An Exploratory of Prevalence and Associated Factors of Cardiovascular Risk among Elderly with Hypertension in Chiang Rai Province

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Abstract

Objective: The objective of this study was to examine the prevalence and explore factors associated with cardiovascular risk levels among elderly with hypertension patients. **Method:** A cross-sectional analytical study was carried out on 615 samples drawn in Doi-Louang District, Chiang-Rai Province, Northern Region, Thailand from December 2018 - July 2019 through a multistage sampling technique. A binary logistic regression was used for the univariate and multivariate analyses to examine factors associated Cardiovascular risk. **Result:** A total of 615 elderly with hypertension were recruited into the study, of whom 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 or extremely-high level about 30.90%. Factors associated with CVD risk were 70-79 groups of age (OR= 3.05,95% CI= 2.12-4.38), male (OR= 2.29, 95% CI= 1.61 - 3.24), Family' history with hypertension (OR= 1.61,95% CI= 1.13 – 2.29), diagnosed with diabetes (OR= 2.86,95% CI= 1.93 -4.24), and self-care behavior factors were low medication behavior level (OR= 1.74,95% CI= 1.08 -2.78), after adjust confounding factors there were no behavior factors associated with CVD risk, otherwise only current smoking that associated CVD risk factors was confirmed majors risk factors behavior (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 smoking and increased medication behavior.

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

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Introduction

Cardiovascular disease (CVD) describes multitudinous conditions that affect the functioning of heart/cardiovascular (Mendis, Puska, Norrving, & Organization, 2011). According to the high rate of disease morbidity, CVD has become the leading cause of mortality around the world (Mozaffarian et al., 2015). An increasing CVD incident rate and its risk factors in developing countries are receiving extensive global concern (Reduce & Population, 2010). Original research from the past 10 years found that the widely held assumptions that blood pressure has strong associations with the occurrence of all cardiovascular diseases across a wide age range (Banik, 2014). The cardiovascular and expanded-cardiovascular mortality risks were lowest when systolic blood pressures were 120 to 129mmHg, and increased significantly when systolic blood pressures (SBPs) were ≥ 160 mm Hg or diastolic BPs were ≥90mm Hg. A J-curve phenomenon for SBP on CVD and expanded-CVD mortality was observed. The impacts of stage 2–3 hypertension on mortality risks were significantly increased among women. The mortality risks of hypertension were not attenuated with older age. (Wu et al., 2015).

In 2012-2015, five major non-communicable diseases in Thailand, including ischemic heart disease, diabetes, cerebrovascular disease, chronic obstructive pulmonary disease, and hypertension (Beru of Non-Communicable Disease, 2017). 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 (Zhou et al., 2017). In older persons, 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 (Chrysant, 2018). Previous studies presented that ethnic groups have differences in CVD risk (Chiu, Austin, Manuel, & Tu, 2010) and underserved patients has a low perception of risk and cardiovascular knowledge (D'agostino et al., 2008).

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 (WHO, 2007). 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, 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 (WHO, 2017). 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) (Zhao et al., 2015).

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 (Haines, Patterson, Rayner, & Hyland, 2007). Furthermore, some environment of hypertension patient effects to blood pressure control and risk for CVD. Other external effect from environment, for instance, environmental factors, such as the built environment, noise, ambient temperature, neighborhood greenspaces, and proximity to major roadways or co-exposure to other pollutants and toxins. Individuals who often have exposed to these factors have been found to have increased CVD risk as reflected by and incident hypertension (Alageel, Wright, & Gulliford, 2016). Longer-term exposure over a few years further increases the risk of cardiovascular mortality and decreases life

expectancy by months to years (Brook, Weder, & Rajagopalan, 2011). 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 underserved population. Framingham Risk Score (FRS) is widely used as a mean to quantify the realistic risk of CVD (D' agostino et al. , 2008).

Chiang-Ria Province, Northern region reported increasing the incidence rate of CVD from 2015- 2018 especially elderly groups, top five of elderly with hypertension death rate was Weiang-Papoa (12. 24%) , Chieng-Khong (11.84%) , Pan (11.53%) , Phaya Meng Rai (10.34%) and Doi-Luang district (9.59), prevalence of hypertension in elderly groups was 42.09% . (Health Data Center, 2018). Consequently, prevention 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, it is critical that we 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 objective 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 website of Ramathibodi Hospital, Mahidol University (Mahidol University, 2018) included gender, age, SBP, low density lipoprotein (LDL) , high-density lipoprotein (HDL) cholesterol, total cholesterol, diabetes, and smoking status that appropriate to measure CVD risk as CVD percent. Self-care behaviors have been promoted from Ministry of Public Health such as medication, dietary, drinking, stress-management, smoking, and exercise to reduce CVD risk for 10 years. In addition, we examined a variety of socioeconomic and behavioral factors that have been associated with increased risks for CVD in this research.

Materials and Methods

Study design and sampling

A cross-sectional analytical study design was conducted in Chiang-Rai province, Thailand. Population was 76,000 elderly more than 60 year of age with hypertension patients, the respondents who continued medical adherence living in Chiang-Rai at least 6 months. Participants move out the area, more than 80-year-old and unable to communicate with Thai Language were excluded. Outcome of measurement was a 10-year risk of CVD in elderly between 60-79 of age with hypertension. 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 prior study (Chuaytem et al, 2018) were 42% , and design effected for cluster surveys were 2 (DEFF: 2) . The required sample size was 615. Sampling selection of participants was multi-stage sampling technique including the first stage was simple random sampling from top five of death rate in 2018 and Doi-Luang district was selected, the second stage was proportional from all four sub-districts and each village, the last stage was systematic random sampling from each village.

Data collection and Measurement

Data were collected at household in 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) (WHO, 2000b) (WHO, 2000a). and stress level. Second, self-care behavior composes of dietary behavior, medication behavior, physical activity assessment, stress management, and smoking behavior. 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$\pm$SD score was used to be criteria of category into " low," " moderately" and "high." Third, psychological composes of 5 items of ST-5 5 items of ST-5 were rated on low stress (0-4), moderate stress (5-7), high stress (8-9), highest stress (10-15) (health,

2019). Last, laboratory report including last blood pressure level on patient's medical book that 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 noncommunication disease clinic required from laboratory of Doi Luang hospital. The results were calculated with Thai CV risk score developed by Faculty of Medicine Ramathibodi Hospital on web, 2015 calculated based on SEAR-D specific WHO-ISH Risk prediction charts (charts, 2018) assess the risk of cardiovascular in the next 10 years. CVD risk score was interpreted by rating of CV risk calculated percentage including $<10\%$ = low risk, 10 % -$<$ 20% = moderate risk, 20 %-$<$ 30% = High risk, 30-$<$40% = extremely high, and $>$ 40% = dangerous level. However, in this study, we separated to observed probability of high risk only 2 categories as low or moderate and high level that appropriated to explore from the various factors. 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 percentage means standard deviation to describe the general characteristic and separated score into categorical data. To explore the main factors of CVD risk scores such as age, SBP, low density lipoprotein (LDL), high-density lipoprotein (HDL) cholesterol, total cholesterol, diabetes, and smoking status., 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) were 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 prior to analysis.

Results

As shown in Table 1, most of the 615 participants studied (59.20 %) were female. The average age was 67 years, and 68.8% were 60-69 years of age. Regarding the general characteristics of the sample, 61.30% had primary school or higher education, 69% were married, 56.30% had a family history of hypertension, and 20% had concomitant DM. Most participants had low stress levels, and more than 30% were overweight. The average SBP, total cholesterol, LDL, and HDL levels were 136.13 mmHg, 193.80 mg/dL, 111.39 mg/dL, and 50.04 mg/dL respectively. An exploratory analysis of the four main characteristics predicting CV risk score, namely SBP, total cholesterol, LDL, and HDL, revealed that average SBP was higher in men and among those from 70-79 years of age. The average LDL level differed as per sex, educational level, and BMI, whereas the average HDL level differed as per sex, family history of hypertension, concomitant diabetes, and BMI.

Table 1 Sample characteristics of older adults with hypertension grouped according to the four major CVD risk factors (n=615)

Factors	Total	SBP (mmHg)	Total Cholesterol (mg/dL)	LDL (mg/dL)	HDL (mg/dL)
	N (%)	$\bar{X}\pm SD$	$\bar{X}\pm SD$	$\bar{X}\pm SD$	$\bar{X}\pm SD$)
Total	615(100)	136.13±17.06	193.80±42.52	111.39±32.96	50.04±14.31
Sociodemographic factors					
Age ($\bar{X}$ ±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
Sex					
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 History of Hypertension					
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
Diagnosed with Diabetes Mellitus					
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					
<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 HDL; high-density lipoprotein; LDL, low-density lipoprotein; SBP, systolic blood pressure; SD, standard deviation

Most participants had a high level of medication behavior and moderate dietary behavior and stress management level. Approximately 30% were former smokers and 12% were current smokers, and most participants engaged in physical activity sometimes or frequently. The average SBP significantly differed according to smoking status; the average LDL significantly differed according to the frequency of physical activity; and the average HDL significant differed as per the medication consumption behavior and smoking status, as shown in Table 2.

Table 2 Behavior characteristics of older adults with hypertension according to the four major cardiovascular risk factors

Factors	Total	SBP (mmHg)	Total Cholesterol (mg/dL)	LDL (mg/dL)	HDL (mg/dL)
	N (%)	$\bar{X}\pm SD$	$\bar{X}\pm SD$	$\bar{X}\pm SD$	$\bar{X}\pm SD$)
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					
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	348 (56.60)	134.60±16.44*	196.59±43.27	112.73±32.77	51.34±15.02*
Former	195 (31.70)	138.13±18.19	191.40±43.16	110.53±34.66	48.08±13.11
Current	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/Frequently	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 HDL; high-density lipoprotein; LDL, low-density lipoprotein; SBP, systolic blood pressure; SD, standard deviation

As shown in table 3 elderly with hypertension had low or moderate risk level 69. 10% and high or extremely high- risk level 30.90%.

Table 3 A 10-year cardiovascular risk elderly with hypertension

Cardiovascular risk level	N (%)
Low (<10%)	170(27.60)
Moderate (10-<20%)	255(41.50)
High (20 -<30%)	127(20.70)
Extremely High (30-<40%)	63 (10.20)

As shown in Table 4 both univariate and multi-variate test Characteristics of CVD risk factors according to the level of personal factors and level of CVD risk level. The prevalence of high-risk level was 30.90% . In the univariate test in detecting factors associated with high-risk level of CVD 10 personal factors found to be associated: age groups, male gender, family with hypertension, with diabetes status. Moreover, multivariate test found that age groups, male gender, diagnosed with diabetes status, associated with high-risk level. The participants who had 70-79 year of age were 6. 34 times more likely to be 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 compared to those who did not have.

Table 4 Sociodemographic factors associated with cardiovascular disease risk

Factors	Low or Moderate 425(69.10) n (%)	High 190(30.90) n (%)	COR	95%CI	p-value	AOR	95%CI	p-value
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)	0.90	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	0.330	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
Diagnosed 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	0.800	0.46	0.18-1.17	0.103
High or highest	15(57.70)	11(42.30)	1.69	0.76-3.76	0.200	1.30	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)	1.10	0.75-1.62	0.620	0.93	0.53-1.64	0.800

COR=Crude Odds Ratio, AOR = Adjust Odds Ratio

As shown in Tale 5, both univariate and multi-variate test Characteristics of CVD risk factors according to the level of behavior factors and level of CVD risk level. In the univariate test in detecting factors associated with high-risk level of CVD: 2 behavior factors found to be associated: medication behavior level and smoking status. Participants who had low and moderate of medication level had 1. 70 and 1.50 times more likely to have high-risk than those who were high level (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, multivariate test found that only smoking behavior associated with 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 cardiovascular disease risk (N=615)

Factors	Low or Moderate 425 (69.10) n (%)	High 190(30.90) N (%)	COR	95%CI	p-value	AOR	95%CI	p-value
Medication Behavior								
High	213(74.20)	74(25.80)	1					
Moderate	144(65.80)	75(34.20)	1.50	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	1.60	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	0.50	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)	3.90	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	0.900

COR=Crude Odds Ratio, AOR = Adjust Odds Ratio

Discussion and Recommendations

To our knowledge, this is the first community study to examine overall CVD risk among older rural area with hypertension in Northern region, Thailand. The study indicates that elderly with hypertension had low, moderate, high, and higher CVD risk level 27.60%, 41.50%, 20.70% , and 10.20% respectively similarly to prior study that nearly one-fourth of rural and tribal population are at moderate risk and almost one tenth have high risk of developing cardiovascular events within next ten years. (Madhu, Prathyusha, Prakruthi, & Srinath, 2019) maybe because in Chiang-Rai province has similar rural and tribal population.

According to sociodemographic factors, age and gender was strong associated with CVD risk level. Most of major factors calculate CVD percent in this study in 70-79 of age had 6. 34 times more likely to be high -risk level of CVD than those 60-69 groups and male had 2.78 times more likely to be high -risk level of CVD than those females. It maybe because higher group of age had average SBP than lower group and in male was found the average of SBP higher than female and multivariate test showed SBP and HDL had strong association with CVD risk similarly to Lin et al (Lin et al., 2019) found that SBP were statistically significant difference between male and female, and difference groups of age. SBP were higher in male than female and in 70-79 group of age higher than 60-69 group. Corresponding with systematic review found that the prevalence of individuals categorized as high risk was higher in male compared to female (18.8% versus 8.2%), while only 42.8% of male were classified as low risk versus 73.7% of female (Diederichs et al. , 2018) . 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 woman) 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 (Kjeldsen, 2018). Primary prevention of CVD in older adults should apply statin therapy and blood pressure control that reduce the risk of myocardial infraction and stroke. (Barry, O'Neill, & Graham, 2016).

Surprisingly, family history with hypertension was association with CVD risk when calculated by the univariate test. Patients who were not family history of hypertension more likely to have high-risk than those who had family's history with hypertension. It maybe because family history with hypertension groups were higher concern preventive behaviors than who had no family history of hypertension. Participants who were diagnosed with diabetes (DM) patients had 5.2 time more likely to have CVD high-risk level than those who had not. We found that proportion of who was diagnosed with diabetes (49.60%) had higher rate compared to no-diabetes patients (25.60%). Moreover, we found both marital status and educational level had statistic significant with average of total cholesterol and LDL, BMI had statistic significant with average of LDL and HDL.

According to behavior factors in multivariate of the study, only smoking factor had associated with 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 medication behavior level had significant difference in average of HDL.

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 was moderate level of CVD risk among elderly with hypertension patients in rural area that replied that hypothesis of the study. 45.10% of moderate risk level was 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 (Alwan, 2011). Related with our study that age increasing is risk to CVD. Other researchers described that Physical activity associated to 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 (Lachman et al., 2018). Conversely, based on our finding was different to any study; we found that exercise activity was not associated to CVD risk in age over 60 years, although, there is exercise behavior associated to CVD risk. However, differences of physical activity measurements; type of exercise questionnaires in our study and heart rate measuring instrument in another finding may indicate different CVD risk level. In addition, our study found that older smokers are 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 (Hedström & Bergh, 2010). Furthermore, exposure to tobacco smoke is a major risk factor for cardiovascular disease as mentioned in the epidemiological study, smoking with 20 cigarettes per day had a risk of 1.78 times cardiovascular disease compared with those who smoked 1 cigarette per day (Erhardt, 2009).

Last finding was low blood pressure controlled was 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 high risk during 20 years of follow- up period (Karmali & Lloyd-Jones, 2017). 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 (Ko et al., 2016). Karmali and Lloyd recommended that on treatment patient age over 60 years with or without diabetes and chronic kidney disease would recommend blood pressure level$\leq$ 140/90 mmHg (Dennison-Himmelfarb et al., 2013). The limitations were blood test laboratory collection to calculated CVD risk and data recording. There is barrier of visiting to 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 villages were ethnic (Yao) who are unable to communicate with Thai language; there are impacts of communication during data recording. Particularly, investigate CVD risk among hill tribe group and specifically ethnic translators should be collaborated 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 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.

Acknowledgments

References

Alageel, S., Wright, A. J., & Gulliford, M. C. (2016). Changes in cardiovascular disease risk and behavioural risk factors before the introduction of a health check programme in England. *Preventive medicine, 91*, 158-163.

Alwan, A. (2011). *Global status report on noncommunicable diseases 2010*: World Health Organization.

downloadable/ucm_463344.pdf

Banik, S. (2014). Blood pressure and incidence of twelve cardiovascular diseases: Lifetime risks, healthy life-years lost and age-specific associations in 1.25 million people. *Journal of Neuroanaesthesiology and Critical Care, 1*(03), 224-225.

Barry, A. R., O'Neill, D. E., & Graham, M. M. (2016). Primary prevention of cardiovascular disease in older adults. *Canadian Journal of Cardiology, 32*(9), 1074-1081.

Brook, R. D., Weder, A. B., & Rajagopalan, S. (2011). "Environmental hypertensionology" the effects of environmental factors on blood pressure in clinical practice and research. *The Journal of Clinical Hypertension, 13*(11), 836-842.

Chiu, M., Austin, P. C., Manuel, D. G., & Tu, J. V. (2010). Comparison of cardiovascular risk profiles among ethnic groups using population health surveys between 1996 and 2007. *Cmaj, 182*(8), E301-E310.

Chuaytem B. et al, B. C. e. (2018). *Factors associated with cardiovascular risk among elderly with hypertension patients in Ban Mae-bong health promoting hospital, Doi-luang district, Chiang-Rai Province.* Paper presented at the The 9th International Graduate Students Conference on Population and Public Health Sciences, Bangkok, Thailand.

Chrysant, S. G. (2018). Aggressive systolic blood pressure control in older subjects: benefits and risks. *Postgraduate medicine, 130*(2), 159-165.

D'agostino, R. B., Vasan, R. S., Pencina, M. J., Wolf, P. A., Cobain, M., Massaro, J. M., & Kannel, W. B. (2008). General cardiovascular risk profile for use in primary care. *circulation, 117*(6), 743-753.

Dennison-Himmelfarb, C., Handler, J., Lackland, D. T., LeFevre, M. L., MacKenzie, T. D., Ogedegbe, O., . . . Townsend, R. R. (2013). 2014 Evidence-Based Guideline for the Management of High Blood Pressure in Adults Report From the Panel Members Appointed to the Eighth Joint National Committee (JNC 8). *JAMA, 311*, 507-520.

Department of Mental Health. (2019). Stress Evaluation (ST-5) Retrieved from https://www.dmh.go.th/test/qtest5/

Diederichs, C., Neuhauser, H., Rücker, V., Busch, M. A., Keil, U., Fitzgerald, A. P., & Heuschmann, P. U. (2018). Predicted 10-year risk of cardiovascular mortality in the 40 to 69 year old general population without cardiovascular diseases in Germany. *PloS one, 13*(1), e0190441.

Disease, B. o. N.-c. (2017). Non- communicable disease report Retrieved from http://thaincd.com/document/file/download/paper-manual

Erhardt, L. (2009). Cigarette smoking: an undertreated risk factor for cardiovascular disease. *Atherosclerosis, 205*(1), 23-32.

Haines, A., Patterson, D., Rayner, M., & Hyland, K. (2007). Prevention of cardiovascular disease: Guidelines for assessment and management of cardiovascular risk. In.

Health Data Center, Ministry of Public Health. (2018). Prevalence rate of cardiovascular disease Retrieved from https://hdcservice.moph.go.th/hdc/reports/report.php?source=formated/format_1.php&cat_id=6a1fdf282fd28180eed7d1cfe0155e11&id=f346e9d449b04c07cc80edeefc0cc360

Hedström, L., & Bergh, H. (2010). Sublingual varices in relation to smoking and cardiovascular diseases. *British Journal of Oral and Maxillofacial Surgery, 48*(2), 136-138.

Institute of Medicine (US). Committee on Public Health Priorities to Reduce and Control Hypertension in the US Population. (2010). A population-based policy and systems change approach to prevent and control hypertension. National Academies Press.

Karmali, K. N., & Lloyd-Jones, D. M. (2017). Global risk assessment to guide blood pressure management in cardiovascular disease prevention. *Hypertension, 69*(3), e2-e9.

Kjeldsen, S. E. (2018). Hypertension and cardiovascular risk: general aspects. *Pharmacological research, 129*, 95-99.

Ko, M. J., Jo, A. J., Park, C. M., Kim, H. J., Kim, Y. J., & Park, D.-W. (2016). Level of blood pressure control and cardiovascular events: SPRINT criteria versus the 2014 hypertension recommendations. *Journal of the American College of Cardiology, 67*(24), 2821-2831.

Lachman, S., Boekholdt, S. M., Luben, R. N., Sharp, S. J., Brage, S., Khaw, K.-T., . . . Wareham, N. J. (2018). Impact of physical activity on the risk of cardiovascular disease in middle-aged and older adults: EPIC Norfolk prospective population study. *European journal of preventive cardiology, 25*(2), 200-208.

Lin, H.-Q., Wu, J.-Y., Chen, M.-L., Chen, F.-Q., Liao, Y.-J., Wu, Y.-T., & Guo, Z.-J. (2019). Prevalence of dyslipidemia and prediction of 10-year CVD risk among older adults living in southeast coastal regions in China: a cross-sectional study. *Clinical interventions in aging, 14*, 1119.

Mahidol University. (2018). Thai CV Risk Score Retrieved from https://med.mahidol.ac.th/cardio_vascular_risk/thai_cv_risk_score/

Madhu, B., Prathyusha, K., Prakruthi, P., & Srinath, K. (2019). Comparison of prevalence of life style risk factors and 10 year risk of CVD event among rural and tribal population of Kollegal Taluk, Chamrajanagar district, South India. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews, 13*(5), 2961-2966.

Mendis, S., Puska, P., Norrving, B., & Organization, W. H. (2011). *Global atlas on cardiovascular disease prevention and control*: World Health Organization.

Mozaffarian, D., Benjamin, E. J., Go, A. S., Arnett, D. K., Blaha, M. J., Cushman, M., . . . Howard, V. J. (2015). Heart disease and stroke statistics—2015 update: a report from the American Heart Association. *circulation, 131*(4), e29-e322.

World Health Organization. (2007). *Prevention of Cardiovascular Disease. Pocket Guidelines for Assessment and Management of Cardiovascular Risk. Africa: Who/Ish Cardiovascular Risk Prediction Charts for the African Region*: World Health Organization.

World Health Organization. (2000a). The Asia-Pacific perspective: redefining obesity and its treatment.

World Health Organization. (2000b). Obesity: preventing and managing the global epidemic.

World Health Organization. (2017). Fact sheet: the top 10 causes of death. *World Health Organization, Geneva, Switzerland*.

World Health Organization. (2018). cardiovascular risk prediction charts Retrieved from http://www.who.int/cardiovascular_diseases/guidelines/Chart_predictions/en/

Wu, C.-Y., Hu, H.-Y., Chou, Y.-J., Huang, N., Chou, Y.-C., & Li, C.-P. (2015). High blood pressure and all-cause and cardiovascular disease mortalities in community-dwelling older adults. *Medicine, 94*(47).

Zhao, J., Kelly, M., Bain, C., Seubsman, S.-A., Study, T. T. T. C., & Sleigh, A. (2015). Risk factors for cardiovascular disease mortality among 86866 members of the Thai cohort study, 2005-2010. *Global journal of health science, 7*(1), 107.

Zhou, B., Bentham, J., Di Cesare, M., Bixby, H., Danaei, G., Cowan, M. J., . . . Bennett, J. E. (2017). Worldwide trends in blood pressure from 1975 to 2015: a pooled analysis of 1479 population-based measurement studies with 19· 1 million participants. *The Lancet, 389*(10064), 37-55.