Predictors of Albuminuria and Uncontrolled Blood Pressure in People with Hypertension in The Community

Lapatrada Numkham, Noppawan Piaseu, Orasa Panpakdee, Susanna L. Cunningham, Natkamol Chansatitporn

Abstract : The aims of this descriptive predictive study of people with hypertension in the community were to 1) describe the prevalence of albuminuria and uncontrolled blood pressure, and 2) examine the factors predicting of albuminuria and uncontrolled blood pressure. A socio-ecological model was used to guide the conceptual framework. The sample was 360 community-dwelling people with hypertension in a province in central Thailand. Data were collected using questionnaire-based, structured interviews about health information, health behaviors, knowledge and attitude toward hypertension, family support, and community participation. A three-day food record was completed. Body mass index, waist circumference, blood pressure, and albuminuria were measured. Data were analyzed using descriptive statistics and multiple logistic regression.

The prevalences of microalbuminuria, macroalbuminuria and uncontrolled blood pressure were 23.6%, 3.9%, and 52.2% respectively. Multiple logistic regression analysis revealed that sodium intake and stress together predicted 72.5% of albuminuria. Sodium intake, medication adherence, knowledge of hypertension, and stress together predicted 65.3% of uncontrolled blood pressure. These results suggest that community health nurses should 1) monitor people with uncontrolled hypertension who exhibit high sodium intake and implement interventions to increase health awareness and promote low sodium consumption; 2) coordinate with the physicians to monitor albuminuria, particularly in persons with high sodium intake and high stress; and 3) collaborate with the community to initiate a campaign to raise awareness of the risks of high blood pressure.

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Introduction

According to the World Health Organization (WHO), elevated blood pressure or uncontrolled hypertension is the highest leading behavioral and physiological risk factor globally in terms of attributable deaths. It has been estimated that high blood pressure causes 45% of coronary heart disease deaths and 51% of stroke deaths.[1] The recommended blood pressure level is below 140/90 mmHg for the general population

***Lapatrada Numkham**, RN, PhD (Candidate). Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand, 10400.*
***E-mail:** rada_tu@hotmail.com*
***Correspondence to: Noppawan Piaseu**, RN, PhD (Nursing). Associate Professor, Ramathibodi School of Nursing, Faculty of Medicine Ramathibodi Hospital, Mahidol University. 270, Rama VI Road, Ratchathewi, Bangkok 10400, Thailand. **E-mail:** noppawan.pia@mahidol.ac.th*
***Orasa Panpakdee**, RN, DNS. Associate Professor, Ramathibodi School of Nursing, Faculty of Medicine Ramathibodi Hospital, Mahidol University. 270, Rama VI Road, Ratchathewi, Bangkok 10400, Thailand.*
***Susanna L. Cunningham**, RN, PhD. Professor, Biobehavioral Nursing and Health Systems, School of Nursing, University of Washington, USA.*
***Natkamol Chansatitporn**, BSc., ScD.(Biostatistics). Assistant Professor, Department of Biostatistics, Faculty of Public Health, Mahidol Univesity. 420/1 Ratchawithi Road, Ratchthewi, Bangkok 10400, Thailand.*

and for the population with hypertension with no other complications, and less than 130/80 mmHg for those with diabetes mellitus or chronic kidney disease.[2] The last National Health Examination Survey IV (2008-2009) of 12,240 Thai people aged 15 years and older found that 20.7% of people diagnosed with hypertension had uncontrolled blood pressure [3] and it was reported by WHO that 22.3% of people diagnosed with high blood pressure in Thailand do not have their blood pressure under control.[4]

One of the negative health outcomes of high blood pressure is albuminuria, including microalbuminuria[5] and macroalbuminuria.[6] Microalbuminuria is a biological marker of systemic endothelial dysfunction, considered to be an early sign of the atherosclerotic process and the resulting kidney damage.[5] Macroalbuminuria, an advanced stage of microalbuminuria, is associated with the risk for progressive loss of renal function and a worse cardiovascular prognosis.[6] However, macroalbuminuria is more closely associated with renal dysfunction than cardiovascular events.[6]

Most studies about albuminuria in Thailand have been done in people with diabetes mellitus, but two studies have been conducted, revealing 18-45% of microalbuminuria in the sample with hypertension.[7,8] Although there were studies addressing predictors of uncontrolled blood pressure in different geographical areas including the central,[9] the north-easthern,[10] and the southern part of Thailand,[11] differences in settings occur in community contexts and lifestyle.

The complications of uncontrolled blood pressure impact individuals, family, and society at the national level, resulting in increased healthcare costs and decreased national income. Therefore, the goal of this study was to investigate predictors of uncontrolled blood pressure and albuminuria among people with hypertension to develop information on how to improve hypertension care.

Conceptual Framework and Review of the Literature

The Socio-ecological Model,[12] based on Bronfenbrenner's Ecological Systems theory, was used to guide the study. This Model is comprehensive, including all factors from individual to community and from biological factors to psychosocial and behavior factors. The Model focuses on the dynamic interaction of the person with their environment.[13] Using the socio-ecological approach includes factors classified at an individual level such as personal characteristics, knowledge and attitudes about hypertension, stress, and health behaviors. The factor classified at the interpersonal level was family support and at the community level it was participation in community activities.

Albuminuria is predictive of poor renal and cardiovascular outcomes in people with hypertension. The individual factors that have been found to be associated with albuminuria include age[5], gender[14], smoking, stress, inflammation,[5] sodium intake,[5,15,16] and metabolic syndrome which includes diabetes mellitus,[14] hypertension,[14] body mass index (BMI)[17], waist circumference (WC)[17], and hyperlipidemia. No existing literature related to albuminuria has been done using a model that allows examination of family or community level factors.

Individual risk factors for hypertension can be categorized into two groups: non-modifiable and modifiable risk factors. Non-modifiable factors include gender, age, and duration of hypertension. The risk for developing high blood pressure is at ages over 65 years, and women are at greater risk than men.[3] Modifiable risk factors include individual health behaviors such as dietary behavior, alcohol drinking, exercise, medication adherence, body weight, and stress management.[9,18,19] A positive correlation has been found between a reduction of sodium intake and a decrease in blood pressure.[18] Many studies have shown that excessive alcohol intake,[19] lack of exercise behavior,[9] poor medication adherence,[9,20] and stress[15] are associated with the incidence of high blood pressure. Obesity represents a state of vascular inflammation that can cause endothelial dysfunction[21] and is one of the factors related to uncontrolled blood pressure.[21,22]

In addition, a lack of awareness about hypertension and knowledge of disease and treatment have been associated with uncontrolled blood pressure.[23]

Previous studies in Thailand have indicated that family members are the major source of emotional, appraisal, and instrumental support for people with hypertension[10,24] and the most significant factor related to blood pressure control in Thailand was family and family support.[10,24] To date, a small number of studies have included community involvement in the predictors of blood pressure control among people with hypertension. If community involvement were included in the predictors, the scope of nursing practice would expand to the community and collaboration could take place with other professionals that work with the community, such as social workers or the local government. Community participation is a principle that involved active inhabitants in all appearances of strategic plan development, implementation, and evaluation for continued participation in empowerment programs.[25]

Aims: The study aims were to: 1) describe the prevalence of albuminuria and uncontrolled blood pressure and 2) examine the personal factors (age, gender, duration of hypertension, BMI, waist circumference, knowledge and attitude toward hypertension, and stress), health behaviors (smoking, alcohol drinking, physical activity, medical adherence, stress management, and sodium intake), family support and participation in community activities predicting albuminuria and uncontrolled blood pressure in community dwellers with hypertension.

Methods

Design: A cross sectional, predictive design was used.

Ethical Considerations: The study was approved by the Human Subjects Committee of Mahidol University. Participants that met the eligibility criteria were informed of the study purpose and their right to refuse to answer the questions and were asked to sign a consent form.

Sample and Setting: Potential participants were people with hypertension that had come for follow-up at a chronic illness clinic at two health-promoting hospitals in a community in a province in central Thailand, from May to July, 2013.

The participants were recruited through convenience sampling according to the following inclusion criteria: 1) a diagnosis of hypertension for at least six months; 2) no medication changes with the past month; 3) able to read, write, and verbally communicate in Thai; 4) willingness to participate in the study; 5) aged ≥60 years, and 6) no mental health problems based on the Chula Mental Test. Persons who were pregnant, lactating, taking more than three medicines, and/or had a fever or cellulitis were excluded from the study.

Sample size was determined based on logistic regression. The recommended sample size for each group was at least 10 observations per estimated parameter.[26] Since this study included 15 predictors, the minimum sample size for each group was 150. There were two outcome category groups: controlled and uncontrolled blood pressure groups so the total sample size was 300. To allow for incomplete data on some participants, 60 participants (approximately 20% of the sample) were added resulting in a final sample size of 360.

Instruments: The instruments consisted of six questionnaires and a record form. These were personal factors, health behaviors, family factor, and community factor instruments:

1) The Demographic Questionnaire (DQ), developed by the researcher, consisted of age, gender, occupation, religion and duration of hypertension. Age and duration of hypertension were reported in years.

2) The Knowledge of Hypertension Questionnaire (KHQ), modified from Rujiwatthanakorn,[27] consists of 12 items concerning hypertension knowledge: knowledge about food consumption (5 items), medication (2 items), stress (2 items), exercise (2 items), and

complications (1 item). The respondents answer yes, no, or not sure. The scores are 1 (yes) and 0 (no or not sure). The total scores range from 0 to 12 and are classified into 3 levels according to Bloom's cut-off point, 60%-80%, as follows: 0-7 or < 59% low; 8-9 or 60-80% moderate; and 10-12 or 80-100% high.

3) The Attitudes toward Hypertension Questionnaire (AHQ), modified from Klabcharone, [28] consist of 10 items with positive and negative statements: the feelings, beliefs and opinions of the participants toward their high blood pressure and related to signs and symptoms (1 item), causes (2 items), complications (1 item), and prevention of hypertension (6 items), using a 5-point rating scale from 1 (disagree) to 5 (completely agree). The scores range from 10-50 and are divided into 3 levels based on $\bar{X} \pm S.D$: positive attitudes (> 46), medium attitudes (34-46), and low attitudes (< 34).

4) The Life Distress Inventory (LDI) used to measure perceived stress, was developed by Patrayutawat et al., [29] and consists of 20 items. Responses are on a 5-point rating scale ranging from 0 (no stress) to 4 (severe stress). The total scores range from 0-80 and are divide into 5 groups: low (0-3), normal (4-18), mild (19-25), moderate (26-33), and high stress (34-80). Later for the multiple logistic regression the scores are dichotomized: normal and low are included in the normal group, while mild, moderate and high stress are included in the stress group.

5) Body Mass Index is recorded as body weight in kilograms divided by height in meters squared as measured by the digital weighing scale and height meter. Participants were classified into 4 groups: underweight if their BMI was lower than 18.5 kg/m^2; low-risk cardiovascular disease (CVD) if the BMI was between 18.5 – 22.99 kg/m^2, moderate-risk group for CVD if the BMI was 23.00-27.49 kg/m^2, and high-risk group for CVD if the BMI was 27.50 kg/m^2 and above.[30]

6) Waist Circumference (WC) was measured as the distance around the abdomen at the level of the umbilicus. It was measured at the end of a normal expiration. Participants were classified into 2 groups: normal and excessive. The cut-off point of excessive in men was >90cm. and for women it was >80cm.

The six health behavior instruments included:

1) The Cigarette Smoking Questionnaire (CSQ), was developed by the researcher based on a literature review. The use of cigarettes and cigars and smokeless tobacco products was assessed. Participants were classified into 2 groups: smoking and nonsmoking.

2) The Alcohol Intake Questionnaire (AIQ) to assess the frequency of drinking and the number of drinks that the participants consumed was developed by the researcher based on a literature review. A drink is classified as 12oz. beer, 4oz. wine, or 1.5oz. 80-proof spirits.31 Participants were classified into 3 groups: non-drinking, moderate drinking, and excessive drinking. A person that did not drink at all was classified as a non-drinker. A person that drank one to two drinks a day for men, and one drink a day for women was classified under moderate drinking. Any person that drank more than that specified as moderate drinking was placed into the excessive drinking category.31

3) The Medication Adherence Questionnaire (MAQ) was modified from Itthakom [20] and consists of a modified visual analog scale: the % of frequency of medications taken as prescribed in the past month. The modified visual analog scale asked people with hypertension to put a mark on the line (100 mm.) at the point showing their best guess about what % of their medications they had taken in the last month. If the % was more than 80% participants were classified into adherence to medication. For more understanding, an open-ended question about the reason for low medication adherence was added.

4) The Stress Management Questionnaire (SMQ) was modified from the instrument of the Department of Mental Health, Ministry of Public Health, Thailand and Rujiwatthanakorn [27] and consisted of 10 items about strategies to reduce stress, and one

open-ended question. Responses were yes or no. Participants who responded to "yes" were classified into having stress management strategies and if "no" were classified into having no stress management.

5) The Global Physical Activity Questionnaire (GPAQ), measured participants' self report of level of physical activity. It was originally developed by WHO and translated into the Thai language by the Division of Physical Activity and Health, Department of Health, Ministry of Public Health, Thailand.[32] The 16 item GPAQ measures 3 domains: activity at work; travel to and from places; and recreational activities. The participants were classified into 3 groups: high, if the participants engaged in vigorous activity ≥ 3 day/week and total MET (min/wk) ≥ 1500 or had overall of vigorous or moderate activities ≥ 7 day/week and total MET (min/wk) ≥ 3000; moderate if the participants engaged in low to vigorous activities and had vigorous activities ≥ 3 day/week and spent ≥ 20 min/day or had moderate activities ≥ 5 day/week and spent ≥ 30 min/day or had overall vigorous activities ≥ 5 day/week and total MET (min/wk) ≥ 600; and low if the level of physical activity was lower than the criteria for high and moderate.

6) The Dietary Recording Form (DRF) for a 3-day food record was developed by the researcher based on a literature review. Participants recorded all food items and amounts consumed for 3 days (2 weekdays and 1 weekend day). The information was recorded and calculated using the INMUCAL-NUTRIENT program WD.5 version, developed by the Institute of Nutrition, Mahidol University, to determine daily sodium intake. Participants were classified into 2 groups—high sodium intake and low sodium intake—and the cut-off point for low daily sodium intake was 2,400 mg per day.

The family factor instrument was *The Family Support Questionnaire* (FSQ), developed by the researcher based on a literature review and House's theory of family social support. It consists of 20 items including four types of support: emotional support (6 items), informational support (4 items), instrumental support (5 items), and appraisal support (5 items), with a 5-point rating scale from 1 (not at all true) to 5 (completely true). The scores range from 20-100 and were divided into 3 levels based on X±S.D: high (> 86), medium (54-86), and low (< 54).

The community factor instrument was *The Participation in Community Activities Questionnaire* (PCAQ), modified from Juejunthuk,[33] consisted of 11 items, including five dimensions: decision making, planning, implementation, benefits, and evaluation, on a 4-point rating scale from 0 (never) to 3 (every time). The scores ranged from 0-33 and were divided into 3 levels based on X±S.D: high (> 25), medium (5-25), and low (< 5).

Dependent variables include:

1) Blood Pressure (BP) was the average blood pressure at the time of study entry, measured with a calibrated sphygmomanometer follow by the recommendation from JNC-7.[2] The systolic and diastolic blood pressure levels for the second and the third measurement were averaged and recorded. A participant was categorized into one of two groups based on their blood pressures. They were in the uncontrolled group if the averaged systolic blood pressure (SBP) was ≥140 mmHg and/or the averaged diastolic blood pressure (DBP) was ≥90 mmHg for the sample with hypertension without diabetes mellitus or chronic kidney disease, and the SBP was ≥130mm Hg and/or the DBP was 80 mmHg for those with diabetes mellitus or chronic kidney disease. Participants were allocated to the control group if the SBP was <140 mmHg and the DBP was <90 mm Hg for the sample with hypertension without diabetes mellitus or chronic kidney disease, and if the SBP was <130mm Hg and the DBP was <80 mmHg for those with diabetes mellitus or chronic kidney disease.

2) Albuminuria was determined by using the urine albumin to creatinine ratio (UACR). Measurement was done on a participant's spot urine collected in a 15 ml container. The container was kept cool until it was returned to the laboratory for analysis with

instrumentation laboratory (i lab 650) using the immune turbidity method. The results were divided into 2 groups: normoalbuminuria if the UACR was lower than 30 mg/g, and albuminuria if the UACR was greater than 30 mg/g.

The questionnaires on demographics, knowledge of hypertension, attitudes toward hypertension, life distress inventory, medication adherence, stress management, global physical activity, dietary recording, family support, and participation in community activities were content validated by five professionals, one cardiologist and four nurse instructors all experts in hypertension care. For item relevance, the content validity index (CVI) was determined based on the proportion of agreement (strongly agree and agree) and disagreement (disagree and strongly disagree) with each item. The reliability testing of the research tool was conducted at the health-promotion hospital using 22 people meeting the inclusion criteria, and but were not included in the actual study. Cronbach's alpha coefficient was calculated to assess the reliability of the questionnaires. The summary of psychometric properties of the questionnaires are included in **Table 1**.

Table 1 Summary of variables and measurements

Variables	Method of measurement	Psychometric property	
		Content Validity	Reliability
Personal factors			
Age, gender, duration of hypertension	Demographic questionnaire	0.96	-
Knowledge of hypertension	Knowledge of hypertension questionnaire	0.93	KR-20 Original 0.48 Pilot 0.43 This study 0.43
Attitude toward hypertension	Attitude toward questionnaire	0.98	Cronbach's alpha Original 0.70 Pilot 0.70 This study 0.74
Stress	The Life Distress Inventory	0.95	Cronbach's alpha Original 0.84 Pilot 0.95 This study 0.92
Body Mass Index	Weight/ height Weight measure by digital weighting scale	-	The reliability of weighting scale was conducted once a week with a plummet.
Waist circumference	Measure past the navel at breath out by measuring tape	-	Calibration of the tape was done from the Ministry of Commerce
Health behaviors factors			
Medication adherence	Medication adherence questionnaire	0.80	Cronbach's alpha Original 0.89 Pilot study 0.99 This study 0.99

Table 1 Summary of variables and measurements (continued)

Variables	Method of measurement	Psychometric property	
		Content Validity	Reliability
Stress management	The stress management questions	0.95	Cronbach's alpha Pilot study 0.51 This study 0. 62
Physical activity	Global Physical Activity Questionnaire (GPAQ)	0.99	Kappa = 0.67-0.73
Sodium intake	3-day food record	0.99	-
Family factor			
Family support	Family support questionnaire	0.99	Cronbach's alpha Pilot 0.73 This study 0.95
Community factor			
Participation of community activities	Participation of community activity questionnaire	0.84	Cronbach's alpha Original 0.75 Pilot 0.97 This study 0.97
Dependent Variables			
Blood pressure	Measure 3 times with mercury sphygomomanometer		Calibration of the sphygmomanometer was done from the MMC Company.
Albuminuria	Spot urine for Albumin and Creatinine which analysis with instrumentation laboratory (i lab 650) by immune turbidity method.		Calibration of the instrumentation laboratory was done form company every 3 months

Data Collection: Participants had their body weight, height, waist circumference, and blood pressure measured by the principal investigator (PI) and research assistants who were health volunteers trained by the PI. Participants were informed of the methods for albuminuria collection. A face-to-face structured interview was performed by the PI and research assistant for 45 minutes using the previously described questionnaires. In addition, a 2-day food record was completed and then within 1 week the researcher telephoned participants to obtain the information for one weekend day.

Data Analysis: Descriptive statistics were used to describe the demographic characteristics of the sample. Multiple logistic regression was used to analyze the association between personal factors, health behaviors, and family factor in relation to the controlled blood pressure and albuminuria of people with hypertension. Prior to the logistic regression analysis, the assumption testing for multicollinearity of all predictors was done by considering tolerance and the variance inflation factor (VIF). A common cut-off for multicollinearity is <0.10 for tolerance value, with a VIF value of >10.[26] Results revealed higher tolerance values (> 0.10) and a lower VIF (< 10). Thus, the predictors did not exhibit multicollinearity.

Results

Demographic data: After recruiting people with hypertension using the screening criteria, 8 people >75 years were excluded due to having mental health problems as screened by the Chula Mental Test. Three hundred and seventy-two people with hypertension

that met the study criteria were approached, however, 12 men refused to participate because they were busy and felt that participation would be inconvenient. As a result there were 360 participants with 73% being women. Approximately 67% were aged 60 years and older with a mean age of 63.5 ± 9.9 years. The most frequent participant occupations were employee (56%) and agriculturist (30%). The duration of hypertension was from 6 months to 37 years, with a mean of 6.9 ± 5.8 years. Seventy-seven percent of the participants had co-morbidities. Hyperlipidemia was the most common co-morbidity (62%), followed by diabetes mellitus (DM) (36%) (**Table 2**).

Prevalence of albuminuria: The prevalence of albuminuria was 27.5%. Microalbuminuria (UACR 30-300 mg/g) was found in 27.5% of the participants while 3.9% had macroalbuminuria (UACR > 300 mg/g) (**Table 2**).

Prevalence of uncontrolled blood pressure: Among the 360 participants that agreed to participate in the study, 52.2 % had uncontrolled blood pressure (**Table 2**).

Table 2 Demographic and disease characteristic of the sample (n=360)

Demographic	**N**	**%**	**Disease**	**N**	**%**
Gender			**Blood pressure**		
Male	97	26.9	Controlled (< 140/90 mmHg)	172	47.8
Female	263	73.1	Uncontrolled (≥ 140/90 mmHg)	188	52.2
Age (years)			**Albuminuria**		
Range 36-89			Normoalbuminuria (< 30 mg/g)	261	72.5
Mean 63.5			Microalbuminuria (30-300 mg/g)	85	23.6
S.D. 9.9			Macroalbuminuria (> 300 mg/g)	14	3.9
			Range 6-1,355		
			Mean 52.96		
			S.D. 129.46		
Duration of Hypertension (years)					
Range 0.6- 37					
Mean 6.9					
S.D. 5.8					
Occupation			**Co-Morbidities**		
employee	202	56.1	No	84	23.3
agriculturist	108	30.0	Yes	276	76.7
merchant	36	10.0	Hyperlipidemia	223	61.9
unemployed	14	3.9	Diabetes Mellitus	129	35.8
			Heart disease	16	4.4
			Renal disease	1	0.3
Religion					
Buddhist	100	100.0			

Predictors of albuminuria: Multiple logistic regression was employed to examine which risk factors had an effect on the probability of albuminuria. After entering the order of predictors into the model from the first step by the binary logistic regression, it was found that the determinants in predicting albuminuria were higher sodium intake and stress. The chi-square goodness of fit test was 0.258 at p-value > .05. Therefore, the data fit the model. The overall percentage of predicted albuminuria was 72.5% (**Table 3**). A person that consumed more than 2,400 mg/day of sodium was 58 times more likely to have albuminuria than those that consumed less than 2,400 mg/day (95% CI = 8.0-424.3) and a person reporting stress was 1.9 times more likely to have albuminuria than those without stress (95% CI = 1.1-3.4) (**Table 3**).

Table 3 Multiple Logistic Regression analysis of predictors on albuminuria (n = 360)

Predictors	Coefficient (β)	SE (β)	OR	95%CI	p-value
Sodium intake					
≤ 2,400 mg/day*			1.00		
> 2,400 mg/day	4.064	1.014	58.19	7.98- 424.34	<.001
Stress					
No*			1.00		
Yes	0.638	0.293	1.89	1.07-3.36	.030
Constant	-4.714	1.007			

Predictive power = 72.5%

*Reference group

Predictors of uncontrolled blood pressure: Sequential analysis was used to assign the priority of entry of the variables to the model by considering the p-values from the univariate analysis. Multiple logistic regression was employed to examine which risk factors had an effect on the probability of uncontrolled blood pressure. It was found that the determinants which were predictive of blood pressure controlled were low sodium intake, adherence to medication, high knowledge of hypertension, and no stress. The chi-square goodness of fit test was 0.711 at p-value > .05. Therefore, the data fit the model. The overall percentage of predicted blood pressure control was 65.3% (**Table 4**).

Among these significant predictors of blood pressure controlled, the odds ratio of high sodium intake was 2.7. Thus, a person consuming >2,400 mg/day of sodium was approximately 3 times more likely to have uncontrolled blood pressure than those whose sodium consumption was <2,400 mg/day (95% CI = 1.6-4.5). The risk of having uncontrolled blood pressure among the persons that exhibited poor medication adherence was approximately 2.5 times that of the individuals that exhibited adherence (95% CI = 1.3-4.7). A person with a low level of knowledge of hypertension was 2.4 times more likely to have uncontrolled blood pressure than those with high levels of knowledge (95% CI = 1.2-4.8). Finally, the odds ratio of the association between stress and uncontrolled blood pressure was 1.98. Therefore, a person who reported experiencing stress had a risk of uncontrolled blood pressure 2 times that of the individuals that did not experience stress (95% CI = 1.1-3.5) (**Table 4**).

Table 4 Multiple Logistic Regression analysis of predictors on uncontrolled blood pressure (n = 360)

Predictors	Coefficient (β)	SE (β)	OR	95%CI	p-value
Sodium intake (mg/d)					
< 2,400*			1.00		
> 2,400	0.992	0.260	2.70	1.62-4.49	<.001
Medication adherence					
Adherence*			1.00		
Non-adherence	0.904	0.331	2.47	1.29-4.73	.006
Knowledge of hypertension					
High*			1.00		
Moderate	0.388	0.247	1.48	0.91-2.39	0.116
Low	0.861	0.364	2.37	1.16-4.82	0.018
Stress					
No*			1.00		
Yes	0.683	0.293	1.98	1.11-3.52	.020
Constant	-1.223	0.280			

Predictive power = 65.3%

* Reference group

Discussion

The prevalence of microalbuminuria among participants with hypertension was consistent with the levels found in previous studies.[8, 34, 35] One-third of the participants had renal damage, probably related to the high prevalence of uncontrolled blood pressure, which was higher than previous studies.[7,36] This difference in prevalence might be due to differences in the method of urine collection (time, 24-hour, random) and the quality of the albumin assay.

The prevalence of uncontrolled blood pressure among people with hypertension in a community in central Thailand, was twice that observed in the last National Health Examination survey IV (2008-2009),[3] and by WHO.[4] One possible explanation for this difference is that the cut-off point to define blood pressure control among persons with other complications, such as diabetes mellitus and kidney disease, was lower. The participants also had other cardiovascular risk factors: three-fourths had overweight and obesity; two-thirds had hyperlipidemia; one-third had DM; and almost all participants had abdominal obesity. Additionally, 72% consumed more than 2,400 mg/day of sodium. All these risk factors were likely contributing to uncontrolled blood pressure.

The predictors of albuminuria: The best predictors of albuminuria were higher sodium intake and stress, with a 72.5% overall predictive power (**Table 3**). Albuminuria is a biological marker of systemic endothelial dysfunction and it has been found to be a sensitive predictor of cardiovascular risk in people with hypertension.[6] According to the social ecological model, the predictors that influence albuminuria were intrapersonal factors. It could be assumed from this finding then that the greatest effect of albuminuria was at the individual level—the family and community level did not influence albuminuria.

Sodium intake was the first predictor of albuminuria. This might be partly due to high sodium consumption in Thai people when compared with western countries.[37] This finding was similar to that of previous studies, which indicated that increased dietary sodium was associated with albuminuria,[5,15] with high sodium intakes associated

with significantly raised albuminuria. High dietary sodium intake is hypothesized to cause arterial injury without increasing blood pressure.[16] Moreover, during high sodium intake, renal blood flow decreases and intra-glomerular pressure increases.[16]

Stress was the second predictor of albuminuria. Hypotheses about the pathophysiology of albuminuria suggest that increased levels of urinary albumin may be related to inflammation, endothelial dysfunction or abnormalities in the renin-angiotensin-aldosterone system.[5] These hypotheses may explain the impact of stress on urinary albumin loss.

Blood pressure control and BMI were not associated with albuminuria in this study. The possible reason might be that the differences of the cut-off point on blood pressure control and BMI for Asians, and the average of blood pressure with previous studies.[14, 17] Waist circumferences (WC) was not associated with albuminuria. It might have been because a measurement error of WC from the participants who tended to pull in their abdomens.

The predictors of uncontrolled blood pressure: The best predictors of uncontrolled blood pressure were higher sodium intake, poor medication adherence, less knowledge of hypertension, and stress—with 65.3% overall predictive power (**Table 4**). According to the Socio-Ecological Model, two predictors (knowledge of hypertension and stress) were intrapersonal factors, while sodium intake and medication adherence were health behaviors. These predictors were at a microsystem level that could affect blood pressure. Therefore, the main influences on uncontrolled blood pressure were the intrapersonal factors. This result can be explained from a socio-ecological perspective—that health status is affected by a variety of personal factors, including genetic heritage, behavioral patterns, and psychological dispositions.[12]

Higher sodium intake was the strongest predictor of uncontrolled blood pressure, even though some data on sodium intake may be under-estimated by the participants. This finding is consistent with previous studies, where higher levels of sodium intake was associated with uncontrolled blood pressure.[18, 38] Most participants in this study consumed more than the recommended amount of sodium, with a mean intake of 3324 ± 1582 mg/d. Additionally, the data from the 3-day food record showed that most participants used seasonings and they preferred to buy food from food shops rather than cooking at home. In the Thai culture, food at food shops or food stalls is very salty,[39] thus adding to the risk of participants that consumed more than 2,400 mg/day.

Poor medication adherence was the second predictor of uncontrolled blood pressure. This finding was consistent with prior studies in which drug compliance was associated with uncontrolled blood pressure.[9, 20] The goal of antihypertensive therapy is achieve and maintain blood pressure control in order to reduce the probability of future cardiovascular and renal events. An approach to accomplishing these goals is to increase adherence to treatment regimens among the patients.[40] Nevertheless, most of the participants with low medical adherence revealed that "they were not ill, and their blood pressure was normal level. Therefore, they had no need to take medicine regularly." Therefore, the lack of symptoms of hypertension was found to decrease adherence.

Lack of knowledge about hypertension was the third predictor of uncontrolled blood pressure. This finding was consistent with previous studies in which knowledge of hypertension was associated with blood pressure control.[23,24] However, this was inconsistent with another study[11] that knowledge of hypertension was not significantly related to blood pressure control, even in rural contexts. It might be explained that most respondents of those studies had good knowledge about hypertension, or they had participated in some public health education programs on hypertension prevention.

Stress was the fourth predictor of uncontrolled blood pressure. This finding was homogenous with previous studies that emphasized the idea that a stimulus or circumstance causing such a condition or a daily life event is associated with lack of blood pressure control.[9]

Stress can cause high blood pressure which is explained by its pathogenesis. Stress stimulates the over-activity of the sympathetic nervous system and this brings about an increase in arterial contractibility and leads to increased vascular resistance. Moreover, stress can decrease the filtration surface in the kidney resulting in sodium and fluid volume thus increasing preload by raising cardiac output and by disturbing the renin-angiotensin function.[41]

However, the rest of the personal factors (gender, age, duration of hypertension, BMI, WC, attitude toward hypertension, activities), health behaviors (cigarette smoking, alcohol drinking, stress management, and physical activity), family support and participation in community were not significantly associated with uncontrolled blood pressure. One possible reason might be because of the community context, the way of life in rural area in Thailand in which people engaged in such physical activities in their daily life, and participated in the community activities. Moreover, a culture of the family in Thailand is expected a family member have a good take care of their family members or parents.

Limitations

Limitations include the following: 1) the charted blood pressure depended on the current blood pressure measurement, and did not necessarily reflect previous blood pressure levels found in the medical records; 2) the determination of UACR was based on a single urine specimen; 3) self-report of the 3-day food record evaluating the sodium intake of people with hypertension may have underestimated the ingredients of the menu because Thai food and some households in large families whose members eat together; and 4) errors in measuring waist circumference from the participants who trended to pull in their abdomens.

Conclusion and Recommendations

The prevalence rate of albuminuria among the participants with known hypertension was 27.5% and 52.2% of participants with uncontrolled blood pressure. The predictors of albuminuria were higher sodium intake and stress. The predictors of uncontrolled blood pressure were higher sodium intake, poor medication adherence, low knowledge about hypertension, and stress. Recommendations *for nursing practice* are as follows: the community health nurses should 1) monitor persons with uncontrolled hypertension that exhibit high sodium intake and implement interventions in order to increase health awareness and promote low sodium consumption; 2) coordinate with the physicians in order to monitor albuminuria particularly regarding those with high sodium intake and high stress; and 3) collaborate with the community and local government to initiate a campaign to raise community awareness. *In further studies*, intervention programs to increase the health awareness and promote low sodium consumption should be implemented for people with hypertension who have high sodium intake; and albuminuria should be monitored regularly in people with uncontrolled hypertension, high sodium consumption and high stress.

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References

1. World Heart Federation. Cardiovascular disease: Risk factors [cited 2014 January 4]. Available from http://www.world-heart-federation.org/press/fact-sheets/ cardiovascular-disease-risk-factors/
2. National Heart, Lung, and Blood Institute. The seventh report of the Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure. USA: National Institutes of Health publication [cited 2014 January 4]. Available from: http://www.nhbi.nih.gov-guidelines-hypertension-jnc7full.pdf.
3. Aekplakorn, W. (Eds). National Health Examination survey IV (2008-2009). Nonthaburi: The Graphico System; 2010 [in Thai].

4. World Health Organization. Global health observatory data repository [cited 2014 January 4]. Available from http://apps.who.int/gho/data/node. main.A875
5. Basi S, Mimran A, Fesler P, Lewis J. Microalbuminuria in type 2 diabetes and hypertension. Diabetes care. 2008; 31 (suppl. 2): 194-201.
6. de Jong P, Gansevoort R, Bakker S. Macroalbuminuria and microalbuminuria: do both predict renal and cardiovascular events with similar strength?. J Nephrol. 2007; 20: 375-380.
7. Gojaseni P, Phaopha A, Chailimpamontree W, Pajareya T, Chittinandana A. Prevalence and risk factor of microalbuminuria in Thai nondiabetic hypertensive patients. Vascular Health and Risk Management. 2010; 6: 157-165.
8. Buranakitjaroen P, Deerochanawong Ch, Bunnag P. Microalbuminuria prevalence study (MAPS) in hypertensive patients with type 2 diabetes in Thailand. J Med Assoc Thai. 2005; 88(11): 1624-1629.
9. Siemmai A, Auamnoy T. Factors correlated with blood pressure level in hypertensive patients. Vajira Medical Journal. 2010 54(3): 301-308 [in Thai].
10. Jaiyangyuen U. Factors influencing health-promoting behaviors of elderly people with hypertension. [Thesis]. Bangkok, Thailand: Mahidol Univ.; 2008.
11. Chitpulkusol P. Factors related to blood pressure controls in patients with hypertension of Thabsakae hospital. J Health Sys Res. 2008; 2 (3): 1336-1343 [in Thai].
12. Stokols D. Establishing and maintaining healthy environments: Toward a social ecology of health promotion. Am Psychol. 1992; 47(1), 6-22.
13. Lounsbury D, Mitchell S. Introduction to special issue on social ecological approaches to community health research and action. American Journal of Community Psychology. 2009; 44: 213-220.
14. Poudel B, Yadav B, Nepal A, Jha B, Raut K. Prevalence and association of microalbuminuria in essential hypertensive patients. N Am J Med Sci. 2012; 4(8): 331-335.
15. Khaledifar A, Gharipour M, Bahonar A, Sarrafzadegan N, Khasravi A. Association between salt intake and albuminuria in normotensive and hypertensive individuals [cited 2014 January 21]. Available from http://dx.doi.org/10.1155/2013/523682.
16. Yilmaz R, Akoglu H, Altun B, Yildirim T, Arici M, Erdem Y. Dietary salt intake is related to inflammation and albuminuria in primary hypertensive patients. Eur J Clin Nutr. 2012; 66: 1214-1248.
17. Thoenes M, Reil J, Khan B, Bramlage P, Volpe M, Kirch M. Abdominal obesity is associated with microalbuminuria and an elevated cardiovascular risk profile in patients with hypertension. Vascular Health and Risk Management. 2009; 5: 577-585.
18. Montasser M, Douglas J, Roy-Gagnon M, Van Hout C, Weir M, Vogel R. Determinants of blood pressure response to low-salt intake in a healthy adult population. J Clin Hypertens. 2011;l 13: 795-800.
19. Briasoulis A, Agarwal V, Messerli F. Alcohol consumption and the risk of hypertension in men and women: A systematic review and meta-analysis. J Clin Hypertens (Greenwich). 2012; 14: 792-798.
20. Itthakom S. Factors related to caregivers' help with medication adherence of persons with hypertension. Master thesis, Mahidol University; 2006 [in Thai].
21. Kotsis V, Stabouli S, Papakatsika S, Rizos Z, Pariti G. Mechanisms of obesity-induces hypertension. Hypertension Res. 2010; 33: 386-393.
22. Zaw K, Latt T, Aung P, Thwin T, Myint T. Prevalence of hypertension and its associated factors in the adult population in Yangon Division, Myanmar [cited 2014 January 15]. Available from http://aph.sagepub.com/
23. Malik A, Yoshida Y, Erkin T, Salim D, Hamajima N. Hypertension-related knowledge, practice and drug adherence among inpatients of a hospital in Samarkand, Uzbekistan. Nagoya J Med Sci. 2014; 76: 255-263.
24. Rujiwatthanakorn D, Panpakdee O, Malathum P, Tanomsup S. Effectiveness of a self-management program for Thais with essential hypertension. Pacific Rim Int J of Nurs Res. 2011; 15 (2): 97-110
25. Ratanavaraha V, Jomnonkwao S. Community participation and behavioral changes of helmet use in Thailand. Transport Policy. 2013; 25: 111-118.
26. Hair J, Black W, Bakin B, Anderson R. Multivariate data analysis: A Global perspective. (7th ed). London: Upper Saddle River; 2010.
27. Rujiwatthanakorn D. The effectiveness of a self-management program on knowledge, self-care ability, and blood pressure control in persons with uncontrolled essential hypertension. [Dissertation]. Bangkok, Thailand: Mahidol Univ.; 2010.
28. Klabcharone S. Relationship between attitude towards nutritional behavior, family support and food consumption behavior of chronic renal failure patients undergoing hemodialysis. [Thesis]. Bangkok, Thailand: Mahidol Univ.; 2002.

29. Patrayutawat S. Manual of psychological testing. Bangkok: Division of Psychology, Faculty of Medicine Siriraj, Mahidol University; 2005 [in Thai].
30. World Health Organization. Appropriate body-mass index for Asian population and its implications for policy and intervention strategies. The Lancet, 2004; 363: 157-163.
31. American Heart Association. High blood pressure [cited 2014 February 3]. Available from website http://www.heart.org/HEARTORG/Conditions/ HighBloodPressure/WhyBloodPressureMatters/Vision-Loss-and-High-Blood-ressure_UCM_301826_Article. jsp
32. Division of Physical Activity and Health, Department of Health, Ministry of Public Health. Global Physical Activity Questionnaire [cited 2013 Feb 17]. Available from website http:// http://dopah.anamai.moph.go.th/
33. Juejunthuk S. An application of promotion motivation theory and community participation in prevention of hypertension, Mueang District, Nongkhai Province. [Thesis]. Mahasarakham, Thailand: Mahasarakham Univ.; 2009 [in Thai].
34. Bacanu E, Bacanu M, Botez C. Microalbuminuria in essential hypertension at patients with or without type 2 diabetes. Proceedings of the Romanian Academy. 2011 Series B 2: 145-154.
35. Sabharwal R, Singh P, Arora M, Somani B, Ambade V. Incidence of microalbuminuria in hypertensive patients. Indian Journal of Clinical Biochemistry, 2008; 23(1): 71-75.
36. Poudel B, Yadav B, Nepal A, Jha B, Raut K. Prevalence and association of microalbuminuria in essential hypertensive patients. N Am J Med Sci. 2012; 4(8): 331-335.
37. Powles J, Fahimi S, Micha R, Khatibzadeh S, Shi Peilin, Ezzati M, et al. Global, regional and national sodium intakes in 1990 and 2010: a systematic analysis of 24 h urinary sodium excretion and dietary surveys worldwide. BMJ Open. 2013; 3: e003733. doi: 10.1130/bmjopen-2013-003733.
38. Wisetborisut O. Prevalence and factors associate to controlled and uncontrolled hypertension at outpatient department, Division of family medicine, Faculty of Medicine, Chiang Mai University. [Thesis]. Chiang Mai, Thailand: Chiang Mai Univ.; 2010 [in Thai].
39. Kantachuwetsiri, S. Eat less salt 50% [cited 2014 January 8]. Available from Thai low salt network website http://www.lowsaltthailand.org [in Thai].
40. James P, Oparil S, Carter B, Cushman W, Dennison-Himmelfarb C, Handler J, et. Al. 2014 Evidence-based guideline for the management of high blood pressure in adults report from the panel members appointed to the Eight Joint National Committee (JNC 8). JAMA. 2014; 311(5): 507-520.
41. Buranakitjarean P. Essential hypertension. Bangkok: Folkdoctor; 2010 [in Thai].

ปัจจัยทำนายภาวะอัลบูมินยูเรียและการควบคุมความดันโลหิตไม่ได้ของผู้มีภาวะความดันโลหิตสูงในชุมชน

ลภัสรดา หนุ่มคำ นพวรรณ เปียซื่อ อรสา พันธ์ภักดี Susanna L. Cunningham ณัฐกมล ชาญสาธิตพร

บทคัดย่อ : การศึกษาภาคตัดขวางนี้มีวัตถุประสงค์เพื่อ 1) ศึกษาความชุกของภาวะอัลบูมินยูเรียและการควบคุมความดันโลหิตไม่ได้ และ 2) ศึกษาปัจจัยทำนายภาวะอัลบูมินยูเรียและการควบคุมความดันโลหิตไม่ได้ในผู้ที่เป็นความดันโลหิตสูงในชุมชน โดยใช้รูปแบบนิเวศวิทยาสังคมเป็นกรอบแนวคิดในการศึกษา กลุ่มตัวอย่างคือผู้เป็นความดันโลหิตสูงจำนวน 360 รายที่อาศัยอยู่ในชุมชนจังหวัดปทุมธานี เก็บรวบรวมข้อมูลโดยการสัมภาษณ์แบบมีโครงสร้างจากแบบสอบถามข้อมูลสุขภาพ พฤติกรรมสุขภาพ ความรู้และทัศนคติเกี่ยวกับความดันโลหิตสูง การสนับสนุนของครอบครัวและการมีส่วนร่วมในชุมชน รวมทั้งการบันทึกอาหารที่บริโภคใน 3 วัน การประเมินดัชนีมวลกาย เส้นรอบเอว ความดันโลหิต และการตรวจโปรตีนในปัสสาวะ วิเคราะห์ข้อมูลโดยใช้สถิติบรรยายและการถดถอยพหุโลจิสติก

ผลการศึกษาพบว่า ภาวะไมโครอัลบูมินยูเรีย มีความชุกร้อยละ 23.6 ภาวะแมคโครอัลบูมินยูเรีย มีความชุกร้อยละ 3.9 และการควบคุมความดันโลหิตไม่ได้ มีความชุกร้อยละ 52.2 การวิเคราะห์ถดถอยพหุโลจิสติกพบว่า ปริมาณโซเดียมที่บริโภคและ ความเครียดร่วมกันทำนายภาวะอัลบูมินยูเรียได้ร้อยละ 72.5 และพบว่า ปริมาณโซเดียมที่บริโภค ความสม่ำเสมอในการกินยา ความรู้เกี่ยวกับความดันโลหิตสูงและความเครียดร่วมกันทำนายการควบคุมความดันโลหิตได้ร้อยละ 65.3 ผลการศึกษามีข้อเสนอแนะสำหรับพยาบาลดังนี้ 1) ควรให้ความสำคัญกับกลุ่มที่ควบคุมความดันโลหิตไม่ได้โดยการควบคุมการบริโภคโซเดียมและทำกิจกรรมการพยาบาลเพื่อเพิ่มความใส่ใจและส่งเสริมให้ลดการบริโภคโซเดียม 2) ควรประสานงานกับแพทย์ในการติดตามอัลบูมินในปัสสาวะโดยเฉพาะอย่างยิ่งในผู้ที่บริโภคโซเดียมสูงและมีความเครียดสูง 3) ควรประสานงานกับชุมชนจัดกิจกรรมรณรงค์สร้างความตระหนักต่อความเสี่ยงของภาวะความดันโลหิตสูง

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คำสำคัญ : การควบคุมความดันโลหิตไม่ได้ ความดันโลหิตสูง แนวคิดนิเวศวิทยาสังคม อัลบูมินยูเรีย

ลภัสรดา หนุ่มคำ, *RN, PhD (Candidate) ผู้ช่วยศาสตราจารย์, โรงเรียนพยาบาลรามาธิบดี คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล กรุงเทพฯ* ***E-mail:*** *rada_tu@hotmail.com*
ติดต่อที่: นพวรรณ เปียซื่อ, *RN, PhD (Nursing), โรงเรียนพยาบาลรามาธิบดี คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล กรุงเทพฯ*
E-mail: *noppawan.pia@mahidol.ac.th*
อรสา พันธ์ภักดี, *RN, DNS, รองศาสตราจารย์, โรงเรียนพยาบาลรามาธิบดี คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล กรุงเทพฯ*
Susanna L. Cunningham, *RN, PhD. Professor, Biobehavioral Nursing and Health Systems, School of Nursing, University of Washington, USA.*
ณัฐกมล ชาญสาธิตพร, *BSc., ScD.(Biostatistics), ผู้ช่วยศาสตราจารย์, ภาควิชาชีวสถิติ คณะสาธารณสุขศาสตร์ มหาวิทยาลัยมหิดล กรุงเทพฯ*