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AN EDUCATIONAL ASSESSMENT OF PREVENTIVE BEHAVIORS OF CARDIOVASCULAR DISEASE AMONG ADULT WORKERS WITH HYPERTENSION

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ABSTRACT

Introduction: In Thailand, approximately 13 million adult workers have hypertension, with approximately 4.7% of those living in acculturated societies at a higher risk of developing cardiovascular disease (CVD). **Aims:** This study aims to examine the factors that predicted CVD prevention behaviors in individuals with hypertension. **Methods:** A cross-sectional analytical study was conducted on 1,151 adult workers with hypertension from Sukhothai Province, Thailand, using a multistage sampling technique. The measurement tools included a standardized questionnaire approved by three experts and tested for reliability using the Cronbach's alpha. A multiple regression analysis was used to identify factors that predicted CVD prevention behaviors. **Results:** This study involved a total of 1,151 participants, 61.90% of whom were females, with an average age of 52 years. In addition, 71.80% of the participants had a family history of CVD. The majority of the participants (73.4%) exhibited moderate levels of CVD preventive behaviors. Factors that predicted CVD preventive behaviors included self-efficacy (β = 0.423), family and social support (β = 0.162), perceived information (β = 0.119), attitude (β = 0.117), knowledge (β = 0.089), living with nuisance (β = -0.049), and family history of hypertension (β = 0.049). These predictors accounted for 39.2% of the variance (R^2 = 0.392, p = 0.05). **Conclusion:** The intervention mapping to promote CVD preventive behaviors in adult workers with hypertension should focus on increasing self-efficacy by providing information to improve individual knowledge and attitude, as well as addressing environmental factors that may affect people's well-being, such as nuisances.

Keywords: cardiovascular disease, working adults, PRECEDE model, preventive behaviors, hypertension patients

INTRODUCTION

Cardiovascular disease (CVD) is a group of conditions that affect the heart and blood vessels, including cerebrovascular disease, rheumatic heart disease, and coronary heart disease. According to the World Health Organization (WHO) (2022a), heart attacks and strokes are responsible for more than 80% of CVD deaths, with one-third of these deaths occurring in people under the age of 70 years. Low- and middle-income countries account for at least three-quarters of all CVD deaths. In low- and middle-income countries, individuals with CVD and other noncommunicable diseases often lack access to effective and equitable healthcare services that meet their needs. As a result, many individuals in these countries experience delayed disease identification and premature death from CVD and other noncommunicable diseases during their most productive years of their lives (WHO, 2022b).

Over the past decade, primary research has established a consensus that blood pressure is causally associated with the development of all cardiovascular diseases in adults of all ages (Banik, 2014). A systolic blood pressure between 120 and 129 mmHg is associated with the lowest risks of CVD. The risk of death significantly increased when systolic blood pressure (SBP) reaches 160 mm/Hg or diastolic blood pressure (BP) reaches 90 mm/Hg. Women with stage 2 or 3 hypertension have a significantly higher risk of death. However, the risk of hypertension-related death decreases with age (Wu et al., 2015). In addition, the living environment of patients with hypertension

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can affect their blood pressure and the risk of CVD. External environmental factors that can have an impact include the built environment, ambient temperature, noise, proximity to major highways, green spaces, and exposure to other pollutants and toxins. Individuals who are frequently exposed to environmental factors are at an increased risk of CVD, as evidenced by the incidence of hypertension (Alageel et al., 2016). A systematic study found multiple associations between various behavioral risk factors, such as alcohol consumption, smoking, physical inactivity, and eating habits, and an increased risk of CVD (Haines et al., 2007; WHO, 2007). The implementation of suitable health promotion programs and techniques is crucial to prevent chronic diseases and enhance overall quality of life (Edelman and Kudzma, 2021). Healthcare systems should prioritize incorporating healthy lifestyle (HL) activities into all patient and client communications. To lower the risk of CVD, it is recommended to engage in regular physical activities that increase cardiorespiratory fitness (CRF), maintain healthy eating habits, quit smoking, get enough sleep, and lose weight. Clinicians should prioritize the incorporation of HL behaviors when communicating with patients. However, they cannot improve health literacy alone. They must collaborate with other healthcare professionals with expertise in HL behaviors, including exercise psychologists, nurses, dietitians, and health behavior specialists (Joseph et al., 2017).

According to public health statistics from the Health Data Center Thailand from 2015 to 2016, the incidence of CVD increased from 35.26 to 47.77 and gradually decreased from 2017 to 2022 to 45.00, 36.75, 26.13, 25.04, 21.36, and 21.17 per 100.000 population. The case fatality rate of CVD among people aged between 40 and 59 years increased from 2018 to 2022. Approximately 4.7% of individuals living in acculturated societies were at a higher risk of developing CVD (Health Data Center, 2022). CVD is predicted to place a significant burden on Thailand's healthcare system over the next 20 to 30 years (WHO, 2017). This health problem affects not only older individuals, but also younger asymptomatic individuals (Cheah et al., 2018). The Thai population health survey from 2019 to 2020 found that 13 million individuals aged 18 years and older had hypertension. To prevent CVD and kidney disease, which are major causes of death, blood pressure control is crucial for individuals with hypertension (Department of Disease Control, 2021). Therefore, preventive measures are of the utmost importance. Disease prevention is crucial to halt the development of disease, particularly in adult worker patients with hypertension.

Individuals, organizations, and communities should adopt health promotion programs because collaboration between participants and healthcare professionals can help people achieve their health goals (Bauer et al., 2014). Healthcare professionals can assess the health risks and enrichment elements during health promotion programs. Theory-based health promotion initiatives are essential for determining the appropriateness of these components (Gielen et al., 2008). Patients with hypertension can reduce their risk of CVD by not smoking, engaging in physical activities, consuming a heart-healthy diet, maintaining a healthy weight, and managing stress and depression (Benjamin et al., 2018; WHO, 2022a).

The Policy, Administrative, and Organizational Structures in Educational and Environmental Development (PRECEDE-PROCEED) model is a useful theoretical framework for planning, implementing, and evaluating health promotion activities. Providing people with more knowledge can increase their likelihood of engaging in health-related behaviors. Therefore, the PRECEDE-PROCEED can serve as the theoretical basis for health promotion interventions across different demographic groups,

especially those that are beneficial for increasing knowledge (Kim et al., 2022). The PRECEDE model was developed to address the need for health diagnosis and education, while the PROCEED model was later added to the framework by integrating elements of policy, legislation, organization, and environment to emphasize the consequences of ecological factors in the modified model (Green & Kreuter, 2005).

To promote preventive behaviors, the first process of the PRECEDE framework, which should identify factors associated with the behaviors, is ecological and educational assessment. Previous studies found that factors associated with CVD preventive behaviors were perceived benefits and general knowledge, suggesting that perceived barriers, perceived benefits, family history of CVD, and screening purpose motivated young people to engage in health promotion practices (Lim et al., 2021). Gender, perceived susceptibility, response efficacy, and self-efficacy were also associated with CVD preventive behaviors (Arees, 2018). In recent years, data on sociodemographic factors and CVD preventive behaviors have increased. However, there has been little effort in the collection of these data and analysis of the actual factors associated with behaviors in the field. Few studies have examined the factors associated with preventive behaviors, especially in the adult workers in Thailand. In order to improve and implement an effective intervention to prevent CVD in patients with hypertension, it is necessary to understand a variety of CVD prevention strategies as well as the their sociocultural factors. Therefore, an ecological and educational assessment is an important step to identify behavioral factors and to examine factors that predict CVD preventive behaviors.

This study focused on dietary avoidance of fat and cholesterol, physical activity, weight control, stress management, smoking and alcohol cessation, medications, and medical adherence. In addition, sociodemographic factors, including gender and genetics, predisposing factors, including self-efficacy, knowledge, and attitudes, reinforcing factors, including family and social support, enabling factors, including access to services and perceived information, and environmental factors, including nuisance, were examines. This study aims to examine factors that predict preventive behaviors in adult workers with hypertension to promote CVD prevention behaviors using the PRECEDE model.

METHODS

Study design and sampling

This cross-sectional analytical study was conducted in Sukhothai Province, Thailand. The province has 37,355 adult workers aged between 20 and 59 years with hypertension. Participants were required to be in continuous medical adherence and to have lived in Sukhothai for a minimum of six months. Participants who moved out of the study area and were diagnosed with CVD were excluded. The outcomes of the measurement were preventive behaviors, including diet, exercise, weight control, stress management, smoking and alcohol cessation, medications, and medical adherence. The sample size was determined using the proportional estimation, with 1,151 subjects required. The participants were selected using a multistage sampling technique. In the first stage, a simple random sampling technique was used in the top three districts with the highest prevalence of CVD in 2022. In the second stage, proportions with the outcomes in all of the three districts were examined. The last stage involved a systematic random sampling technique in all districts.

Data collection and measurement

A multistage sampling technique was used to collect the data. Stage 1 involved the random selection of three of the nine districts in Sukhothai Province. Stage 2 involved the random selection of

two sub-districts from the selected districts. Finally, all participants were randomly selected systematically for interview. Data were collected and participants were interviewed in collaboration with researchers, health promotion hospital staff, and the three District Health Offices.

The measurement tools included a standardized questionnaire that was approved by three experts and used the index of item objective congruence (IOC) between 0.6 and 1.0. The questionnaire had eight parts, including (1) general information of age, gender, diabetes level, family history of hypertension and CVD, body mass index (BMI) classified according to the WHO guidelines: underweight (<18.5), normal (18.5-24.9), overweight (25-29.9), and obese (≥30)(WHO, 2000a; 2000b); (2) knowledge measured by positive and negative statements: yes, no, and uncertain; (3) attitude measured by positive and negative statements: strongly agree, agree, uncertain, disagree, and strongly disagree; (4) self-efficacy measured by positive and negative statements: very high, high, moderate, low, and very low, (5) social support measured by positive and negative statements: always, sometimes, rarely, and never; (6) access to service measured by positive and negative statements: very high, high, moderate, low, and very low; (7) perceived information measured by positive and negative statements: very high, high, moderate, low, and very low; and (8) preventive behaviors measured by dietary avoidance of fat and cholesterol, exercise, weight control, stress management, smoking, drinking, medications, medical adherence and consisting of positive and negative statements: always, sometimes, rarely, and never.

Finally, the reliability was tested using the Cronbach's alpha for knowledge, attitude, self-efficacy, social support, access to service, perceived information, and preventive behaviors and obtained the values of 0.85, 0.76, 0.77, 0.73, 0.90, 0.87, and 0.83, respectively. According to Bloom (1971), preventive behavior was interpreted on the basis of criteria-based grading considerations. The criteria are divided into three levels, namely high, moderate, and low with 80 percent or more, between 60 and 79.99, and less than 60, respectively.

Statistical analysis

Descriptive statistics including frequency, percentage, mean, and standard deviation, were calculated to describe the general characteristics. To examine the relationship among the main factors, including sociodemographic, predisposing, enabling, reinforcing, and preventive behaviors, the Spearman's rank correlation coefficient, independent t-test, and Chi-squared test were used. Finally, a multiple regression analysis was used to investigate factors that predicted the research outcomes, namely preventive behaviors.

Ethical considerations

This study received ethical approval from the Ethics Committee in Human Research of the Institutional Review Board of Naresuan University, Phitsanulok Province, Thailand, with a certificate number 069/2022.

RESULTS

Table 1 shows that 61.95% of the participants were females and the median age was 52 years. In terms of general characteristics, 71.8% of the patients had a family history of heart disease (HD), more than half had dyslipidemia, and 16.8% had coexisting diabetes mellitus (DM). Most participants lived with nuisance and more than 60% were overweight or obese. In addition, gender was found to be associated with age, time since diagnosis of hypertension (HT), family history of HT, family history of HD, dyslipidemia, and BMI level. Furthermore, on average, women had a longer time since diagnosis of HT compared to men.

Table 1. Characteristics of the participants

Characteristics	General (n = 1,151)	Male (n = 438)	Female (n = 713)	Statistics	p-value
Sociodemographic					
Age ((X) ± SD)	51.71± 6.53	50.52 ± 7.41	52.44 ± 5.81	t = 4.62	<0.001
Time since Diagnosis of Hypertension (HT)	6.53 ± 4.41	5.89 ± 3.96	6.92 ± 4.62	t = 4.02	<0.001
Family History of HT					
Yes	278 (24.20)	120 (43.20)	158 (56.80)	$\chi2$ = 4.06	0.044
No	873 (75.80)	318 (36.40)	555 (63.60)		
Family History of Heart Disease (HD)					
Yes	826 (71.80)	335 (40.60)	491 (59.40)	$\chi2$ = 7.77	0.005
No	325 (28.20)	103 (36.40)	222 (68.30)		
Diagnosed with Diabetes					
Yes	193 (16.80)	63 (32.60)	130 (67.40)	$\chi2$ = 2.88	0.090
No	958 (83.20)	375 (39.10)	583 (60.90)		
Diagnosed with Dyslipidemia					
Yes	574 (49.90)	202 (35.20)	372 (64.80)	$\chi2$ = 3.98	0.046
No	577 (50.10)	236 (40.90)	341 (59.10)		
Body Mass Index					
Underweight	36 (3.10)	21 (58.30)	15 (41.70)	$\chi2$ = 27.81	<0.001
Normal	414 (36.00)	191 (46.10)	223 (53.90)		
Overweight	451 (39.20)	146 (32.40)	305 (67.60)		
Obese	250 (21.70)	80 (32.00)	170 (68.00)		
Environment					
Living with nuisance					
Yes	797 (69.20)	316 (39.60)	481 (60.40)	$\chi2$ = 2.80	0.094
No	354 (30.80)	122 (34.50)	232 (65.50)		

Table 2. Mean score of predisposing, enabling, and reinforcing factors and preventive behaviors

Factors	Number of items	Range of scores	General (n = 1,151) (X̄) ± SD	Male (n = 438) (X̄) ± SD	Female (n = 713) (X̄) ± SD	t	p-value
Predisposing							
Knowledge	10	0-10	6.22 ± 3.50	6.25 ± 3.49	6.20 ± 3.51	0.217	0.829
Attitude	10	10-50	35.82 ± 0.79	35.69 ± 3.82	35.90 ± 3.77	0.935	0.350
Self-efficacy	10	10-50	38.35 ± 4.36	37.54 ± 4.80	38.85 ± 3.99	5.016	<0.001
Reinforcing							
Family and social support	10	10-40	28.55 ± 3.91	28.45 ± 0.99	28.60 ± 3.85	0.637	0.524
Enabling							
Access to service	8	8-40	31.76 ± 5.23	31.86 ± 4.94	31.70 ± 5.41	0.495	0.621
Perceived information	7	7-35	23.44 ± 5.34	23.62 ± 5.43	23.33 ± 5.29	0.878	0.380
Preventive behaviors	23	23-92	64.75 ± 8.65	63.52 ± 9.58	65.51 ± 7.93	3.659	<0.001

Table 3. Correlation between sociodemographic, predisposing, enabling, reinforcing factors and preventive behaviors

Factors	1	2	3	4	5	6	7	8	9	10	11	12	13
(1) Preventive behavior	1.00												
(2) Age	0.06	1.00											
(3) Family history of HD	0.05	0.01	1.00										
(4) Diagnosed with DM	0.04	0.06*	0.06*	1.00									
(5) Time since diagnosis of HT	0.02	0.28**	0.02	0.15**	1.00								
(6) BMI	0.05	-0.18**	0.03	0.06*	0.04	1.00							
(7) Knowledge	0.24**	-0.00	0.08**	0.18**	0.05	0.04	1.00						
(8) Attitude	0.29**	0.04	0.05	0.05	0.01	0.03	0.39**	1.00					

Factors	1	2	3	4	5	6	7	8	9	10	11	12	13
(9) Self-efficacy	0.51**	0.14**	-0.03	0.03	0.09**	0.01	0.18**	0.24**	1.00				
(10) Family and social support	0.36**	0.04	0.00	0.02	0.03	0.03	0.11**	0.15**	0.31**	1.00			
(11) Access to service	0.20**	0.00	-0.03	-0.04	0.06*	0.04	-0.04	0.13**	0.28**	0.33**	1.00		
(12) Perceived information	0.27**	-0.05	-0.02	0.00	-0.04	0.02	0.13**	0.13**	0.18**	0.43**	0.47**	1.00	
(13) Living with nuisance	-0.11**	-0.06	0.02	-0.01	-0.03	0.03	0.01	0.03	-0.08**	-0.04	-0.05	-0.03	1.00

* Correlation is significant at 0.05 (2-tailed).
** Correlation is significant at 0.01 (2-tailed).

This study found that the prevalence of hypertension and family history of heart disease, dyslipidemia, and BMI in females was higher than in males. Table 2 presents the mean scores of self-efficacy and preventive behaviors between males and females in this study. The findings revealed a significant difference in the average scores between the two sexes, with females exhibiting higher average scores in both self-efficacy and preventive behaviors compared to males. Overall, the levels of knowledge, attitude, self-efficacy, family and social support, access to service, perceived information, and preventive behaviors were at a moderate level.

Table 3 shows that preventive behaviors as well as personal, redisposing, enabling, and reinforcing factors had a negative correlation with males living with nuisance. Meanwhile, they had a positive correlation with knowledge, attitude, self-efficacy, family and social support, access to service, and perceived information.

In terms of preventive behaviors, most of the participants had a low or moderate levels of dietary avoidance of fat and cholesterol (94.1%), had always done physical activities and exercises (60.3%), had moderate weight control (44.4%). Moreover, only 14.2% of them were smokers, while approximately half of them consumed alcohol. To control blood pressure, the participants reported high levels of medication use and adherence, as shown in Table 4. Furthermore, the multiple regression analysis was used to examine the factors that predicted preventive behaviors. The final model predicted that preventive behaviors, including knowledge, attitude, self-efficacy, family and social support, perceived information, living with nuisance, and family history of HT, were associated with preventive behaviors and predicted 39.2% of behaviors. Table 5 shows the major factors that influenced preventive behavior scores, namely self-efficacy, family and social support, and perceived information.

Table 4. Preventive behaviors

Preventive behaviors	n	%
Dietary avoidance of fat and cholesterol		
Low	444	38.60
Moderate	639	55.50
High	68	5.90
Physical activity		
Always	694	60.30
Sometimes	333	28.90
Never	112	10.80

Preventive behaviors	n	%
Body weight control		
Low	465	40.40
Moderate	511	44.40
High	175	15.20
Stress management		
Low	367	31.90
Moderate	567	49.20
High	217	18.90
Smoking		
Non-smoking	987	85.80
Smoking	164	14.20
Drinking		
Non-drinking	590	51.30
Drinking	561	48.70
Medication adherence		
Low	69	6.00
Moderate	359	31.20
High	723	62.80
Doctor's appointment		
Always	918	79.80
Rarely or never	233	20.20
Overall preventive behavior		
Low	120	10.40
Moderate	845	73.40
High	186	16.20

DISCUSSION

A cross-sectional study by means of an ecological and educational assessment was conducted to explore and examine the factors that predicted preventive behaviors of CVD among adult workers with hypertension according to the PRECEED framework of the PRECEED-PROCEDE model. To the best of the researchers' knowledge, this study is the first to examine overall preventive behaviors in a community setting among adults with hypertension who live in a rural area in the lower northern region of Thailand. This study found that 73.4% of adults with hypertension exhibited moderate preventive behaviors of CVD. The data are in contrast to the theory that sociodemographic factors and gender were strongly associated with preventive behaviors of CVD. In addition, females had a higher average score for overall behavior and self-efficacy than males. However, when comparing the prevalence of BMI in overweight and obese individuals, dyslipidemia, and diabetes, females had a higher prevalence than males.

The correlation matrix revealed a significant relationship between predisposing factors, namely knowledge, attitude, and self-efficacy, and preventive behaviors. To develop a model for behavioral changes, it is necessary to focus on enhancing knowledge and attitude to improve self-efficacy outcomes. Preventive behaviors include a high level of physical activity, medication adherence, and doctor's appointments. On the other hand, self-efficacy, family and social support, perceived information, attitude, knowledge, living with nuisance, and family history with HT were factors predicting preventive behaviors of CVD.

Furthermore, the results of the multivariate analysis suggested that self-efficacy played a crucial role in influencing behaviors. To prevent CVD, it is important to evaluate overall cardiovascular risk, which can be done in various ways.

Table 5. Factors predicting preventive behaviors

Factors	B	SE	β	t
Knowledge	0.220	0.061	0.089	3.584**
Attitude	0.267	0.057	0.117	4.645**
Self-efficacy	0.839	0.050	0.423	16.722**
Family and social support	0.358	0.059	0.162	6.056**
Perceived information	0.193	0.042	0.119	4.646**

Living with nuisance	-0.917	0.434	-0.049	-2.113*
Family history of HT	0.947	0.445	0.049	2.126*
constant	6.309	2.598		2.429*

R^2 = 0.392, SEE = 6.76, F= 105.19, Sig of F = <0.001, * = P < 0.05, ** = P< 0.01

Although young women may have many major risk factors and a significant increase in their relative risk, they are unlikely to experience high levels of risk due to the significant impact of age on risk (Kjeldsen, 2018). However, when comparing individuals of the same age, males tend to have more risk factors than females, such as smoking or drinking.

In adult workers, primary prevention of CVD should include statin therapy and blood pressure control, which reduce the risk of coronary artery disease and stroke by promoting preventive behaviors (Barry et al., 2016). The PRECEED model in this study identified predisposing factors, such as knowledge, attitude, and self-efficacy, that influenced preventive behaviors. Knowledge enables individuals to identify potential threats and take appropriate preventive measures. Staying informed helps individuals make better decisions and implement preventive behaviors effectively. Attitude influences an individual's behavior, especially their desire to engage in preventive behaviors.

Individuals who have a positive attitude towards preventive behaviors are more likely to adopt healthy habits and take the necessary precautions. This is because they perceive preventive behaviors as beneficial and are more motivated to engage in actions that promote their well-being. On the other hand, individuals with a negative attitude may be less inclined to prioritize preventive measures, hindering their ability to protect their health.

Self-efficacy, as well as knowledge and attitude, was found to be the most influential factor in promoting preventive behaviors, particularly medication adherence (Lu et al., 2020). In this study, self-efficacy refers to an individual’s belief in their ability to effectively carry out a certain task.

Strong self-efficacy increases the likelihood of adopting and maintaining healthy preventive behaviors. Individuals who are confident in their ability to take preventative measures are more likely to overcome obstacles and sustain their efforts. In addition, enhancing self-efficacy through education and support can significantly contribute to preventive behaviors.

Family and social support in promoting preventive behaviors is crucial. Support from loved ones, including family members, friends, and communities, can positively impact an individual's motivation to engage in preventive measures (Shumaker & Czajkowski, 2013). Social support can influence stress management, and low social support or being single, as well as depression may be independent risk factors for poor cardiovascular prognosis (Compare et al., 2013). Through encouragement, shared knowledge, and collective efforts, individuals are more likely to adopt and sustain preventive behaviors. The presence of a supportive network can provide individuals with a sense of accountability and reinforce the importance of preventive behaviors.

Perceived information refers to an individual's understanding and interpretation of health-related information. Perceived severity and calls to action have been identified as determinants of perceived prevention behaviors of CVD (Amdemariam et al., 2022). When individuals perceive information accurately and comprehensively, they can make informed health decisions. Therefore, effective communication of preventive measures, risks, and benefits can positively influence individuals' perceptions of information, leading to increased engagement in preventive behaviors.

This study focused on environmental factors that can negatively

impact preventive behaviors, such as living with nuisance or in unhealthy environments or unsafe conditions with waste or air pollution, poor community cleanliness, and drainage problems. Some these nuisances can cause stress and depression which may be associated with CVD (Hare et al., 2014).

Individuals living in environments with health risks, such as high pollution levels or inadequate sanitation, may face obstacles to adopting health-protective measures. As a result, overcoming these barriers require collective efforts from policymakers, communities, and individuals to address and mitigate nuisance factors.

Preventive behavior plays a crucial role in protecting individuals from various health risks and promoting overall well-being. This study has demonstrated the positive correlation between preventive behaviors and various factors, including knowledge, attitude, self-efficacy, family and social support, access to services, perceived information, as well as the negative correlation with living with nuisance. By understanding the importance of these factors, individuals can make informed decisions and take proactive measures to protect their health.

Finally, the primary outcome of reducing the risk of CVD was blood pressure control (Wu et al., 2015; Ettehad, et al., 2016), which includes weight control, stress management, dietary avoidance of fat and cholesterol, exercise, smoking and alcohol cessation, medications, medical adherence.

By prioritizing proactive measures, individuals can reduce the risk of CVD and improve their overall quality of life. In addition, it is important for individuals, communities, and policymakers to work together to create an environment that supports and encourages preventive behaviors.

Nevertheless, several limitations of this study should be considered. This study was limited to three out of nine districts in Sukhothai Province and used a simple random sampling technique from health promotion hospitals. Therefore, the participants may not be representative of all patients with hypertension in Sukhothai Province.

This study suggests that authorities should promote and improve individual self-efficacy, attitude, and knowledge to reduce the risk of CVD. Intervention programs aimed at improving these individual behaviors should focus on social support, including families, communities, and health authorities, through perceived information about the reduction of the risk of CVD. Environmental factors, such as noise and air pollution, might have both direct and indirect effects on patients with hypertension. Therefore, policies should aim to reduce environmental health problems in the communities. Further research should focus on the administration, implementation, and effectiveness of the intervention as a cohesive program using methods of delivery that suit the participants' knowledge, attitude, and level of self-efficacy.

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