVD risk. The limitations were blood test laboratory collection to calculated CVD risk and data recording. There is the barrier to visiting collecting blood at Health Promoting Hospital because elderly patients depend on their partner or their relative. On the other hand, some elderly moves out of the area due to them had complication of treatment with other hospital provinces. Additionally, most elderly were illiterate or elderly patients in some village were ethnic (Yao) who are unable to communicate with the Thai language; there are impacts of communication during data recording. Particularly, investigate CVD risk among hill tribe group and specifically ethnic translators should collaborate in further study.

To reduce CVD risk factors of elderly with hypertension, we recommended concerning in the middle old age, male, family's history with hypertension, and overweight and obesity groups and the intervention should reduce the prevalence of smoking, increasing the medication behavior by the effect of increasing HDL. The next study should study intervention mapping and intervention effect of CVD risk.

DECLARATIONS

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Conflicts of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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