CHAPTER 2

LITERATURE REVIEW

The present study focuses on the adherence to therapeutic regimens and influencing factors including medication and lifestyle modifications among Thai persons with hypertension. This review is organized into four parts. In the first part, the literature related to overview of hypertension including classification, related factors, pathophysiology, complications and treatment are presented. The second part addresses the concept of adherence to regimen among hypertensive patients including definition, attributes, models, adherence to regimens among persons with hypertension and measuring. The third part addresses factors related adherence to therapeutic regimens among persons with hypertension. Conceptual framework is presented in the final part.

Overview of Hypertension

Classification

Hypertension is defined as systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg (Chobanian et al., 2003; Thai Hypertension Society, 2008).

World Health Organization and International Society of Hypertension [WHO/ISH] classify blood pressure levels into 4 categories based on the severity of hypertension (WHO/ISH, 1999) as follows:

1. Mild hypertension is described as systolic blood pressure 140-159 mmHg and diastolic pressure 90-99 mmHg.

2. Moderate hypertension is described as systolic blood pressure 160-179 mmHg and diastolic pressure 100-109 mmHg.

3. Severe hypertension is described as systolic blood pressure ≥ 180 mmHg and diastolic pressure ≥ 110 mmHg.

4. Isolated systolic hypertension is described as systolic blood pressure ≥ 140 mmHg and diastolic pressure ≤ 90 mmHg.

The 7th Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure [JNC-7] provides the classification of blood pressure for adults aged ≥ 18 years based on the mean of two or more properly measured seated blood pressure reading on two or more office visits, as follows: (Chobanian et al., 2003)

1. Normal blood pressure is defined as systolic blood pressure less than 120 mmHg and diastolic pressure less than 80 mmHg.

2. Pre-hypertension is defined as systolic blood pressure 120-139 mmHg or diastolic blood pressure 80-89 mmHg.

3. Stage 1 hypertension is defined as systolic blood pressure 140-159 mmHg or diastolic pressure 90-99 mmHg.

4. Stage 2 hypertension is defined as systolic blood pressure ≥ 160 mmHg or diastolic pressure ≥ 100 mmHg.

Additionally, hypertension can be classified by cause (DeMartinis, 2009). It is divided into 2 groups as follows:

1. Primary hypertension or essential hypertension or idiopathic hypertension is defined as an elevation of blood pressure without evidence of any other disease processes.

2. Secondary hypertension is defined as hypertension that develops from an identifiable cause (a specific disease state or problem) such as renal disorders, endocrine disorders, pregnancy-induced, neurological disorders, acute stress, increased intravascular volume, alcohol, and nicotine (DeMartinis, 2009; Kaplan, 2006).

When a patient's systolic and diastolic blood pressure falls into different categories, the higher category should be applied. The JNC-7 (Chobanian et al., 2003) has presented a new classification, prehypertension. This new group is proposed to identify persons who have a high risk of developing hypertension. To diagnose hypertension, all of the presented classifications have defined hypertension as having systolic blood pressure ≥ 140 mm Hg and diastolic blood pressure ≥ 90 mm Hg. The JNC-7 classification is presented in this study.

Factors Related to Hypertension

More than 90% of the cases of hypertension are primary or essential hypertension (Kaplan, 2006). The factors influencing blood pressure in primary hypertension are divided into 2 main factors including non-modifiable and modifiable risk factors.

Non-modifiable risk factors. Non-modification risk factors include family history, age, gender, and ethnicity.

Family history. A family history of hypertension is related to a rising in the prevalence and incidence of hypertension. A person with a family history of hypertension is associated with a two fold higher hypertension prevalence than one without it (Hajjar, Kotchen, & Kotcher, 2006). Gu and his colleagues who studied the incidence of hypertension among Chinese men and women found that a positive family history of hypertension was related to a 15% increased risk of incidence of hypertension (Gu et al., 2007).

Age. Blood pressure is lower in children than in adults and increases continuously in the first two decades of life (Hajjar et al., 2006). In adults, systolic and diastolic blood pressure increase gradually with age. For instance, systolic blood pressure increased by 0.29-0.91 mmHg per year in men and 0.6-1.31 per year in women (Hajjar et al., 2006). Also, the National Health and Nutrition Examination Survey (NHANES) 2003-2004 in the United Stated found that the prevalence of hypertension was 7.3% in persons 18 to 39 years, 32.6% in persons 40 to 59 and 66% in persons 60 years and older (Ong, Cheung, Man, Lau, & Lam, 2007). Moreover, Davis, Liu, Quarells, and Din-Dzietham (2005) who studied the prevalence of hypertension in a population-based sample of African Americans found that advancing age was a significant predictor of hypertension (OR = 1.09, 95% CI = 1.06-1.11, $p < .0001$).

Gender. Men demonstrate more rapidly increasing blood pressure with age than women before menopause. After menopause, women indicate a steeper increase

(Hajjar et al., 2006). In the NHANES survey in 1999-2002, hypertension prevalence in women was 29% whereas in men it was 27.8% (Hajjar et al., 2006).

Ethnicity. The highest prevalence in hypertension in the NHANES 2003-2004 survey was Non-Hispanic blacks. The hypertension prevalence among Non-Hispanic blacks was higher than non-Hispanic Whites in 2003-2004 (OR = 1.61, 95% CI = 1.30-1.99, $P < 0.001$). Moreover, the prevalence in hypertension in Mexican Americans increased from 13.2 % in 2001-2002 to 16.9% in 2003-2004 (Ong et al., 2007). The reason for the increased prevalence of hypertension among blacks is unclear, but the increase has been attributed to lower rennin levels, greater sensitivity to vasopressin, higher salt intake, and greater environmental stress (DeMartinis, 2009). Poverty, racial discrimination and barriers to health care obviously are involved in the higher hypertension-related morbidity and mortality seen in U.S. Blacks (Jha et al., 2003, as cited in Kaplan, 2006).

Modifiable risk factors. Modifiable risk factors which include stress, body mass index (BMI), sodium intake, and physical activities are described as follow.

Stress. Stress activates the sympathetic nervous system directly (SNS) by increasing its activity. Over-activity of the sympathetic nervous system can result from raised production of catecholamines (epinephrine and norepinephrine) or from raised receptor reactivity involving these neurotransmitters. Raised SNS activity induces increased heart rate and systemic vasoconstriction, therefore increasing the blood pressure (Brashers, 2006). Many studies suggest that people exposed to repeated psychogenic stresses may develop hypertension more frequently than would otherwise with similar people who are not under stress (Kaplan, 2006). Air traffic

controllers, who work under high-level psychological stress, annually develop hypertension at a rate 5.6 times greater than that of non-professional pilots who are initially comparable to the controllers in physical characteristics (Cobb & Rose, 1973, as cited in Kaplan, 2006). Davis et al. (2005) who carried out a study to estimate aspects of the effects of self-reported exposure to stress-related racial discrimination and hypertension in African Americans found that the magnitude of stress derived from exposure to racial discrimination was positively associated with an increased likelihood of hypertension. Participants reporting a "moderate" level of generally derived stress were more likely to be hypertensive than those reporting "no to low" stress (OR = 2.35, 95% CI = 1.14-4.83, P = 0.02). Participants reporting a "high to very high" generally derived stress level were more likely to be hypertensive than those reporting a "no to low" stress level (OR = 2.50, 95% CI = 1.17-5.34, P = 0.01).

Obesity. Obesity is associated with subsequent development of hypertension, especially in the upper body with increased amounts of fat about the midriff, waist, and abdomen. The hemodynamic pattern of obesity-related hypertension is volume expansion, increased cardiac output, and systemic vascular resistance that fails to fall enough to balance the higher cardiac output (Kaplan, 2006). Increased activity of sympathetic nervous system, the rennin-angiotensin system, aldosterone, insulin, free fatty acid and leptin from selective leptin resistance are mechanisms of obesity-related hypertension. As a consequence of whatever is responsible, increased arterial stiffness is accompanied by weight gain (Kaplan, 2006). Increase of body weight, regardless of overweight or obesity (Body Mass Index (BMI) > 24.9 kg/m^2) is related to an increase of the incidence rate of hypertension (Kaplan, 2006). In the NHANES-III data, the hypertension prevalence

with increasing degrees of obesity ranged from 49% to 64% in obese men and 39% to 63% in obese women compared with 27% in normal-weight men and 23% in normal weight women (Hajjar et al., 2006). The individuals whose weight was normal (BMI < 25), overweight (25 ≤ BMI < 30) and obese (BMI ≥ 30) had an increased prevalence of hypertension (34.1, 49.0, and 65.1% respectively) (Sun et al., 2007). In addition, increasing BMI was a significant predictor of hypertension (OR = 1.05, 95% CI = 1.01-1.10, p = .003) (Davis et al., 2005).

Sodium intake. Excess sodium consumption increases fluid volume and contributes to occurrence of hypertension. Higher sodium intake is related to higher blood pressure levels (Chobanian & Hill, 2000). The results from the Trials of Hypertension Prevention Collaboration research Group, a randomized controlled study, found that persons with high-normal blood pressure who restricted sodium intake moderately for 1.5-5 years had lower blood pressure and lower incidence of hypertension than those who did not limit sodium intake (Kokkinos, Panagiotakos, & Polychronopoulos, 2005).

Physical activity. Physical inactivity is an important factor that contributed to hypertension prevalence. A study in the United States found that hypertension prevalence was significantly less in persons who were the most active, compared with those who were sedentary (OR = 0.73, 95% CI = 0.59-0.90) (Bassett, Fitzhugh, Crespo, King, & McLaughlin, 2002). Also, a the prospective study in Finland, found that people with regular physical activity were associated with a decreasing risk of hypertension in both men and women (Hu et al., 2004). Hazard ratios of hypertension associated with light, moderate, and high physical activity were1.00, 0.63, and 0.59 in men, and 1.00, 0.82, and 0.71 in women, respectively.

In brief, increasing blood pressure is associated with both modifiable and non-modifiable risk factors. Avoiding modifiable risk factors by approaching lifestyle modifications can prevent the likelihood of developing high blood pressure in people with normotensive blood pressure.

Pathophysiology of Hypertension

Blood pressure is the force of blood against the arterials blood pressure. The pressure required to move blood through the circulatory bed is provided by the pumping action of the heart (cardiac output) and the tone of the arteries (peripheral resistance). This relationship can be written as an equation (Kaplan, 2006):

Blood pressure (BP) = Cardiac output (CO) × Peripheral resistance (PR)

Cardiac output depends on the stroke volume and heart rate per minute. In addition, the stroke volume is activated by the venous blood return and heart contractility. This action is regulated by the autonomic nervous system and the quality of the myocardium. The heart rate is also affected by the autonomic nervous system. The peripheral resistance depends on the radius of the vessel and blood viscosity. Generally, blood pressure is regulated by four systems: the arterial baroreceptor and chemoreceptor, regulation of body fluid volume, the renin-angiotensin system, and vascular autoregulation (DeMartinis, 2009). These systems affecting blood pressure are described as follows: (DeMartinis, 2009; Kaplan, 2006; Schwartz & Sheps, 2004).

The function of arterial baroreceptors which are found in the carotid sinus, arota, and the wall of the left ventricle monitors the level of blood pressure and decrease blood pressure by inducing vasodilation and slowing the heart rate via the

vagus nerve. Barorecptors are activated by increasing blood pressure and afferent signals entering the vasomotor center in the brainstem. Decreasing the sympathetic system and stimulation of the vagus nerve at the cardiac site induces slowing the heart rate and decreasing contractility, thus lowering blood pressure. On the one hand, when decreasing blood pressure, the activities that induce increasing blood pressure are vasoconstriction, increasing heart rate and increasing contractility. However, barorecptors activity is generally thought to be reset during sustained increase in blood pressure so that baroreceptors are not thought to play a role in long-term control of blood pressure (Kaplan, 2006).

Chemoreceptors, located in the medulla, carotid, and aortic bodies, are sensitive to alterations in concentrations of oxygen, carbon dioxide, and hydrogen ions (pH) in the blood. A fall in arterial oxygen concentration or hydrogen ions causes a reflexive rise in pressure, whereas an increase in carbon dioxide concentration causes a decrease in blood pressure (DeMartinis, 2009). The afferent signals entering the respiratory center in the medulla induce an increasing respiratory rate and activated vasomotor center in brain thus, vasoconstriction and increasing peripheral resistance.

The kidney plays a major role in regulating body fluid volume and long-term control of blood pressure. Alterations in fluid volume affect systemic arterial pressure. Thus an abnormality in the transport of sodium in the renal tubules may cause essential hypertension. When sodium and water levels are extreme, and increased total blood volume, hence blood pressure increases. Pathologic changes that alter the pressure threshold at which kidneys excrete salt and water alter systematic blood pressure (DeMartinis, 2009).

Renin and angiotensin play a role in blood pressure regulation. Dysfunction of the renin-angiotensin system in individuals with hypertension can cause persistent increases in peripheral resistance and renal salt retention (Brashers, 2006). Renin is an enzyme that is produced by the kidney. Renin plays a role in changing angiotensinogen to angiotensin I, then angiotensin I changes to angiotensin II by a converting enzyme from the lung. Angiotensin II acts as a vasoconstrictor and also stimulates the release of aldosterone which induces sodium and fluid retention. In addition, the increase of the sympathetic nervous system and angiotensin II activity inhibit sodium excretion, thus resulting in increased blood pressure (DeMartinis, 2009). Angiotensin II is also responsible for hypertrophy of the myocardium related to hypertension (Brashers, 2006). Increased rennin secretion has been examined as a cause of increased peripheral vascular resistance in primary hypertension (DeMartinis, 2009).

Lastly, vascular autoregulation is a role of the vascular vessel that responds to increase and decrease in the arterial blood volume. For instance, when arterial blood volume increases, vasoconstriction is the outcome. The peripheral vascular dilatation and constriction are regulated by the sympathetic nervous system and the rennin-angiotensin system. For individuals with hypertension, over-activity of the sympathetic nervous system can result from increased production of catecholamines (epinephrine and norepinephrine) or from increased receptor reactivity associated with these neurotransmitters. Increased sympathetic nervous system activity induces an increased heart rate and systemic vasoconstriction, thus raising the blood pressure (Brashers, 2006).

In conclusion, high blood pressure is the result of increasing cardiac output and peripheral vascular resistance which the dysfunction of arterials baroreceptor and chemorecptors, regulation of body blood volume, rennin-angiotensin system and vascular autoregulation is the process. Primary or essential hypertension may occur from alteration of one or more systems. No single alteration of these affects in all hypertensive patients (DeMartinis, 2009).

Complications of Hypertension

Complications of hypertension, which deteriorate the target organ, are as a consequence of degenerative change of the vascular that affects several organs such as the heart, brain, and kidney. Persons who have uncontrolled hypertension are at risk of these complications. The complications are described as follows:

1. Cardiovascular complications include left ventricular hypertrophy, angina pectoris, congestive heart failure (left heart failure), coronary artery disease, myocardial infarction, and sudden death (Brashers, 2006). Hypertension contributes to the risk of arterial fibrillation and is the single most important antecedent to the development of heart failure (Schwartz & Sheps, 2004). The effects of long-term hypertension reflect both atherosclerosis and the growth of structural adaptation of the heart (left ventricular hypertrophy [LVH] and left atrial enlargement) to increase afterload. The structural changes limit coronary reserve (Schwartz & Sheps, 2004).

2. Cerebrovascular complications which are similar to those of other arterial beds and include transient ischemic, stroke, cerebral thrombosis, aneurysm, and hemorrhage (Brashers, 2006). Hypertension increases the risk of stroke by exacerbating atherosclerosis in the aortic arch and carotid, and cerebral arteries

(causing thrombosis or embolic ischemic strokes) and by inducing arteriosclerosis in small, penetrating subcortical cerebral vessels, leading to periventricular leukoenceophalopathy and lacunar strokes (Schwartz & Sheps, 2004).

3. Renal complication occurs by arteriosclerotic changes that lead to ischemic injury and loss of glomeruli and tubular elements, finally leading to the shrunken kidney of nephrosclerosis (Schwartz & Sheps, 2004). Disturbances in filtrations and reabsorption of serum sodium of renal leads to retention of water, urea and creatinine (Brashers, 2006). Therefore, end-stage renal disease results from the effect of hypertension.

4. Retinopathy, loss of vision, also derives from adverse effects of hypertension. Arteriosclerosis of retina vessels is induced by chronic hypertension; these changes at the site of arterial-venous crossing can lead to branch retinal vein occlusion (Schwartz & Sheps, 2004). Atherosclerotic emboli can occlude central or branch retinal arteries, with sudden and irreversible visual loss. Reduced blood flow in the carotid or ophthalmic artery caused by severe atherosclosis can cause venous stasis retinopathy, macular edema, epiretinal membrane formation, and collateral vessel formation which are induced by occlusive disease of retinal vessels (Schwartz & Sheps, 2004).

Generally, long-term hypertension leads to these complications but can be prevented by controlling blood pressure to optimal level. Controlled blood pressure is the therapeutic goal; in order to decrease morbidity and mortality for the major risks, cardiovascular disease (CVD), stroke and chronic renal failure.

Treatment of Hypertension

Lowering blood pressure, preventing complications and reducing risk factors for cardiovascular disease (CVD) are the treatment goals. The target level of blood pressure to achieve this goal is less than 140/90 mmHg in hypertensive patients without target organ damage and less than 130/80 mmHg in those with complications, such as CVD, diabetes mellitus, renal failure (Chobanian et al., 2003). Treatments are composed of non-pharmacologic treatment and pharmacologic treatment.

The algorithm for the therapy of hypertensive patients is recommended by JNC-7 (Chobanian et al., 2003). The treatment begins with lifestyle modifications in persons whose blood pressure is more than 120/80 mmHg. If the blood pressure goal is not accomplished, antihypertensive drugs should be used as a sequence-stepped care approach. Firstly, in stage 1 hypertension without compelling indications (SBP = 140-159 mmHg and/or DBP = 90-99 mmHg), the initial drug is Thiazide-type diuretic as a monotherapy or a combination with one of the other classes (angiotensin-converting enzyme inhibitors [ACE], angiotensin-receptor blockers [ARBs], β-blockers, calcium channel blockers [CCBs]). In stage 2 hypertension without compelling indicators (SBP $\geq$ 160 mmHg or DBP $\geq$ 100 mmHg) a two drug combination should be used in which the first choice drug is a Thiazide-type diuretic. If the initial drug is not effective in controlling blood pressure to the normal level both in stage 1 and 2, use a combination of other classes of antihypertensive drugs or increase dosage. Secondly, hypertensive persons with compelling indicators should use a drug for the compelling indicators (such as heart failure, diabetes, chronic renal failure etc.) and other antihypertensive drugs as needed. Moreover, lifestyle

modifications are recommended for individuals in all classifications of blood pressure (Chobanian et al., 2003). The algorithm for treatment of hypertension is presented as figure 2-1.

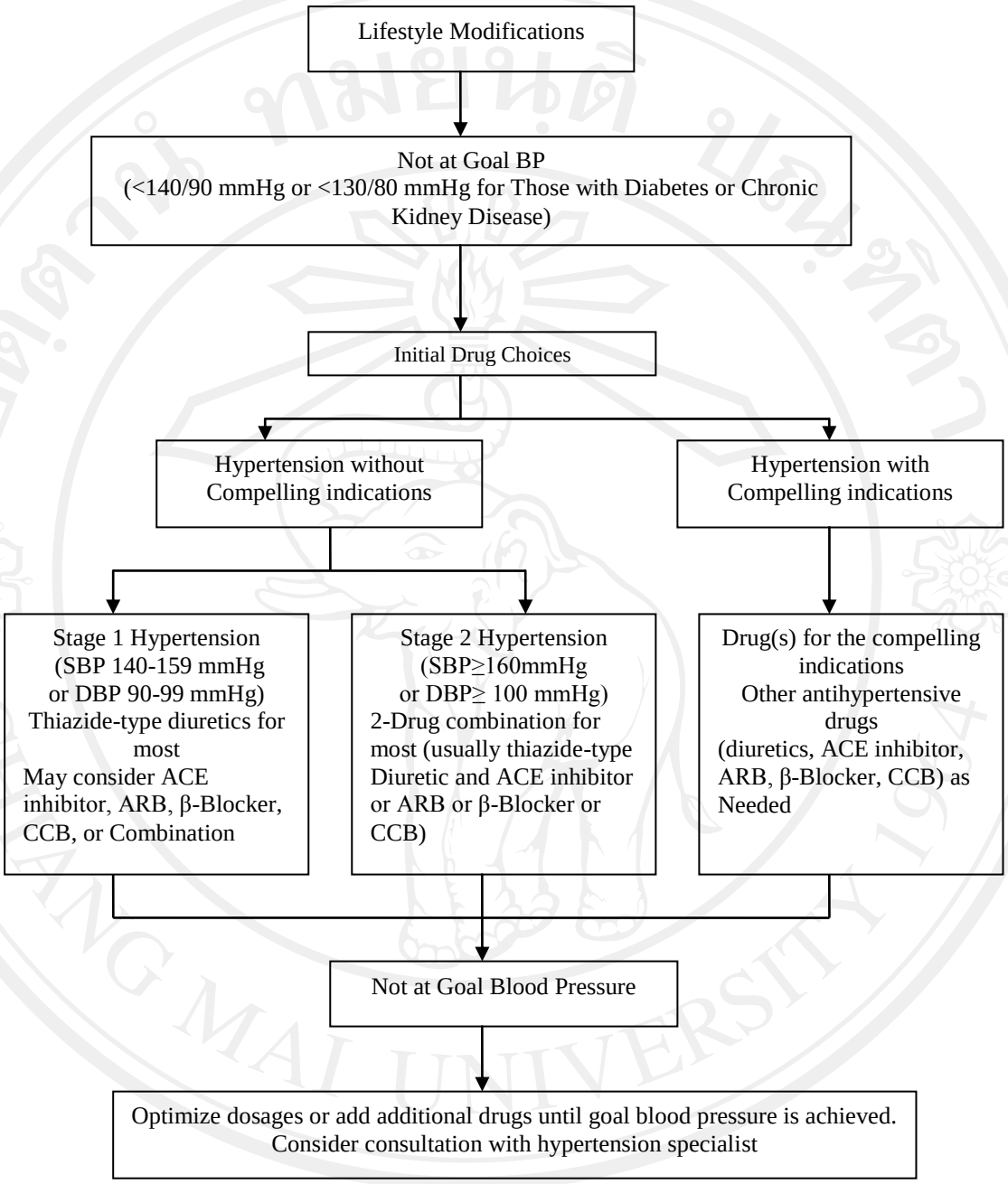

Figure 2-1. Algorithm for Treatment of Hypertension

Note. From "The seventh report of the Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure" 2003 (p. 2564), by A. V. Chobanian, G. L. Bakris, H. R. Black, W. C. Cushman, L. A. Green, J. L. Izzo, . . . E. J. Roccella, 2003, *The Journal of the American Medical Association*, *289*(19), 2560-2571. Reprinted with permission.

Pharmacologic treatment. Drugs used in the treatment of hypertension include diuretics, angiotensin-converting enzyme (ACE) inhibitors, angiotensin II receptor blockers (ARBs), antiadrenergics, calcium channel blockers, and direct-vasodilators. Additionally, these drugs act to decrease blood pressure by decreasing cardiac output or peripheral vascular resistance (Pennington, 2009).

Diuretics. Effects of diuretics are usually ascribed to reduce absorption of sodium and water in kidney. The result of increasing urine output and sodium in urine are a decrease in blood volume and cardiac output. With long-term administration of a diuretic, cardiac output returns to normal, but there is a persistent decrease in peripheral vascular resistance. Diuretics act as a persistent small reduction in extracellular water and plasma volume; reduce receptor sensitivity to vasodilation, and arteriolar vasodilation secondary to electrolyte depletion in the vessel wall, thus lowering blood pressure (Kaplan, 2006; Pennington, 2009). There are three groups of diuretic used as the antihypertensive medicines (Broyles, Reiss, & Evans, 2007; Kaplan, 2006; Pennington, 2009).

Thiazide diuretics. These diuretics are normally used in hypertensive treatment. They act by inhibiting sodium and chloride reabsorption in the early segment of the distal convoluted tubule. Thus, a decrease in blood volume and extracellular fluid causes a decrease in blood pressure. The known side effects are hypokalemia, hyperuricemia, hyperglycemia, muscle weakness, chloride depletion and metabolic alkalosis (Broyles et al., 2007; Kaplan, 2006). Hydrochlorothiazide [HCTZ] (usual dose 12.5-50 mg/day), Indapamide (2.5 mg/day), Chlorthalidone (50-100 mg/day) and Metolazone (2.5-20 mg/day) include in this group.

Loop diuretics. Drugs in this group include Furosemide (20-80 mg/day), Bumetanide (0.5-2 mg/day) and Ethacrynic acid (50-200 mg/day). They act by inhibiting the reabsorption of sodium and chloride in the ascending loop of Henle. They are popular agents in treating clients with seriously impaired glomerular filtration rates. Hypokalemia is a side effect of these drugs, and when administered parentally in high dose, hearing loss may occur (Broyles et al., 2007).

Potassium-sparing diuretics. Spironolactone (25-50 mg/day) acts by inhibiting the action of aldosterone leading to an increase in sodium and chloride excretion. Amiloride hydrochloride (5-10mmg/day) and Triamterene (100-300 mg/day) act directly to block sodium reabsorption in the distal tubule, and reduce potassium and hydrogen secretion and excretion independent of aldosterone. Drugs in this group are often used in combination with thiazide or loop diuretics to obtain enhanced diuretics activity. The known side effects are nausea, flatulence, skin rash and hyperkalemia (Kaplan, 2006). Using Spironolactone for prolonged periods may induce enlarged breasts (gynecomastia) (Broyles et al., 2007).

Angiotensin-converting enzyme inhibitors (ACE-I). Their actions are to inhibit the angiotensin converting enzyme and renin that transforms angiotensin I to angiotensin II resulting in vasoconstriction and decreasing aldosterone production which reduces retention of sodium. Also, the increasing effect of bradykinnin which induces vasodilation, and decreases peripheral vascular resistance, without changing cardiac output are the action of ACE-I. Captopril (25-100mg/day), (5-40mg/day), Fosinopril (10-40 mg/day), Lisinopril (10-40 mg/day), Ramipril (2.5-20mg/day) and Quinapril (10-80mg/day) include in this group. The usual daily frequency for these groups requires 1 pill except for Catopril and Enalapril which require 2 pills per day.

Cough, hypotension and hyperkalemia are known as adverse effects of them (Pennington, 2009).

Angiotensin II receptor blockers (ARBs). ARBs compete with angiotensin II to catch on to its receptor which result in decreasing effect of angiotensin II which induces vasoconstriction and artery wall thickness. Also, they decrease aldosterone hormone which contributes to vasodilation and decreasing abortion of sodium (Pennington, 2009). The medicines in this group include Losartan (25-100 mg/day), Valsartan (80-100 mg/day), Candesartan (8-32 mg/day), Irbesartan (150-300 mg/day), etc. All of them require 1-2 pills/day. The known adverse effects of them include coughing (lower than ACE inhibitors), hypotension and an increase in creatinine and potassium (Kaplan, 2006).

Antiadrenergics. Antiadrenergic drugs are divided into 2 groups: beta-adrenergic blockers and alpha- adrenergic blockers.

Beta-adrenergic blockers. Beta-adrenergic blockers act to lower blood pressure by inhibiting beta-adrenergic receptors in the brain and decreasing angiotensin II which induces vasoconstriction and decrease peripheral vascular resistance. As a result, the reduced heart rate and decreased cardiac output lead to a decrease in blood pressure. Added with vasodilator group they can reduce the side effects which increase heart rate, and with the diuretic group decreasing circulating rennin activity. Propanonol (40-160 mg/day, frequency 2 pills/day), Bisopropol (2.5-10mg/day, 1 pill/day), Atenolol (25-100 mg/day, 1 pill/day) and Metroprolol (50-100 mg/day, 1-2 pills/day) are in this group. The side effects of this group are inducing or exacerbating bronchospasm in predisposed patients, fatigue, worsening of insulin

sensitivity, rising in serum triglycerides, falling in HDL-cholesterol, and worsening of psoriasis (Kaplan, 2006).

Alpha-adrenergic blockers. Alpha- adrenergic blockers block the activation of postsynaptic α_1-receptors by circulating or by neurally releasing catecholamines, an activation that normally induces vasoconstrictions. Peripheral resistance reduces without altering the cardiac output (Kaplan, 2006). The presynaptic □2-receptors inhibit the release of norepinephrine, thereby the frequency of tachycardia and cardiac output are decreased. The drugs in this group include Doxazosin (1-16mg/day, 1 pill/day), Prazosin (2-20 mg/day, 2-3 pills/day), Terazosin (1-20 mg/day, 1-2 pills/day), etc. Fatigue, and decreased heart rate are known common side effects of this group (Kaplan, 2006).

Calcium channel blockers (CCBs). Calcium channel blockers reduce blood pressure by inducing vasodilation, depressing cardiac contractivity, and inhibiting artrioventricular (AV) conduction (Kaplan, 2006). CCBs inhibit voltage sensitive calcium channel and inhibit calcium from entering the muscular cells, resulting in relaxation of the smooth muscles around the arteries; thus, cardiac output and the rate of hearthbeat are decreased. Drugs in this group are Amlodipine (2.5-10 mg/day, 1 pill/day), Flodipine (2.5-20 mg/day, 1 pill/day) etc. The side effects of this group are tachycardia, headache, dizziness, flushing, orthostatic hypotension, local ankle edema, etc. (Kaplan, 2006).

Direct vasodilators. These drugs are used to decrease blood pressure by entering the vascular smooth muscle cells to induce direct vasodilation which function by inhibiting hormonal vasoconstriction, preventing calcium entry into the cells and blocking □-adrenergic receptors (Kaplan, 2006). These mechanisms affect the smooth

muscles around the arteries, relaxing the muscles and vasodilation, hence lowering the peripheral vascular resistance and also blood pressure (Kaplan, 2006). Hydralazine requires 25-100 mg/day and usual daily frequency 2 pills. The dose range of Minoxidil is 2.5-80 mg/day and requires 1-2 pills/day.

Hypertensive patients without compelling indicators require at least one drug to achieve their blood pressure control with the addition of another type of antihypertensive drug or an increase in dosage when their blood pressure is >140/90 mmHg.

Compelling indicators for specific therapy involve high-risk conditions that they can direct a sequence of hypertension (heart failure, ischemic heart disease, chronic kidney disease, recurrent stroke) or commonly associated with hypertension (diabetes, high coronary disease risk). A patient with hypertension and certain comorbidities requires special attention and follow-up by the physician.

Hypertensive patients may suffer several factors from taking antihypertensive drug, such as daily frequency, the number of pills per day and side effects. The more hypertensive patients have comorbidities, the more they suffer from their treatment. They have to take at least two drugs due to having to control both hypertension and other compelling indications.

Non-pharmacologic treatment or lifestyle modifications. For preventing and controlling hypertension, lifestyle modifications should be recommended for all persons with hypertension which include weight reduction in persons who are overweight or obese, dietary sodium reduction, adoption to Dietary Approaches to Stop Hypertension (DASH) eating plan, regular physical activity and restriction of alcohol drinking (Chobanian et al., 2003). The significance of lifestyle modifications

is to reduce blood pressure, increase antihypertensive medication efficacy, reduce the number and doses of antihypertensive medication, and lessen cardiovascular risk (European Society of Hypertension [ESH] and European Society of Cardiology [ESC], 2007; Chobanian et al., 2003). The explanations of lifestyle modifications are discussed as follows:

Weight reduction. A weight reduction 10 kg reduces systolic blood pressure 5-20 mmHg (Chobanian et al., 2003). The findings of Stevens et al. (2001) who studied long-term weight loss and changes in blood pressure found that persons who lost at least 4.5 kg and sustained this weight reduction for the next 30 months had the greatest decrease in blood pressure (Stevens et al., 2001). In addition, a meta-analysis of randomized controlled trials in weight reduction and blood pressure showed that an average weight loss 5.1 kg (95% CI = -6.03 to -4.25) decreased systolic blood pressure by 4.44 mmHg (95% CI = -5.93 to -2.95) and diastolic blood pressure by 3.57 mmHg (95% CI = -4.88 to -2.25). Also with each weight reduction of one kilogram, systolic blood pressure reduction was 1.05 mmHg (95% CI = -1.43 to -0.66) and diastolic blood pressure reduction was 0.92 mmHg (95% CI = -1.28 to -0.55) (Neter, Stam, Kok, Grobbee, & Geleijnse, 2003). As well a systematic review using literature published from 1966 to 2001 for assessing long-term effects of weight loss on blood pressure, the result showed that for a 10 kg weight loss, there were decreases of 4.6 mmHg and 6.0 mmHg in diastolic and systolic blood pressure, respectively (Aucott et al., 2005).

Dietary sodium reduction. Many studies regarding the relationship between dietary control and blood pressure found that eating low-sodium foods could decrease blood pressure. For instance, He, Whelton, Appel, Charleston, and Klag

(2000) conducted a long-term effect study of weight loss and dietary sodium reduction on incidence of hypertension. They found that, in the 7th year of follow-up, the incidence of hypertension in the sodium reduction group was 22.4% and 32.9 % in the control group. The odds of hypertension in the sodium reduction group reduced 35% (OR = 0.65; 95% CI = 0.25-1.69; *P* = 0.37). The evidence concluded by JNC-7 (Chobanian et al., 2003) showed that 1,600 mg sodium has effects similar to single antihypertensive drug therapy. Recommendation for reducing dietary sodium intake to no more than 100 mmol per day (2.4 g sodium or 6 g sodium chloride) induces an average systolic blood pressure reduction of 2 to 8 mmHg. Sodium limitation combined with other dietary counseling may have a greater antihypertensive effect and may allow lessening the number and doses of antihypertensive drugs in order to control blood pressure (ESH & ESC, 2007).

Adopt Dietary Approaches to Stop Hypertension (DASH) eating plan. Consuming a diet rich in fruits, vegetables, and low-fat dairy products with a reduced content of saturated and total fat as recommended by the DASH eating plan results in an approximate systolic blood pressure reduction 8 to 14 mmHg (Chobanian et al., 2003). Decreasing the fraction of saturated fat not only decreases blood pressure but also can decrease the cholesterol level which is a major risk factor in the development of atherosclerosis (DeMartinis, 2009). Sacks et al. (2001) studied the effect of the DASH diet on blood pressure, and the result showed that systolic blood pressure decreased 1.3 mmHg in participants who eat the DASH diet. Furthermore, the result from the study of Ard and colleague who conducted a 12-month follow-up on persons with hypertension in DASH diet found that systolic and diastolic blood pressure

reduced 3.12 mmHg (95% CI = -0.44 to 6.68) and 0.79 mmHg (95% CI = -1.15 to 2.72), respectively (Ard, Coffman, Lin, & Svetkey, 2004).

Physical activity. Moderate-intensity (40-70% VO_2 max) aerobic exercise can reduce blood pressure not only in hypertensive and normotensive participants but also in overweight and normal-weight participants (Choudhury & Lip, 2005; DeMartinis, 2009; Whelton, Chin, Xin, & He, 2002). The available data suggest that moderate-intensity regular aerobic physical activity (such as brisk walking, jogging, swimming) at least 30 minutes per day, most days of the week recommended by JNC-7, can reduce systolic blood pressure 4 to 9 mmHg (Chobanian et al., 2003). Moreover, a meta-analysis of randomized controlled trial in effect of aerobic exercise on blood pressure found that aerobic exercise was related with a significant decrease in mean systolic (-3.84 mmHg, 95% CI = -4.97 to -2.72) and diastolic blood pressure (-2.58 mmHg, 95% CI = -3.35 to -1.81) (Whelton et al., 2002). Additional advantages of regular physical activity include weight loss, improved sense of well-being, increased functional health status, and decreased risk of cardiovascular disease (CVD) and mortality from all causes (Franco, Oparil, & Carretero, 2004).

Moderation of alcohol consumption. The best recommendation is for no alcohol consumption. For drinkers, intake should be limited to 1 to 2 oz of alcohol per day (2 oz of 100-proof whiskey, 8 oz of wine, or 24 oz of beer) in most men and half that amount in women and small men (Franco et al., 2004). Also JNC-7 recommended that drinkers should limit alcohol consumption to no more than 2 drinks (1 oz or 30 ml ethanol, 24 oz of beer, and 10 oz of wine or 3 oz 80-proof whisky) per day in most men and to no more than 1 drink per day in women and lighter weight persons and an approximate systolic blood pressure reduction was

ranged 2 to 4 mmHg (Chobanian et al., 2003). Alcohol reduction was associated with significant reduction 3.31 mmHg and 2.04 mmHg in mean of systolic blood pressure and diastolic blood pressure respectively (Xin et al., 2001).

Lifestyle modifications are important for persons with normal and high blood pressure in reducing both systolic and diastolic blood pressure and also decreasing the risk of cardiovascular disease (CVD). Combinations of two or more lifestyle modifications can achieve even better outcomes (Chobanian et al., 2003). Therefore, all persons with hypertension who take antihypertensive drug and/or are overweight or obese should be receiving advice for lifestyle modification.

Adherence

Definitions of Adherence

In the early literature, the term "compliance" was commonly used in health care professions. Lahdenpera and Kangas (2000) stated that there are many concepts referring to compliance such as adherence and commitment, but the fact that there is no agreement on a commonly accepted definition of the concept compliance. In nursing science, Marston, who first introduced the term compliance into nursing; found that it was inappropriate to compare compliance rates from different studies because of the wide variation in definitions and the lack of objective measures of compliance (Murphy & Canales, 2001). The definition of compliance has been rejected because of its paternalism and its implication that health care providers have the right to authority over the patient's behaviors and actions (Kyngas, Duffy, & Kroll, 2000). Moreover, Murphy and Canales (2001) who gathered the definition of

compliance from a nursing perspective found that the nursing definition of compliance showed more active participation of individuals to self-care themselves by collaborating with health care providers. Moreover, Evangelista (1999) analyzed the concept of compliance and found that compliance has five defining attributes including ability to complete or perform what is due, flexibility, adaptability, malleability and subordinate behaviors. In addition, Kyngas et al. (2001) who conducted concept analysis of compliance found that compliance has been conceptualized as cognitive-motivational processes of personal attitudes and intentions, a set of self-care behaviors, outcomes of patient-practitioner interactions and an ideology that emphasized professional power over the patient. However, the definition of compliance is controversial and calls for reconceptualization (Evangelista, 1999; Murphy & Canales, 2001).

To date the term adherence, an alternative term, is used more widely than the term compliance and they are interchangeable in health care literature. Thus, the term compliance and adherence were included in the review of literature. In health care adherence is generally associated with one's ability to maintain the behaviors associated with a plan of care involving taking medications, keeping appointments, or changing health behaviors (Shay, 2008). Adherence is a positive meaning because the person is viewed in an active role and has a responsibility for his/her health. The definitions of adherence are described as follows.

The World Health Organization (WHO, 2003) defined adherence as "the extent to which a person's behavior: taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from the health care provider".

Shay (2008) defined the term “adherence as one’s ability to maintain the behaviors associated with a plan of care which involves taking medications, keeping appointments, or changing health behaviors”.

Cohen (2009) described the definition of adherence as “persistence in the practice and maintenance of desired health behaviors and is the result of active participation and agreement”.

In summary, the term adherence is focused on maintaining the desired behaviors and agreement on treatment plans whereas the term compliance is not. However, all of the definitions of adherence have a similar focus on the patients as active and agreeable with the recommendations from health care providers to improve their health. The roles of patients and health care providers are mutually responsible in achieving the goal of therapy. However, the definitions given by WHO cover the behaviors that the patients need to perform themselves, but sustained and maintained performance are not considered. Thus, the definition of adherence in this study will be defined as the extent of agreement and performance of persons with hypertension about the recommended behaviors provided by health care providers including antihypertensive medication taking, dietary modifications, weight control, avoiding risk factors, physical activity, stress management and follow-up visits. The attributes of agreement consist of alignment of patients’ behaviors and recommendations, mastery of new behaviors, ongoing collaboration with health care providers on a treatment plan and their perceived ability to meet optimal blood pressure.

Attributes of Adherence

Cohen (2009) introduced the concept analysis of adherence in the context of CVD risk reduction and presented the attributes of successful adherence as follows.

Alignment of patients' behaviors and health recommendations. The treatment and recommendations should be a part of the patient's daily life, so that it does not affect his/her daily life. To reach the goal of their therapy, patients should take medication, change their lifestyle and maintain a healthy lifestyle. Moreover, it is essential for health care providers to assess facility and/or barriers that prohibit the patients in performing recommended behaviors. The patients and health care providers should work together in adjusting the treatment to fit the patient's life.

Mastery of a new behavior and health knowledge. Patients should have enough knowledge and skills to follow the treatment regimens in order to increase their confidence for controlling their own blood pressure. In addition, the patients should have the ability to observe and manage by themselves when there are signs and symptoms. For instance, the patients should have knowledge and information which include the name of the used drug, side effects of the drug, target blood pressure, level of blood pressure, restricted diet, regular exercise, limited alcohol consumption and smoking cessation.

Ongoing collaboration relationship between the patient and health care provider. A good relationship between patients and health care providers should be developed in collaboration and both have mutual responsibility to assist patients to attain and maintain their target goal of treatment. Also, this relationship gives the patient trust and confidence to negotiate in the treatment plan with the health care

providers. The patients and health care providers should change the plan together if the goal of treatment is not accomplished.

Their perceived ability to meet the outcome targets. To reach the target of treatment, patients should perceive their ability to perform recommended behaviors. Patients who perceive high ability tend to attain the outcome targets more than those who perceive low ability. Therefore, the patients should be encouraged to increase their perceived ability to perform certain behaviors.

In summary, to have successful adherence persons with hypertension should have their treatment plan appropriately adjusted into their daily life and have agreement with the recommended behaviors which are practical to perform. Knowledge and skills in recommended healthy behaviors are necessary for them to control their blood pressure and maintain good health. In addition, ongoing collaborative relationships between persons with hypertension and health care providers will enhance persons' confidence to perform required behaviors and adjust them into their daily life. Lastly, they should perceive their ability to perform the recommended behaviors to reach the goal of therapy.

Models of Adherence

To understand the factors affecting adherence to regimens among patients with chronic illness, most of the previous studies use health behavioral theories such as health belief model, health promotion model, and social cognitive theory. Recently, the models of adherence were developed to describe adherence behaviors. These models are presented as follows.

Five Dimensions Model of Adherence. The Five Dimensions Model of Adherence was developed by the World Health Organization in attempting to clarify the role of the many variables influencing adherence to regimens in chronic illnesses (WHO, 2003). Dimensions related to adherence were categorized in a set of five factors.

1. Social and economic factors referred to demographic characteristic and socioeconomic status of individuals. These factors indicated the difference in role, duty, responsibility and social status. There were promotional and obstructive factors for patients' adherence. These factors differentiated individuals in the aspect of social and influence their health behaviors. These factors allowed health care providers to estimate obstacles or choose useful resources for the patient's adherence.

2. Health system and health care team factors were one set of factors affecting adherence among hypertensive patients. These factors were related to interaction between the patients and health care providers. They included not only the relationship between the health care providers and patients, but also the system of reimbursement, availability of medications, training of providers in caring for patients with chronic illnesses, amount of time available for consultations and the amount of working time required per provider. In addition, provisions for patient education and community-provided patient support systems were needed to support patients' self-management and compliance (WHO, 2003). This relationship lead to trust, satisfaction, and confidence for patients to perform the required behaviors.

3. Condition-related factors referred to patients' health status that affected adherence to regimens. Some powerful determinants of adherence were those factors related to the severity of symptoms, level of disability (physical, psychological,

social, and vocational), rate of progression and the severity of the disease, and the availability of effective treatment. The impact of those depended on how they influence patients' risk perception, the importance of complying treatment, and the priority set on adherence. Co-morbidities were important modifiers of adherence behavior (WHO, 2003).

4. Therapy-related factors referred to the complexity of the treatments that made it difficult for patients to adjust to the treatments in their daily life. They included a complex medical regimen requiring life-style change, life-long treatment, experience with prior successful or failed treatments, frequent alterations in treatment strategies, and the severe side-effects.

5. Patient-related factors referred to intrapersonal factors based on individuals' cognition process. The perception, understanding, belief, self-confidence and attitude toward hypertension treatment and adherence derived from the cognition process and individuals' ability. These factors affected the patient's willingness to learn about an illness and motivation to change behaviors. Perceptions of one's need for treatment were influenced by symptoms, expectations and experiences and by illness cognition (WHO, 2003).

This model focuses on factors which affected patients' adherence to regimens in many aspects such as intrapersonal, interpersonal and environmental factors. The advantage of this model for health care providers is the guideline to use as framework to assess what are barriers or enabling factors for patients to perform recommended behaviors to control disease. This model makes health care providers understanding why patients with hypertension comply or not with the recommended behaviors.

Johnson's Medication Adherence Model. Johnson's Medication Adherence Model (MAM) was developed by Mary Jayne Johnson to describe the process of medication adherence and guide health care providers in assessing medication taking in persons with hypertension (Johnson, 2002). Two types of nonadherence behaviors, intentional and unintentional adherence, were described by three core concepts: purposeful action, patterned behavior, and feedback (Hsu et al., 2010; Johnson, 2002).

Purposeful action is individuals' decision making process in which they cognitively or intentionally decide to adhere to or not adhere to antihypertensive medications based on perceived need, effectiveness, and safety (Hsu et al., 2010; Johnson, 2002). Persons decide to take medication if they perceive that the medications are needed to control their blood pressure, how effective antihypertensive medications are, and how safe the antihypertensive medications are.

Patterned behavior is defined as individuals start and establish a ritual habit or pattern of taking hypertensive medications through access, routine, and remembering (Hsu et al., 2010; Johnson, 2002). To initiate and sustain medication taking behavior, persons need to be able to assess drugs or receive treatment from health care providers, establish a routine which is an effective strategy used by persons to facilitate their medication-taking behaviors. Also, they have methods to recall taking their antihypertensive drugs or not forgetting to take them.

Feedback is defined as the process in which individuals use information, facts, prompts, or events to reinforce the need to maintain or modify medication-taking behavior (Hsu et al., 2010; Johnson, 2002). Persons use information to evaluate the need, effectiveness and safety of the medications. Gaining information

from feedback may have both positive and negative incentive effect on taking drugs. If persons perceive the need, effectiveness and safety of medications then the feedback serves as an incentive effect on medication-taking. Conversely, if medications are perceived as not needed, ineffective, or unsafe, the feedback serves as negative effect on medication-taking.

In brief, patterned behavior is stimulated by purposeful action and both of them are affected by feedback. This model focuses on only medication adherence. The advantages of this model are to understand the causes of not taking medications and concerning both the cognitive and behavioral processes which individuals use to decide and maintain to take medicines.

The Hill-Levine Model. The Hill-Levine model adapted from Green and Krueter's PRECEDE-PROCEED model provides the framework for understanding multiple factors that affect one's ability and willingness to stay in care and follow prescribed hypertension regimens (Fongwa et al., 2006). The model merges public health and medical model and integrates health education, behavior change, and maintenance principles with culturally sensitive approaches, social action, and social learning theory (Fongwa et al., 2006). Predisposing factors, enabling factors, and reinforcing factors are concepts of this model and affect adherence to treatment recommendations that induce positive or negative outcomes such as controlling blood pressure and reducing cardiovascular risk factors.

Predisposing factors include knowledge, belief, and attitude of hypertensive patients related to disease, treatment and recommended behaviors for controlling blood pressure. Demographic characteristics are included as predisposing factors including educational level, income and age.

Enabling factors are two subconcepts: access to health care resources and health behavior skills. Access to health care resources is described as the presence or absence of health insurance, regular treating physician for hypertension and use of emergency departments of hypertension-related care. Health behaviors are described as related risk behaviors including alcohol use, illicit drug use, cigarette smoking, and dietary practices.

Reinforcing factors provide social support that is explained as the comfort, assistance, and information perceived to be available through formal or informal contacts with individuals or groups. There are two types of social support: instrumental and emotional support. Instrumental support is defined as help or tangible problems. Emotional support is defined as having someone to go to for personal matters such as anxiety, hopelessness and depression.

In summary, the Hill-Levine model addresses factors affecting adherence to treatment that lead to control blood pressure. The Hill-Levine model focuses on three sets of influencing factors on adherence to regimens including predisposing factors, enabling factors, and reinforcing factors. Understanding the factors that influence adherence to regimens is useful for improving adherence to regimens leading to optimal blood pressure level.

The Five Dimensions Model of Adherence focuses on many factors which influence adherence to regimens and do not focus only on persons' cognitive factors but also on persons' environmental factors, their disease and its treatment which influence both medication and lifestyle modification adherence. However, the direct and indirect effects of each factor on adherence are not clearly shown in this model. Thus it cannot explain direct and indirect effects of each factor on adherence to

regimens. Additionally, in this model some factors such as social and economic factors and condition-related factors are cannot be modified and some factors such as health system and health care team factors and therapy-related factors cannot be modified by nursing roles. In addition, the Medication Adherence Model (MAM) focuses on the cognitive and behavioral process of persons to decide and maintain for taking antihypertensive medications. MAM describes the process by which persons with hypertension decide and maintain to take their medications but do not focus on lifestyle modifications. Generally, MAM is not appropriate model for determining adherence to regimens including medication and lifestyle modifications. Finally, the Hill-Levine model focuses on cognitive, behaviors, health care access and social support which these factors are barriers or enabling factors affecting adherence to treatment. Although, the five dimension model of adherence and the Hill-Levine model are alike because they focus on intrapersonal, interpersonal and environmental factors affecting adherence, the environmental factors in the Hill-Levine model do not focus on persons' disease and its treatments. Some factors in the Hill-Levine model such as access to health care resources cannot be modified by nursing roles. All models are developed to describe adherence behaviors and influencing factors of the recommended behaviors for controlling disease and maintain well-being. Using these models as a guideline to assess adherence behaviors, the health care needed or health problems of patients are represented.

However, all of them have limitations to explain direct and indirect effects of factors on adherence to regimens among persons with hypertension. The present study developed a model of adherence to regimens based on empirical evidences

which show obviously the direct and indirect relationships between related factors and adherence to regimens among persons with hypertension.

Adherence to Therapeutic Regimens Among Persons with Hypertension

The goal of the therapy is to control the blood pressure level so it is less than 140/90 mmHg for reducing cardiovascular diseases and decreasing morbidity and mortality from severe complications (JNC-7) (National Institutes of Health National Heart, Lung, and Blood Institute [NHLBI], 2004). Because of the benefits of taking antihypertensive medications and changing lifestyles on decreased blood pressure, it is an important for persons with hypertension to adhere to these behaviors. Also, the treatments should be a part of their daily routine.

Adherence to medication. Hypertension is one of the risk factors that cause cardiovascular disease. The purpose of taking antihypertensive medications is to decrease blood pressure to an optimal level. The study shows that controlling blood pressure at a normal level can reduce the incidence of cerebro-vascular diseases by 35-40%, reduce the incidence of myocardial infarction by 20-25%, and reduce the incidence of heart failure by 50% (Chobanian et al., 2003). Many studies found that adherence to treatment of patients with chronic diseases was approximately 43-78% (Osterberg & Blaschke, 2005). For hypertension, it was found that the medication adherence level was approximately between 50-70% (Schroeder, Fahey, & Ebrahim, 2004). That means only half of the patients adhere to their treatment (Krousel-Wood, Thomas, Muntner, & Morisky, 2004). About 30-50% of hypertension patients stopped receiving treatment within the first year (Patel & Taylor, 2002) and 43% of

the patients stopped receiving treatments after 4 years of treatment (Krousel-Wood et al., 2004).

Medication adherence in persons with hypertension means that the patient takes medicine to treat hypertension consistently as prescribed. The following practices when taking medicine should be adhered to (Abrams, Lammon, Pennington, & Goldsmith, 2009):

1. Take the medicine at the complete dosage per day as specified for each one.

2. Take the medicine correctly at the specified time or frequency of each drug.

3. Remind oneself not to forget taking medicine, for instance, placing the medicine that must be taken in the morning in a place where the person can see it when having breakfast, such as near the dining table. The medicine that must be taken before bedtime should be placed in the bedroom.

4. Do not decrease or increase the dosage on one own. Do not stop taking medicine when the symptoms disappear.

5. Memorize the medicine name, the number of medicine types, dosage, and the amounts that must be taken each day, and side effects of each medicine.

6. Notice the symptoms and take note about the side effects caused by the medicine. Inform the physician about side effects of each medicine in order to consider changing medicine type or decreasing the dosage.

7. Do not take other people's hypertension medicine because it might not be the same medicine and the dosage might be different.

8. When the patients have to take other medicines in order to cure other diseases, they should inform the physician about the type, amount, dosage, and usage frequency of hypertension medicine. The patients should not buy the medicine on their own in order to prevent drug incompatibility or decrease of hypertension drug effect caused by other medicines.

Adherence to lifestyle modifications. Lifestyle modifications are one part of hypertension management that can decrease blood pressure, enhance drug efficacy in decreasing blood pressure, and decrease risk factors of cardiovascular diseases (Chobanian et al., 2003). In addition, lifestyle modifications are treatment for pre-hypertensive patients in order to prevent hypertension or prolong the occurrence of the disease in an at risk group. The JNC-7 revealed that decreasing of systolic blood pressure 5-20 mmHg with weight reduction, 8-14 mmHg when adopting DASH eating plan, 2-8 mmHg when restricting sodium consumption and 2-4 mmHg when reducing alcohol consumption to moderate. Persons with hypertension need to adhere to regimens to reach optimal blood pressure.

Adherence to weight reduction and weight control. Weight reduction is an effective tool to prevent hypertension and reduce antihypertensive drug usage (Hermansen, 2000). Maintaining body weight at a normal level is to keep the body mass index (BMI) at the range between 18.5-24.9 kg/m^2. Decreasing body weight 10 kilograms can reduce systolic pressure approximately 5-20 mmHg (Chobanian et al., 2003). From a seven years follow-up study, the incidence of hypertension in the weight loss group was 18.9% and 40.5% in the control group. The odds of hypertension in the weight loss group was reduced 77% (OR = 0.23, 95% CI = 0.07-

0.76; *P*=0.37) compared to the control group (He et al., 2000). Therefore, weight reduction has direct influence on blood pressure.

However, sustaining weight reduction in the long term might be difficult. Thus, the emphasis should be placed on prevention of weight gain (Franco et al., 2004). In addition, another way to assess obesity is measuring waist circumference. The criterion of waist circumference in Asian should not exceed 80 centimeters or 32 inches in women and not exceed 90 centimeters or 36 inches in men (Aekplakorn, 2010).

Limiting calorie intake appropriate for daily energy usage and increasing physical activity are important for overweight and obese hypertensive patients (Hermansen, 2000; Kokkinos, Papademetrou, & Moutsatsos, 2000). Patients with hypertension who are overweight should intake lower calorie food by eating smaller portions and cut back gradually (NHLBI, 2006a). Using fat-free or low-fat condiments, eating more fruit and vegetables, limiting foods with lots of added sugar such as bakery, cookies, and flavored yogurts are recommended food for reducing weight. Moreover, moderate physical activity at least 60-90 minutes of daily is recommended for reducing weight and moderate-to-vigorous physical activity for 60 minutes most days of week to prevent gradual weight gain (NHLBI, 2006a).

Adherence to dietary control. Hypertensive patients should eat enough complete nutrients for daily energy usage. Many foods influence blood pressure, such as saturated fat, sodium salt, and potassium. Dietary sodium reduction and adopting Dietary Approaches to Stop Hypertension (DASH) eating plan are recommended for persons with hypertension.

Adherence to dietary sodium reduction. The European Society of Cardiology (ESC) and the European Society of Hypertension (ESH) (2007) recommended that persons with hypertension should have an intake of sodium chloride (NaCl) of less than 5 g/day (85 mmol/day). JNC-7 (Chobanian et al., 2003) also suggested that the patient should reduce his/her dietary sodium intake to no more than 100 mmol/day (2.4 grams of sodium or 6 grams of sodium chloride). To restrict sodium intake, persons with hypertension should choose low or reduced-sodium or no salt-added versions of foods, use fresh vegetables, cook foods without salt or decrease salt, and use spices instead of salt in cooking (NHLBI, 2006b). Hypertensive patient should avoid salty seasoning which is the source of sodium (fish sauce, soy sauce, oyster sauce, tomato sauce, chili sauce), foods that contain a lot of salt (pickle by fermentation, dried foods, snack, and potato chip), canned foods (canned fish, canned curry), baking powder, convenience foods (noodle, rice porridge and soup) (Bureau of Nutrition, Department of Health, Ministry of Public Health, 2011). The Bureau of Nutrition, Department of Health, Ministry of Public Health (2011) recommended strategies to restrict sodium intake by starting with cutting salt intake in half and gradual reducing until no salt or at very little salt is consumed. When eating out, patients should ask for food to be prepared without added salt, MSG or salt-containing ingredients.

Adherence to Adopt Dietary Approaches to Stop Hypertension (DASH) eating plan. The benefits of DASH are to reduce both blood pressure and LDL cholesterol (DeMartinis, 2009). The DASH eating plan is aimed to change eating behaviors by recommending the eating of whole grain products, fish, poultry, and nuts and reducing the eating of lean red meat, sweets, added sugars and sugar-containing

beverages. The DASH is also rich in potassium, magnesium, and calcium, as well as protein and fiber (Appel, 2003; Franco et al., 2004; NHLBI, 2006b; Sacks et al., 2001). To adopt the DASH eating plan into daily life, patients should add a serving of vegetables, fruit, brown rice or whole wheat products, limit the consumption of lean meats and cut the portion of meats back gradually by a half or a third at each meal and include two or more vegetarian-style (meatless) meals each week. Furthermore, they should use fruit or other food low in saturated fat and cholesterol (sesame, olive oil, and fish oil), avoid eating egg yolk, fatty meat, entrails, seafood, and oysters. Moreover, they should avoid using saturated fat such as animal oil and palm oil to cook food (NHLBI, 2006).

Adherence to physical activity. Increasing physical activity can reduce blood pressure (Appel, 2003). From the meta-analysis on 27 randomized control trials researches (RCTs) related to the influence of exercise on blood pressure, it was found that systolic blood pressure decreased 4 mmHg in the participants with aerobic exercise. This study suggested that aerobic exercise is important to prevent and treat hypertension (Whelton et al., 2002). Additionally, JNC-7 (Chobanian et al., 2003) recommended engagement in regular aerobic physical activity of at least 30 minutes per day and at least 3 times a week. It can be useful in decreasing systolic blood pressure approximately 4-9 mmHg. The mechanism of lowering blood pressure is caused by dilation of blood vessels after exercise that remains for 13 hours. When persons exercise regularly, the heart and blood vessels adjust their function to be more effective. That means increasing arterial compliance, which results in decreased peripheral resistance and lower sympathetic nervous system function. Also, norepinephrine decreasing causes vasodilatation. Consequently, the overall blood

pressure is decreased. Aerobic exercises include brisk walking, jogging, swimming, bicycling, rope jumping, and aerobic dancing (Sangprasert, 2007). Persons should avoid isometric exercise, for example, lifting weights. It is not beneficial for physical efficacy because isometric exercises inhibit the vagus nervous system, which increases heart rate and resistance in blood vessels. Thus, blood flow to the heart is decreased while the heart demands high oxygen. Hence, it is inappropriate for a person with hypertension (Franco et al., 2004; Sangprasert, 2007).

Therefore, persons with hypertension should take up aerobic exercise of moderate-intensity, such as walking, aerobic dancing, jogging, Kangfu dancing, or swimming at least 30-60 minutes per day and at least 3 times per week. Persons should exercise for 30 minutes straight or separate the session into 10-15 minutes and exercise until it totals 30-60 minutes. Also, physical activity can be added without major lifestyle changes. The patients should use stairs instead of an elevator, get off the bus one or two stops early, or park the car at the far end of the parking lot. While working, they should take frequent activity breaks, get up and stretch, walk around, and give their muscles and mind a chance to relax. If they do housework, gardening, or yard work they should work at a more vigorous pace (American College of Sports Medicine, 2001; NHLBI, 2006).

Moderation of alcohol consumption. Decreasing alcohol consumption is very important for lifestyle modifications in order to prevent and control hypertension in patients who are heavy drinkers (Xin et al., 2001). From the meta-analysis on 15 randomized control trials study (RCTs) regarding the effect of alcohol reduction on blood pressure among 2,234 participants, the results showed that the decrease of alcohol intake was related to a significant decrease in mean systolic and diastolic

blood pressure of 3.31 mmHg and 2.04 mmHg, respectively (Xin et al., 2001). For drinkers, reducing alcohol intake, their systolic blood pressure will decrease about 2-4 mmHg. Moderation of alcohol consumption should be limited to no more than 1 oz (30 ml) of ethanol (24 oz of beer, 10 oz of wine or 3 oz 80-proof whiskey) in most men and no more than 0.5 oz (one drink) of ethanol per day in women and lighter weight persons (Chobanian et al., 2003).

Adherence to stress management. The empirical studies found that stress management decreased both systolic and diastolic blood pressure. For instance, Dusek et al. (2008) studied the stress management by relaxation response training on systolic hypertension and medication elimination. The results showed that systolic and diastolic blood pressure in relaxation response training group decreased 9.4 and 1.5 mmHg, respectively. Decreasing in systolic and diastolic blood pressure was not significant different between relaxation and control groups. Furthermore, the patients in the relaxation response group eliminated an antihypertensive medicine 4.3 folds compared with the control group (OR = 4.3, 95% CI = 1.2-15.9, P = 0.03) (Dusek et al., 2008). Kaewta (2003) studied the effect of relaxation training with biofeedback on stress and blood pressure among hypertensive patients. The result showed that for both relaxation training with the biofeedback group and the relaxation training group, their blood pressure decreased significantly compared to before training. The relaxation training with biofeedback group had an average blood pressure and stress scores lower than the control group receiving only the relaxation training. Therefore, hypertension patients should apply techniques to relax as follows (Department of Mental Health, 1999).

1. Train for long deep breath by using the diaphragm. When inhaling, the abdomen will inflate. When exhaling, the abdomen will deflate. The lungs will expand causing them to receive more oxygen. The body is then refreshed. It also helps to concentrate on one thing.

2. Alleviate stress by expressing feelings to a reliable person, taking notes, or using humor.

3. Doing entertaining activities or hobbies can alleviate stress, for example, watching movies, listening to music, doing handicraft work, gardening, and exercise.

4. Do muscle relaxation training by contracting and relaxing muscles alternately for a short duration (5 seconds). Contract all muscles in the body, such as fingers, arms, neck, shoulders, face, and legs. Practicing regularly will help reduce stress and promote comfortable sleep.

5. Change one's attitude to be optimistic, stop anger, be generous, forgiving, be creative, seek new ways of solving problems, and not being self-centered.

Adherence to follow-up visit. To control or manage hypertension, the patients should return for follow up and adjustment of medication until the desired blood pressure is achieved. More frequent visits will be needed for patients with stage 2 hypertension or with complicating comorbid conditions. After the blood pressure is at the goal level, the stable the follow up visits can usually be at 3 to 6 month intervals. Physical examination, laboratory tests and checking their blood pressure are also important in sustaining treatment and finding the target organ

damaged. Essentially, the patients should regularly visit the physician by appointment even if there are no symptoms (Chobanian et al., 2003).

Generally, the hypertensive patients should perform behaviors which are recommended by health care providers to control blood pressure to an optimal level and to prevent the cardiovascular diseases, cerebro-vascular disease, and renal failure. Adherence to regimens including taking antihypertensive drugs and changing lifestyles can help patients to control their blood pressure to an optimal level. Hypertensive patients should sustain their treatments which include taking medicine and changing lifestyles. In addition, lifestyle modifications can also enhance drug efficacy, allowing dosage reduction for treatment, resulting in lower cost of treatments.

Measuring Adherence

The methods for assessing adherence are direct and indirect. Each method has both advantages and limitations and there are no gold standard scales for assessing adherence (Hawkshead & Krousel-Wood, 2007; Osterberg & Blaschke, 2005). Direct methods include laboratory detection of the drug or a metabolic product of the drug in a biologic fluid (blood or urine), laboratory detection of biologic markers and direct observation of medication behavior. Direct methods are considered impractical in outpatient settings for monitoring adherence to medications for chronic conditions because hypertensive patients require daily dosages of drug over a span of years rather than days or weeks. The advantages of direct method are accuracy, quantifiable and reliable data. However, the limitations of direct method are high costs and complex procedures. The advantages of indirect methods such as self-

reporting are the simplest method and most economical for assessing adherence. Disadvantages include recall bias and the possibility of over-estimation (Hawkshead & Krousel-Wood, 2007). The measurements for assessing adherence among persons with hypertension are presented as follows.

1. The Morisky Medication Adherence Scale (MMAS) is a self-report medication adherence scale. It measures a specific medication-taking behavior. There are eight items and the response categories are yes/no for each item with a dichotomous response and a 5-point Likert response for the last item. The MMAS scores range from 0 to 8. The scores is divided into 3 levels of adherence: high adherence (score 8), medium adherence (score 6 to < 8), and low adherence (score < 6). Reliability of this scale was 0.83 and the scale was significantly associated with blood pressure control in patients with hypertension ($p < 0.05$). The sensitivity of the measure for identifying low versus higher adherence was estimated to be 93%, and the specificity was 53%, when using a cutpoint of less than 6 (Krousel-Wood et al., 2009; Morisky, 2008).

2. The Hill-Bone Compliance to High Blood Pressure Therapy Scale assesses patient's behaviors for three main parts; medication compliance, appointment and salt intake items and is comprised of 14 questions. Each item has a response on a four point scale ranging from 1 (none of time) to 4 (all of time). The total score ranges from 9 (perfect adherence) to 36 (imperfect adherence). The alpha coefficient of scale was 0.85 (Kim, Hill, Bone, & Levine, 2000; Koschack, Marx, Schnakenberg, Kochen, & Himmel, 2010).

3. The Compliance of Hypertensive Scale (CHPS) was developed to assess five components which are labeled according to their content: intention of care,

lifestyle, attitude towards hypertension and its treatment, responsibility in the treatment and smoking. There are 13 items in which each item can be responded on three to four point scales ranging from 1 to 3 or 4. The resulting sum score is not identified. The Theta coefficient of total score was 0.80 (Lahdenpera, Wright, & Kyngas, 2003).

4. The Patient Adherence Questionnaire developed by Uzun et al. (2009) assesses five categories of adherence including medicine, diet, exercise, home blood pressure measurement and smoking. It contains 44 items with a dichotomous response. The psychometric properties of the scale were not presented (Uzun et al., 2009).

5. Medication Adherence Measurement is a self report of medication adherence. This scale was modified by Naewbood (2005) from Walsh et al. (2002, as cited in Naewbood, 2005). It measures medication adherence in terms of proportion of doses taken, and regularity of taking medication in the past month among hypertensive patients. Two visual analog scales are used to measure medication adherence. A line (100 mm.) which 0 on the left end and 100 on the right end is used to assess the percentage of adherence. An average of both scales is used to indicate medication adherence in the study. A cut point of 80% is used to classify good or poor adherence ($\geq$ 80% = good, < 80% = poor). Higher proportion means better medication adherence. The psychometrics properties of this scale were not presented (Naewbood, 2005).

6. Adherence to Lifestyle Modifications Questionnaire is developed by Limcharoen (2006). This questionnaire consists of five subscales which include dietary control, exercise and physical activities, avoiding risk factors, stress

management and follow-up visit. Responding to each of the 21 items is a line of 11 Likert scale ranging from 0 to 10 points with 0 on the left end and 10 on the right end of the line. An average of all items is used to indicate adherence to lifestyle modifications. A cut-off point of 80% is used to classify good or poor adherence (≥ 80% = good, < 80% = poor). The content validity and reliability of this questionnaire were 1.00 and 0.81, respectively (Limcharoen, 2006).

7. The Hypertensive Compliance Scale (HCS) was developed by Dongyan (2000) to measure the extent to which the hypertensive patients' behavior coincides with their medical regimens prescribed by a physician. The twenty eight items are divided into 7 subscales including antihypertensive medication taking (7 items), dietary modifications (8 items), weight control (2 items), smoking cessation (2 items), alcohol intake limitation (1 item), physical exercise (3 items), and stress management (5 items). This scale is a 6-Likert scale rating from 0 (not applicable) to 5 (all of the time). The total scores of compliance ranging from 28 to 140 are classified into three levels, high (102.7-140), moderate (65.4-102.6), and low (28-65.3). The content validity index (CVI) and reliability of this scale were 0.87 and 0.92, respectively (Dongyan, 2000).

The present study is focused on both medication and lifestyle modification adherence. However, concerning the definition of adherence given by WHO and attributes of adherence given by Cohen (2009), all of the scales can not measure in some attributions of adherence such as mutual agreement of recommendations between patients and their health care provider. Thus, the Hypertensive Adherence Scale will be modified by adding items regarding agreement of recommendations including alignment of patient behavior and provider advice, mastery of new behavior

and health knowledge, ongoing collaborative relationship between the patient and health care provider, and their perceived ability to meet the outcome targets. It is also used to assess adherence to therapeutic regimens in this study.

Factors Related to Adherence to Therapeutic Regimens Among Persons with Hypertension

Factors believed to be related to adherence to therapeutic regimens in this study are based on the literature review focused on obvious relationships between these factors and adherence to therapeutic regimens. There are several factors having a relationship with adherence to therapeutic regimens including socio-economic factors, health system and health care team factors, condition-related factors, therapy-related factors, and patient-related factors. However, this study selected some modifiable factors into the hypothesized model. Factors influencing adherence to therapeutic regimens in several ways are described below:

Age

Age, a factor which is related to development and life experiences, affects the differences of understanding and perception in the health behavioral performance of each person. Increasing age also increases the ability to cope and manage the health problem. Children, who have limited ability to care for themselves, need care from their parents for performing the required behaviors. Adults, who are complete in physical, mental, emotional, and social development, have the ability to take care of themselves. Increased age also affects individuals' health behaviors. When

individuals have to adhere to regimens, an individual who is older is more likely to adhere to regimens than younger individuals. The finding from existing studies related to adherence to regimens in hypertensive patients found the relationship between age and medication adherence and lifestyle modification as follows:

Age and medication adherence. Hadi and Rostami-Gooran (2004) studied medication adherence in hypertensive patients in Shiraz, Iran. The result showed that medication adherence was better among patients who were older than 50 years. Moreover, age was a significant predictor of medication noncompliance (Hassan et al., 2006; Maguire, Hughes, & McElnay, 2008; Morris et al., 2006). Ross, Walker and MacLord (2004) who studied patient compliance in hypertension found that older patients were more likely to be compliant than younger patients (OR = 5.9, $p < 0.001$). Conversely, a previous study showed that there was no relationship between age and medication adherence (Naewbood, 2005; Phosena, 2003).

Age and lifestyle modifications. Limcharoen (2006) conducted a study to examine the factors related to adherence to treatment among 248 essential hypertensive patients. The results showed that age was significantly associated with adherence to lifestyle modification including dietary control, exercise and physical activity, avoiding risk factors, stress management and follow-up visits ($r = 0.258$, $p = 0.001$). Older patients were more likely to adhere to treatment than younger patients.

In conclusion, empirical evidences of the relationship between age and adherence to regimens in persons with hypertension are inconsistent: some findings showed that age was positively related to adherence to regimens, but a few results indicated that there was no relationship between age and adherence to regimens.

Gender

Gender is a biological factor that indicates the difference in the physiology, the role and the responsibility of persons of different sex in their society. Also, some health behaviors depend on gender such as smoking and drinking. Self-awareness related to self-care is greater in females than males because females are assigned the responsibility to take care for their family members but men are not.

Gender and medication adherence. Prior studies of factors related to medication adherence among persons with hypertension showed that gender was significantly negative related to adherence (r = -0.163, p < 0.05). It meant that women had better medication adherence than men (Naewbood, 2005). The study of Ross and colleague (2004) also found that women were more likely to be adherent than men (OR = 0.6, p = 0.015). However, some studies found that there was no relationship between gender and adherence among Thai people with hypertension (Limcharoen, 2006; Phosena, 2003).

Gender and lifestyle modifications. None of the studies showed the relationship between gender and lifestyle modifications.

In brief, the relationship between gender and adherence to regimens are inconsistent: most of studies found that age was associated with adherence to medication, but a few studies indicated that there were no relationship between gender and adherence to medication.

Income

This factor indicates the economic status that affects health behaviors. Persons who have high income have the ability to access to utility resources for promoting adherence to regimens such as having a better chance to select recommended food and find information for making decisions to adhere to regimens. Also, they have a chance to select the best service for their treatment such as physicians, and medicine since they have enough money to pay. On the other hand, persons who have a low income, find it extremely difficult to access to utility resources. Thus, persons who have high income have more ability for adhering to regimens than those who have low income.

Income and medication adherence. Uzun et al. (2009) who studied adherence to treatment and lifestyle change recommendations among hypertensive patients found that hypertensive patients who had lower income had better cumulative adherence (presence of three or more types of adherence) than those with high income (OR = 0.297, 95% CI = 0.13-0.66, $p < 0.001$). However, Naewbood (2005) who studied factors related to medication adherence among persons with hypertension found that there was no relationship between income and medication adherence in hypertensive patients.

Income and lifestyle modifications. Charoenkij (2000), who studied nutritional behaviors of 160 elders with primary hypertension, found that income had a positive relationship with nutritional behaviors ($r = 0.22$, $p = 0.001$). Uzun et al. (2009) found that income was a significant predictor of diet-related adherence among hypertensive patients (OR = 5.27, 95% CI = 2.38-11.63, $p = 0.001$). Patients who had

high income had a better adherence to diet than those with low income. Brooks et al. (2008) conducted a study to examine the predictive factors of adherence in patients with renal disease and hypertension. The results showed that no provision of an annual income was associated with a higher risk of nonadherence compared to those with incomes of $15,000 or higher ($p = 0.04$).

In general, the relationship between income and adherence to regimens among persons with hypertension are inconsistent. The findings indicated that persons who had high income were more likely to be adherent than those who had low income, but one study found that persons who had low income were likely to be adherent than those who had high income. One study also found that there was no relationship between income and adherence to regimens.

Educational Level

Different levels of education affect adherence. Because having a higher education results in improving cognition, knowledge, skill and attitude, all of which affect an individual's ability to acknowledge and understand the illness and treatment. Decision for adhering to regimens is also influenced by these factors.

Educational level and medication adherence. Years of schooling were positively associated with compliance among hypertensive patients ($r = 0.33$, $p = 0.04$), patients who had more years of schooling, had better compliance with their medical regimen (Saounatsou et al., 2001). In addition, hypertensive patients with less than 10th grade education were reported with more unintentional nonadherence than those with more than a 10th grade education (OR = 2.64, 95% CI = 1.59-4.37, $p \leq 0.001$) (Lowry, Dudley, Oddone, & Bosworth, 2005). Furthermore, educational

level is a predictor of medication adherence among persons with hypertension. Naewbood (2005) found that educational level explained 19% of variance in medication adherence (β = 0.138, p = 0.03). Patients with higher education were more likely to have better adherence.

Educational level and lifestyle modifications. Charoenkij (2000) also found that educational level had a positive correlation with nutritional behaviors among elderly with hypertension (r = 0.385, p = 0.001). Kyngas and Lahdenpera (1999) found that hypertensive patients, who had a high level of education, had good compliance with the restricted diet. Similarly, patients who had higher educational level were also better at exercise-related adherence (OR = 6.95, 95% CI = 2.93-16.48, $p < 0.001$) (Uzun et al., 2009).

In brief, educational level has a direct effect on medication adherence and lifestyle modifications among hypertensive patients.

Marital Status

Marital status is the primary social structure which influences individuals' health behavior. Married persons perform health behaviors, such as eating, exercise, coping with situations which are influenced by family members such as wife and husband. Also, married persons feel loved and cared for, and family members may encourage them to adhere to regimens by reminding them to take drugs, suggestions and supporting by providing something which they require such as money, food and time.

Marital status and medication adherence. Several studies found that marital status was one factor which related to adherence to treatment among

hypertensive patients. The result of the study of Morris et al. (2006) who studied factors associated with drug adherence in patients with hypertension found that being married was significant predictor of adherence (OR = 1.68, 95% CI = 1.05-2.69, p = 0.03). Also, Trivedi et al. (2008) found that patients who were married, was a significant predictor of medication adherence (OR = 1.66, 95% CI = 1.14-2.41, p < 0.01).

Marital status and lifestyle modifications. Being married was associated with better adherence to exercise recommendations (r = .10, p < 0.001) (Trivedi et al., 2008). Tantayothin (2003) studied factors influencing nutritional and exercise behaviors of hypertensive patients. The finding showed that marital status was associated with nutritional behaviors (r = -0.027, p < 0.001) and as the predictor of nutritional behaviors in hypertensive patients. It means that hypertensive patients who have wife or husband are more likely to participate in nutritional behaviors than those who are single, widowed, divorced, and separated.

In conclusion, marital status is associated with medication adherence and lifestyle modifications among hypertensive patients and also is a predictor of adherence to regimens.

Follow-Up Interval

Continuing treatment is an important factor for the physician, not only to evaluate treatment, but also to observe side effects of the drugs, and to assess the target organ for improving the treatment plan. Shorter follow-up intervals affects adherence to regimens. The physician can adjust the treatment plan for decreasing adverseness from the treatment. Patients find it difficult to adhere with regimens for

long periods. If the follow-up interval is a long period, changing the treatment plan for decreasing adverseness is too late. Patients who have an ongoing contact with the health care provider are able to maintain lifestyle change (Harris, Oelbaum, & Flomo, 2007).

Follow-up interval and medication adherence. Bardel et al. (2007) conducted a study to investigate adherence to prescription in the female population aged 35-65 years. They found that a check-up scheduled was a predicting factor of adherence (OR = 3.75, 95% CI = 2.97-4.73). An interval between visits to the physician of less than 3 months was a predictor of compliance (OR = 3.06, 95% CI = 1.42-6.63, p = 0.004). This meant that patients who visit physician within less than 3 months were more likely to comply with medication taking (Hadi & Rostami-Gooran, 2004).

Follow-up interval and lifestyle modifications. None of the studies showed a relationship between follow-up interval and lifestyle modifications.

In summary, the follow-up interval is related to only medication adherence among hypertensive patients. However, the relationship between the follow-up interval and lifestyle modifications needs investigating for confirming the relationship in Thai patients with hypertension.

Number of Illness

The number of illness refers to patients' health condition. Patients who have not only hypertension but also other illnesses such as hyperlipidimia, osteoarthritis, and hearth disease, suffer from the complexity of their treatment and

they have to adjust their behaviors and environment for controlling their illness and preventing complications.

Number of illness and medication adherence. Phosena (2003) studied the factors related to noncompliance in patients with hypertension and diabetes. The result, after controlling for covariant factors, showed that the major predicting factor of non-compliance in both group was comorbidities (OR = 1.82, 95% CI = 1.10-3.01). Conversely, the adherence score was higher in patients who had hypertensive complications (such as cardiovascular disease, a history of stroke or ischemic heart attack, heart failure, renal failure and retinal hemorrhanges) (p = 0.02) (Hadi & Rostami-Gooran, 2004). This meant that patients with hypertension who have comorbidity are better at medication adherence. Therefore, the relationship between number of illness and adherence to regimens has been found to be both positive and negative.

Number of illness and lifestyle modifications. None of the studies indicated a relationship between the number of illnesses and lifestyle modifications.

In brief, it is difficult to draw an accurate direction of the relationship between number of illness and adherence to regimens. The number of illness has been shown to be associated with only medication adherence among hypertensive patients.

Duration of Therapy

The duration of therapy refers to the period of time from the first treatment to the present. This factor affects adherence to regimens. Longer periods receiving hypertensive therapy increase patients' learning, information, and experiences to deal

with their disease. Thus, patients have capability to modify the recommended behavior into daily life.

Duration of therapy and medication adherence. Patients who took antihypertensive drugs for more than 5 years had a higher adherence score ($p < 0.05$) (Hadi & Rostami-Gooran, 2004). This means that patients with longer treatment are more likely to perform recommended behaviors. Increasing experience and learning to cope with their treatment are factors that affect patients' behavior to comply with the treatment plan.

Duration of therapy and lifestyle modifications. Nangyeam (2007) studied the determinants of eating behavior of 198 hypertensive patients. The results were the duration of therapy was significantly associated with and predicted the eating behavior in hypertensive patients ($r = 0.228$, $p < 0.01$; $\beta = 0.225$, $p < 0.01$, respectively). Also, a similar study found that the duration of therapy was positively associated with self-care behavior in hypertensive patients ($r = 0.199$, $p < 0.05$) (Onchim, 2002).

In summary, there is a relationship between the duration of therapy and adherence to regimens among hypertension patients.

Number of Pills Per Day

The complexity of managing multiple medications makes it difficult to follow the medication regimens (Wu, Moser, Lennie, & Burkhart, 2008). Increasing the number of pills per day may interrupt patients' daily life because they have to take many drugs as prescribed in several times to control their blood pressure.

Number of pills per day and medication adherence. Limcharoen who studied the factors related to adherence to treatment among essential hypertensive

patients found that numbers of pills per day had a negative relationship with medication adherence (r = -0.127, p = 0.046) (Limcharoen, 2006). Fung et al. (2007) also found that the participants with multidrug regimens were significantly less likely to be adherent to their full regimen than those on a 1-drug regimen (OR = 0.52, 95% CI = 0.50-0.54). Furthermore, by increasing the number of drugs in the regimen, patients were less likely to be adherent to the complete treatment regimen (Fung et al., 2007). This means that increasing number of pills decreases patients' medication adherence.

Number of pills per day and lifestyle modifications. None of the studies showed a relationship between the number of pills per day and lifestyle modifications.

In summary, the number of pills per day has a negative correlation with only medication adherence among hypertensive patients.

Number of Side Effects

The presence of side effects from antihypertensive drugs makes patients suffer from symptoms and interferes with their daily life. These affect patients' decisions to stop taking drugs or adjusting the dose of drug by themselves.

Number of side effects and medication adherence. Naewbood (2005) found that side effects of medication were significantly related to adherence to medication (r = -0.149, $p < 0.05$). It means that patients with fewer side effects were more likely to have better medication adherence. As well as that, the patients who reported ≥ 5 adverse effects from their antihypertensive medicine had more intentional nonadherence than those who reported □ 5 adverse effects (OR = 3.61, 95% CI = 1.85-7.04, $p \leq 0.001$) (Lowry et al., 2005).

Number of side effects and lifestyle modification. There was no study which indicated the relationship between number of side effects and lifestyle modifications among hypertensive patients.

In conclusion, the number of side effects from taking antihypertensive drugs is negatively associated with medication adherence among hypertensive patients.

Though there was a relationship between adherence to therapeutic regimens and previous factors, these factors are unable to be modified or changed by nursing role or nursing interventions. Thus, the five selected factors described below were gathered into the hypothesized model of adherence to therapeutic regimens because they are modifiable factors by nursing role and nursing intervention and show an obviously relationship between them.

Social Support

Social support is one of the important functions of a social relationship (Heaney & Israel, 2002). In addition, social support helps individuals in adopting themselves appropriately to various stimuli, resulting in good health. Social support may benefit health by buffering stress, influencing affective states, and/or changing behaviors (Cohen, 1988, as cited in DiMatteo, 2004). People with illness, whose ability to take care of themselves is limited, should receive assistance regarding health care such as health information in order to control illness, and to manage stress. The definitions of social support are described by many aspects. They are presented as follows.

Shumaker and Brownell (1984, as cited in Schaffer, 2004) defined social support as an exchange of resources that the provider or recipient perceives to enhance the recipient's well being.

Schaefer et al. (1981, as cited in Lohachiwa, 2005) described that social support provides mental assistance to a social member when the person is confronted with stress. They have proposed three types of social support, as follows:

1. *Emotional support* was defined as the attachment and reassurance of being loved and cared.

2. *Information support* was defined as the provision of information that a person can use for problem solving or feedback information in order to know about their behavior and performance.

3. *Tangible support* was defined as the receiving of direct aid, materials, and services.

House (1981, as cited in Heaney & Israel, 2002) defined social support as perceived and provided support and is the functional content of relationships. According to House (1981, as cited in Heaney & Israel, 2002), social support can be categorized into four types of supportive behavior or acts (Dalgard, 2008; Heaney & Israel, 2002).

1. *Emotional support* generally comes from family and close friends and is the most commonly recognized form of social support. Emotional support includes providing empathy, concern, love, trust, and caring. Emotional support will power the persons to cope with their suffering from illness and adherence to regimens.

2. *Instrumental support* is the most concrete direct form of social support. This support provides tangible aids and services that directly assist a person in need.

It can be in the form of money, time, in-kind assistance etc. Instrumental support makes it more convenient for persons with hypertension to adhere to regimens such as modifying environment for assisting individuals to perform required behaviors, helping for visiting their physician and receiving money for health care service fee.

3. *Information support* means providing advice, suggestions and information that persons use to respond to personal or situational demands. Information support increases the information related to hypertension and treatment to help persons decide what behaviors they need to perform, how to perform them and why they need to perform them for adherence to regimens.

4. *Appraisal support* is providing of information that is useful for self-evaluation purposes, in other words, constructive feedback, affirmation, and social comparison. This information is often evaluative and can come from family, friends, co-workers, or community sources. This support makes persons with hypertension know the outcomes from performing adherence to regimens. They can adjust their activities to achieve the target outcomes by receiving information feedback.

In this study, the researcher applied the social support concept of House (1981, as cited in Heaney & Israel, 2002), which describes that social support is perceived and provided support from other people including emotional, instrumental, informational, and appraisal support. The main concept covers all aspects of social support and correlates with the needs of persons with hypertension who require support in order to perform adherent behaviors for controlling their blood pressure. Persons who receive all four types of social support are more likely to adhere to regimens because they receive many beneficial resources to promote them for performing recommended behaviors.

Social Support and medication adherence. DiMatteo (2004) conducted a meta-analysis to examine the relationship between social support and patients' adherence to medical treatment in various chronic diseases including hypertension. This study found that practical support (instrumental support, assistance, reminders, organization, and support for a specific behavior) had the highest correlation with adherence. The standardized odds of adherence (compared with non adherence) were 3.60 times higher among those who received practical support than among those who did not. Emotional support and patient adherence with *r* effect sizes ranging from 0.00 to 0.37. The risk of nonadherence was 1.35 times in patients who did not receive emotional support compared with those who received emotional support. Naewbood (2005) examined the related factors with medication adherence in hypertensive patients; the result showed that a relationship between social support and medication adherence was significant ($r = 0.235$, $p < 0.01$). It means that persons with hypertension who receive better social support, are more likely to have a better medication adherence. Also, Morris et al. (2006) found that social support had predicted with a 1.02 time on adherence among hypertensive patients. (OR = 1.02, 95% CI = 1.01-1.03, $p = 0.002$).

Social Support and lifestyle modifications. Uzun et al. (2009) found that a hypertensive patient who was informed about hypertension and other cardiovascular risk factors was better at diet-related adherence. Also, Pongudom (2006) who studied self-care agency and social support among hypertensive patients found that social support was positively significantly related to self-care agency ($r = .32$, $p < .01$). Shead (2010) who studied the implementation of hypertension treatment recommendations among 151 hypertensive patients found that perceived instrumental

support (r = .30, p < .001) and perceived instrumental support (r = .22, p = .006) had significant positive correlations with a healthy diet.

According to the finding of Roh (2005) who studied modeling adherence to therapeutic regimens in patients with hypertension showed that social support was significantly directly associated with knowledge of hypertension. Receiving advice, suggestions and information induces patients' understanding about what behaviors they need to do, how to do them and why they need to have adherence behaviors. They are important for patients to decide for doing required activities.

There is no evidence which indicates the relationship between social support and perceived self-efficacy among persons with hypertension. The relationship between social support and perceived self-efficacy are presented in other chronic illness. For instance, the study of Khuwatsamrit (2006) who studied adherence to self-care requirements model among patients with coronary artery disease, the results showed that social support had a positive direct effect on perceived self-efficacy (ß = .41, p < .01) and a positive relation to adherence to self-care requirements (r = .24, p < .001). As well the study of Xu (2005) who studied self-management among Chinese adult patients with type 2 diabetes, using structural equation modeling analysis the findings found that self-efficacy mediated the association between social support and self-management. Also, a study on adherence to antiretroviral therapy found that effects of social support on adherence mediated by self-efficacy (Luszczynska, Sarkar, & Knoll, 2007). When patients receive social support including emotional, instrumental, information and appraisal support, they may increase their confidence in their own ability to perform adherence behaviors.

Because they perceive that they have many resources to facilitate them to perform recommended behaviors.

In conclusion, social support is related to adherence to regimens (medication and lifestyle changes) among hypertensive patients. Also social support is associated with hypertension-related knowledge and perceived self-efficacy. Although, several studies reported that social support related to or predicted adherence to regimens, such as medication taking, dietary modification, weight control, physical activity, alcohol intake limitation, and stress management, more studies are needed to investigate the relationship between social support, hypertension-related knowledge and perceived self-efficacy, especially in Thai persons with hypertension. The relationship between social support and other factors are proposed in the figure below.

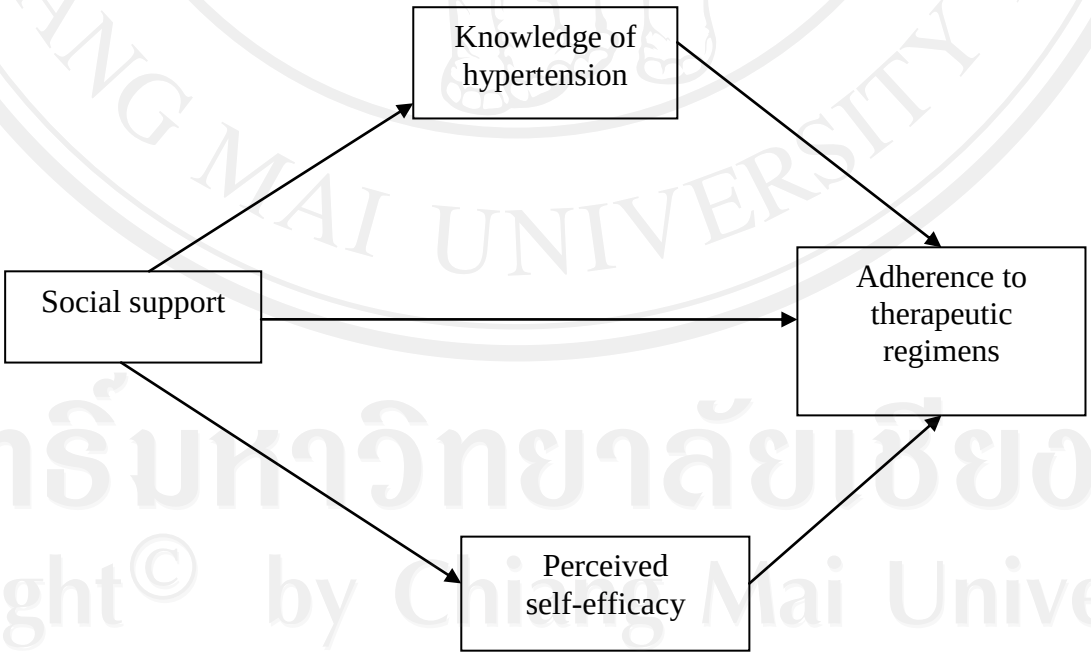

Figure 2-2. The proposed relationship between social support and related factors

Measuring social support. The scales which were used to measure social support among hypertensive patients in the previous studies are described as follows.

1. The Social Support Scale from the study of Naewbood (2005) was developed by Maneesriwongul et al. (2004, as cited in Naewnood, 2005). It is an interview questionnaire based on House's concept of social support. It measures three sources of social support: family members, friends, and health care providers. It is composed of 69 items based on four types of social support: emotional support (18 items), appraisal support (15 items), informational support (21 items), and instrumental support (15 items). A five-point Likert's scale ranges from "strongly agree", "agree", "not sure", "disagree" to "strongly disagree". Responses are scored for 5 to 1, respectively. Items which are negatively worded are reversed before data analysis. Possible scores on this scale range from a low of 69 to a high of 345. A higher score means better social support. A lower score indicates lower social support. According to Maneesriwongul et al. (2004, as cited in Naewnood, 2005), this scale was validated for its content validity by 3 experts and internal consistency coefficient was 0.94.

2. The Social Support Questionnaire which focused on House's concept of social support was developed by Pongudom (2006). It measures 4 subscales of social support including emotional, appraisal, informational and instrumental support. This scale consists of 17 items with a rating scale ranging from 1 (not at all true) to 4 (very true). The average of social support scores is classified level of social support into four categories: lowest (1.00-1.49), low (1.5-2.49), high (2.5-3.49) and highest (3.5-4.00). The content validity index was evaluated by three experts and its value was

0.87. Also, the internal consistency coefficient which was applied to 30 hypertensive patients was 0.96 (Pongudom, 2006).

3. The Received Social Support on Exercise Questionnaire focused on House's social support was developed by Kanthamalee (2007) for measuring social support for exercise among elderly with hypertension. This scale contains 14 items of a 4 rating scale ranging from 4 (mostly true) to 1 (not true). The range of total scores is 14 to 56 used to classify the level of social support into three categories as low (14-28), moderate (29-42), and high (43-56). The content validity index was .94 and internal consistency coefficient was 0.92 (Kanthamalee, 2007).

In summary, several reviews showed that social support based on House's concept has been widely used to assess social support among hypertensive patients. Social support also is an important factor for improving adherence to regimens and is able to be influenced by nursing intervention; therefore it was used as one factor influencing adherence to regimens among Thai persons with hypertension.

The Provider-patient Communication

Patients' communication with providers has been identified as an important factor influencing treatments in the hypertensive populations and is one part of the patient-provider relationship. It indicates trust, confidence, compassion, and help from health care providers. This will support the patient to improve adherence to treatment (Vermeire et al., 2001). Patient-provider communication has an important influence on patient health outcomes and patient health outcomes improve with good physician-patient communication (Ong, de Haes, Hoos, & Lammes, 1995). In general, there are two parts to face-to-face communication: the verbal expression of the sender's

thoughts and feelings, and nonverbal expression. Verbal communication sends the cognitive and affective messages through words, voice inflection and rate of speech. Nonverbal messages are sent by eye movements, facial expressions and body language (Riley, 2008). Additionally, the ultimate purpose of patient-provider communication is the provision of whole-person care which depends on what information is elicited, particularly its relation to care (Weiner, Barnet, Cheng, & Daaleman, 2005). Also, Ong and colleagues (Ong et al., 1995) who conducted a review of the literature regarding to doctor-patient communication described three purposes of communication including creating a good interpersonal relationship, exchanging information and making treatment-related decisions. Chamber-Evans et al. (1999, as cited in Summers, 2002) studied the communication style of nurses. They found that the content of the nurse-patient interaction was the main focus and had one process dimension, affective support. Content included health information, goal setting, and technical procedures. Also, content and relational components were considered as interpersonal communication between patients and health care providers. The content component carried the subject matter expressed in verbal language, whereas the relational component indicated how the health care providers and patients regarded each other and their relationship, and provided a framework for interpreting the content (Gallagher, Hartung, & Gregory, 2001).

The seven essential elements of provider-patient communication were presented in the Bayer-Fetzer conference on physician-patient communication in medical education (Gallagher et al. 2001). The essential elemental tasks included building the doctor-patient relationship, opening the discussion, gathering information, understanding the patient's perspective, sharing information, reaching

agreement on problems and plans, and providing closure. These were described as follows:

1. Building a relationship requires awareness that the ideas, feelings, and values of both the patients and the health care providers influence the relationship. It also concerns both the patient's disease and his or her illness experience. Further, this approach relates to the physician-patient relationship as a partnership, and respects patients' active participation in decision making.

2. Opening the discussion with the patients requires the health care providers to allow the patients to complete their opening statement, trying to elicit the patient's full set of concerns and establishing a personal connection.

3. Health care providers should gather information by using open-ended and closed-ended questions appropriately to assess understanding and perception regarding the illness of the patients. Also, structural, clarifying, and summarizing information are needed for collecting information from the patients. Active listening, both nonverbal and verbal techniques are applied appropriately.

4. For understanding the patients' perspective, it is useful for health care providers to know how the patients perceive their illness and the treatments. Exploring contextual factors (family, culture, gender, age socioeconomic status, spirituality), beliefs, concerns, and expectations about health and illness should be assessed to understand the patients' perceptions. Also, health care providers should acknowledge and respond to the patients' ideas, feelings and values.

5. Health care providers should use language which the patients can understand, avoid technical terms, check for understanding and encourage the patient to share information by asking questions.

6. Communication between providers and patients is needed to reach agreement on patients' problems and treatment plans. To encourage the patients to participate in decision making to the extent that they desire, check the patients' willingness and their ability to follow the plans, and provide the resources and support are the tasks which providers need to do.

7. The last communication element tasks between patients and health care providers is to provide closure by asking whether the patients have other issues or concerns, summarizing and affirming agreement with the plans of action and discussing the next visit.

These essential elements of communication are needed for health care providers to understand persons with hypertension regarding actual needs for controlling blood pressure and to provide health information which is suitable for each patient based on his or her problems. Encouraging patients to share information and to participate in decision making with treatment plans will also improve adherence to regimens.

Provider-patient communication and medication adherence. A previous study on provider communication affecting medication adherence in hypertensive African Americans found that the providers' communication rated by patients to be more collaborative was significantly associated with better medication adherence (r = -.15, p = .003) and patients who rated their providers' communication to be more collaborative were significantly more likely to report better medication adherence than patients who rated their providers' communication as non-collaborative (β = -.11, p = 0.03) (Schoenthaler et al., 2009).

Provider-patient communication and lifestyle modifications. There was no study which indicated a relationship between provider-patient communication and lifestyle modifications among persons with hypertension but a relationship was found in other chronic illness. According to the study of Xu (2005) who studied the factors influencing diabetes self-management in Chinese with type 2 diabetes, the results demonstrated that provider-patient communication was an important factor affecting diabetes self-management (diet, exercise, medication, glucose testing, and foot care).

According to the study of Roh (2005), who developed a model of adherence to therapeutic regimens in patients with hypertension, the finding showed that provider-patient relationship measured the perceived quality of the information and affective behaviors of the provider and the patient's perceived ability to initiate communication about an illness had a positive direct effect on self-efficacy and positive indirect effect on adherence to regimens. The study revealed the relationship between provider-patient communication and knowledge was not found in the study among persons with hypertension, but it was found in a study among type 2 diabetes patients. The results of the study of Xu (2005) demonstrated that provider-patient communication had a direct positive effect on self-efficacy and knowledge in type 2 diabetes.

As described above, exchanging information between patients and health care providers is one purpose of communication. Exchanging information from health care providers to patients provide advice and suggestions for controlling blood pressure. It also contributes to patients' understanding of their illness condition and treatment plan. Additionally, exchanging information between patients and health care providers induces patients' confidence to share their problems or health care

needs with their health care providers. In this case, health care providers can also give direct advice or recommendations which fit with needs or problems of patients. Thus, provider-patient communication is related to knowledge of hypertension and self-efficacy among hypertensive patients.

In summary, various studies show that provider-patient communication is associated with adherence to therapeutic regimens, though fewer studies show a relationship between provider-patient communication and lifestyle modifications. However, one study in Thailand showed that there was no statistically significant relationship between provider-patient communication and adherence to medication and lifestyle modifications among hypertensive patients. This study assessed provider-patient communication as one aspect of service of healthcare provider (Limcharoen, 2006). Thus, the proposed relationships between provider-patient communications and related factors are shown in the figure below.

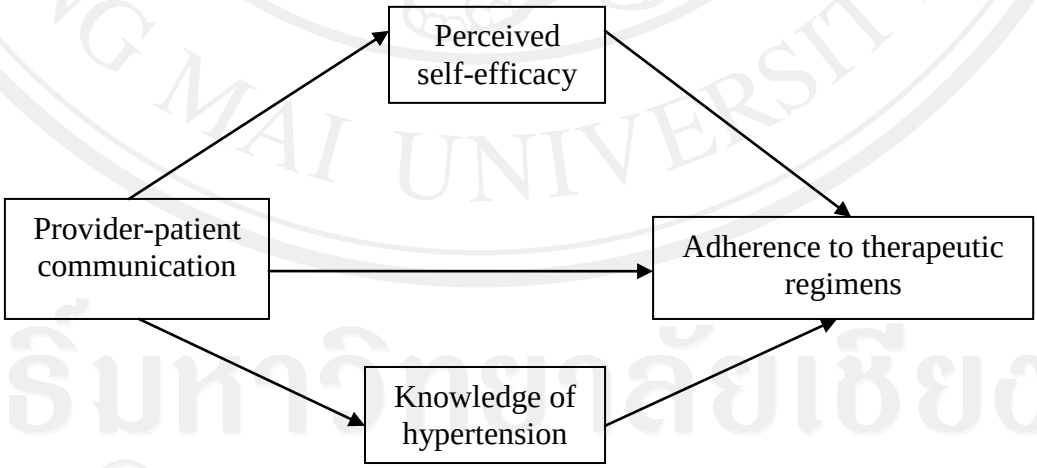

Figure 2-3. The proposed relationship between provider-patient communication and related factors

Measuring the provider-patient communication. The Follow-up Communication Scale developed by Bultman and Svarstad (2000, as cited in Schoenthaler et al., 2009), assessed patients' perception of the quality of their physicians' communication and the extent to which the physician encouraged patient participation in the treatment process. There are 13 items. Responses to the first eleven questions are based on Likert-type scale. The responses to question 1 to 11 are scored as 1= not at all to 4 = very much. The last two items require categorical (yes/no) responses and score as 0 = no or 1 = yes. All of the 13 items are converted into a Z-score and then summed as a continuous measure to create a composite score. The internal consistency reliability was 0 .92. Because of the negative skewed distribution of the range of responses, reverse scoring and transforming the data were performed. As the result, the lower scores indicated a more collaborative communication (Schoenthaler et al., 2009).

The Provider-patient Communication Scale developed by Xu (2005) who modified by taking from 2 scales including the communication subscale of the Interpersonal Processes of Care (IPC) (Stewart et al., 1999) and the doctor support subscale of the Chronic Illness Resources Survey (CIRS) (Glasgow et al., 2000, as cited in Xu, 2005). This instrument consists of 7 items which assesses the patients' perception of provider's communication regarding talking clearly, explaining medical care and responding to patients' concern. It is a 5-point Likert scale from 1 (not at all) to 5 (a great deal) and the sum score ranged from 7 to 35. Higher scores indicate better patient-provider communication. The content validity index (CVI) was higher than .80 for both representativeness and clarity. The reliability evaluated by 30 participants was .74.

The Provider-patient Communication Scale of Xu (2005) was used to assess the patient-provider communication in this study because its validity and reliability were acceptable. It was translated into Thai language.

In summary, a few studies show that provider-patient communication is an important factor for improving adherence to therapeutic regimens and making nursing intervention more likely. There is a shortage of studies examining the relationship between provider-patient communication and adherence to therapeutic regimens among patients with hypertension. Therefore provider-patient communication will be used as one factor to predict adherence to therapeutic regimens in this study.

Knowledge of Hypertension

Knowledge is one component of behavior derived from the cognition process by learning from many resources and then accumulating in terms of understanding, perception, skills, and experiences (Bandura, 1997). This factor increases patients' understanding about hypertension and treatment plan which affect the patient's judgment to adhere to regimens.

Knowledge of hypertension and medication adherence. Most studies found that knowledge about hypertension was significantly associated with adherence. For instance, Karaeren et al. (2009) studied the effect of the content of knowledge on adherence to medication in 227 hypertensive patients. The finding was that patients' knowledge about hypertension and medications was associated with adherence rates. Among the knowledge variables, knowing the duration of use of the medicine (OR = 6.82, 95% CI = 1.47-31.24, p = 0.075), the reason of use of medicine (OR = 2.82, 95% CI = 1.44-5.54, p = 0.01), the cause of hypertension (OR = 3.44, 95% CI = 1.88-

6.29, $p = 0.03$), and the target level of blood pressure (OR = 12.85, 95% CI = 5.04-32.64, $p < 0.001$) were significantly influenced on adherence rates. A lower level of hypertension knowledge was significantly predicted nonadherence (OR = 0.89, 95% CI = 0.79-0.99, $p < 0.05$) (Kim et al., 2007). Limcharoen (2006) who also studied Thai hypertensive patients reported that knowledge of hypertension was significantly related to medication adherence (r = .185, $p = .001$). As well, Naewbood (2005) found that knowledge of hypertension and medication use was significantly related to medication adherence (r = 0.422, $p < 0.01$), also this factor could explain 17.8% of variance in medication adherence ($\beta = 0.433$, $p < 0.001$). It means that better knowledge of hypertension and medication used leads to better medication adherence.

Knowledge of hypertension and lifestyle modifications. Being informed about the prescribed antihypertensive medicines was independently related to diet-related adherence (OR = 14.47, 95% CI = 5.02-41.41, $p = 0.002$), patients who received information were more likely to follow better adhere than those who did not (Uzun et al., 2009). A similar study also showed that knowledge of hypertension was associated with adherence to lifestyle modification ($r = 0.203$, $p = 0.001$) (Limcharoen, 2006). Knowledge of hypertensive diet was related to and as the predictor of the eating behavior among hypertensive patients ($r = 0.368$, $p < 0.01$; $\beta = 0.196$, $p < 0.05$, respectivly) (Nangyaem, 2007).

To control blood pressure to optimal levels, patients have to understand the need for taking medications, lifestyle modifications and how to adjust the regimens according to their illness condition and daily activity. Therefore, the relationship between knowledge of hypertension and adherence to therapeutic regimens is that increased knowledge of hypertension is related to improved adherence to regimens.

A relationship between knowledge and perceived self-efficacy was not found in the study among persons with hypertension, but it was found in a study among persons with type 2 diabetes. According to Xu (2005) who studied self-management (diet, exercise, medication, glucose testing, and foot care) in type 2 diabetes in Chinese reported that knowledge was positively significantly associated with self-efficacy. Also, the final model of this study showed that knowledge had a positive direct effect on self-efficacy and a positive indirect effect on self-management.

Perceived self-efficacy is the bridge between knowing what to do and actually doing it (Bandura, 1997). Patients who know what behaviors are needed to be performed, how to perform them and why they need to be performed, may perceive their own ability to do the required behaviors. Again, patients who know their illness condition and the treatment plan will increase their confidence to do the required behaviors.

In summary, knowledge of hypertension is one individual factor that affects adherence to regimens both medication and lifestyle modifications. Additionally, knowledge of hypertension is positively associated with perceived self-efficacy in patients with hypertension. The proposed relationship between knowledge of hypertension and related factors are shown in the figure 2.4.

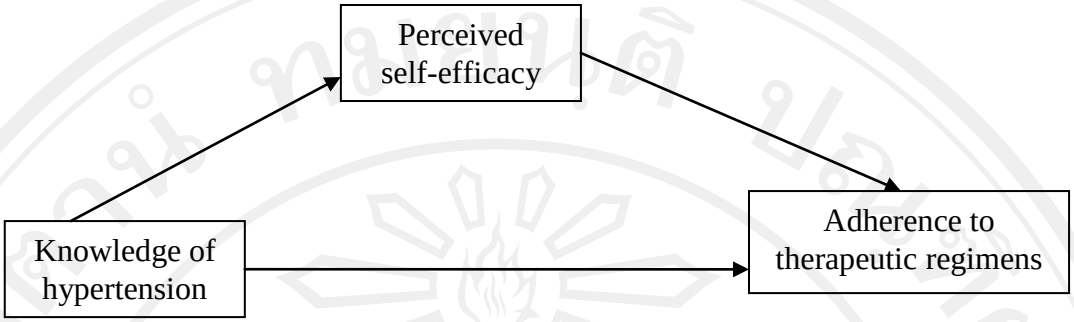

Figure 2-4. The proposed relationship between knowledge of hypertension and related factors

Measuring knowledge about hypertension. The scale to measure knowledge about hypertension among hypertensive patients are described as follows.

1. The Knowledge of Hypertension and Medication Used Scale was developed by Maneesriwonggul et al. (2004, cited in Naewbood, 2005). It measured the knowledge of hypertension and medication used by means of an interview questionnaire that consists of 26 items to measure knowledge of hypertension (6 items) and knowledge about medication use and side effects (20 items). The response of each item is yes, no or don't know. A correct response is given a score of one while an incorrect response and don't know are given a score of zero. Possible scores on this scale ranged from 0 to 26. A higher score meant better knowledge about hypertension and medication used. This instrument was tested for content validity by 3 experts in caring of hypertension in the previous study of Maneesriwongul et al. (2004, as cited in Naewbood, 2005). Internal consistency reliability was tested and its value was reported at .74.

2. The Knowledge of Hypertension Questionnaire measuring knowledge about hypertension was developed by Limcharoen (2006). There are 45 items which

were divided into 6 domains related to knowledge including cause of hypertension, symptoms and complications, lifestyle modifications, action of antihypertensive drugs, taking medication and side effects from antihypertensive drugs. A response of each item is yes, no and don't know. A score of 1 is given a yes response whereas a score of zero is given a no response and don't know. An average of scores is used to indicate level of knowledge about hypertension. A score of ≥ 80% indicates a high level of knowledge about hypertension while low level of knowledge is a score of < 80%. The content validity index (CVI) of this questionnaire was tested by 5 experts and its value was 0.89. Also, reliability was applied to 30 hypertensive patients and its value was 0.84 (Limcharoen, 2006).

In summary, empirical evidence indicates that knowledge of hypertension is associated with adherence to regimens of both medication and lifestyle modifications. This factor also can be improved by nursing intervention to improve adherence to therapeutic regimens, therefore it will be used as one of the factors influencing adherence to therapeutic regimens in this study. The knowledge of the hypertension scale of this study was modified from the questionnaire developed by Limcharoen (2006). The contents for measuring knowledge about hypertension focused on cause, symptoms and complications, medication use and behavioral modifications to control blood pressure (dietary, physical exercise, weight control, alcohol consumption, stress management and follow-up visit).

Health Belief

Belief refers to an individual's subjective probability decisions concerning some distinguishable aspect of his/her world. Patients' beliefs about their disease and its treatment have been proposed to be central to adherence (Meichenbaum & Turk, 1987, as cited in DiMatteo et al., 2007). The Health Belief Model (HBM) is the most commonly used theory in health behaviors and has been used both to explain change and maintain health-related behaviors (Janz, Champion, & Strecher, 2002). The Health Belief Model proposes that people will actively prevent, screen for, or control disease conditions if they are concerned that they are susceptible to the condition, if they believe it could have potentially serious consequences, and if they believe that the benefits of performing behavior outweigh their imagined barriers to performing that behavior (Janz et al., 2002). According to the theoretical constructs of the Health Belief Model, there are four main perceptions of the model that influence personal perceptions about their illness (Janz et al., 2002; Munro, Lewin, Swart, & Volmink, 2007). Moreover, other constructs have been added to the Health Belief Model, including cues to action, modifying factors and self-efficacy (Janz et al., 2002). These constructs are explained as follows.

1. Perceived severity of disease: perceived severity is an individual's belief about the seriousness or severity of a disease. This perception is based on medical information or knowledge, it may also come from beliefs a person has about the difficulties a disease would create or the effect it would have on his or her life. It refers to the person's subjective rather than objective estimate of how serious the illness may be. Patients with hypertension could be concerned with the disease that

could lead to their death, or induce complex complications, and suffer in their daily life such as in their job, family and social relationship. If they perceived the severity of hypertension, they may perform recommended behaviors in order to control their disease and prevent complications of the disease.

2. Perceived susceptibility of risk for disease: perceived susceptibility is one of the more powerful perceptions in prompting people to alter behaviors to become healthier. It refers to a person's subjective perception of the risk of contacting a health condition. When people believe they are at risk for a disease, they will be more likely to take action to prevent it from occurring. Among people who have hypertension, this perception refers to patients' perception of the risk of complications of uncontrolled blood pressure and risk of cardiovascular disease. If they perceive that they are at risk for uncontrolled blood pressure and that it could induce cardiovascular disease, stroke and renal failure, they will do activities for controlling their blood pressure and preventing complications. Perceived threat is the result when the perception of susceptibility is combined with severity. People, whose perception of threat is high, are more likely to comply with the recommended behaviors, while those whose perception is low are likely to ignore them.

3. Perceived benefits of performing behaviors: perceived benefits are a person's opinion of the value or usefulness of a new behavior in decreasing the risk of developing a disease. People tend to alter to healthier behavior when they believe the new behavior will decrease their chance of developing a disease. People, who perceive a profit to perform adherent behaviors, are more likely to act those behaviors or seek a way to prevent and control the disease. Thus, the making of the decision of

hypertensive patients for performing adherent behaviors will be based on patients' perception of the benefits of the adherent actions.

4. Perceived barriers of performing behaviors: perceived barriers are an individual's own evaluation of obstacles to change to a new behavior. Perceived barriers in hypertensive patients refer to patients' belief about barriers to impede adherent behaviors to control their blood pressure. Unlike perceived benefits, persons who perceive the troublesome problems to act the required behaviors such as the complexity of taking pills, inconvenience to visit the physician, and interference with daily life from treatment or required behaviors are more likely to neglect to perform recommended behaviors. Thus, to help them to adhere to treatments, the barriers could be assessed and eliminated in order to help the patients to control their optimal blood pressure.

5. Cues to Action: cues to action are events, people, or things that move people to change their behaviors. Examples include media reports, mass media campaigns, advice from others (Janz et al., 2002). In the HBM, cues to action influence the likelihood of behavior via a perceived threat. Cues to action increase the perception of a threat by giving more information and increasing their awareness related to the disease.

6. Modifying factors: modifying factors do not have a direct effect on health behavior; however they are fundamental factors that influence personal perceptions. Modifying factors include demographic factors (age, gender, educational level, and marital status), psychological factors (reference group, norm and culture) and fundamental factors (knowledge, skill, past experience and motivation) factors.

7. Self-efficacy: self-efficacy is the last construct which is added in the model. It is the belief in a person's ability to do specific behaviors. Persons generally do not try to do a new behavior unless they think they have the ability to do it. The explanation of self-efficacy will be presented separately as one of the factors affecting adherence to regimens.

Health belief and medication adherence. Hypertensive patients will adhere to regimens if they perceive susceptibility, severity, benefits and barriers in order to control their blood pressure to optimal level for preventing severe complications. From the literature reviewed, several studies showed that four components in HBM and adherence were significantly related. Sowapak, Taboonpong, and Chailungka (2006) studied factors related to drug adherence among elders with hypertension. The findings demonstrated that the elders with a low level of perceived severity of illness and risk of complication and low level of perceived benefits were 2.25 and 3.25 times more likely to have nonadhrence to drug regimens compared with those having a higher level of both. Perceived barriers were only one significant predictor of medication taking behavior of hypertensive patients (Wungthanakorn, Phatidumrongkul, & Khomchan, 2008). Particularly, DiMatteo et al. (2007) conducted a meta-analysis study about relationship between health belief and patient adherence. This finding indicated that adherence was significantly positively correlated with patients' beliefs in the severity of the disease to be prevented or treated. A greater perceived disease severity threat was associated with better adherence.

Health belief and lifestyle modifications. Nangyaem (2007) studied factors related to eating behavior of 198 hypertensive patients at Nongchang hospital.

The results showed that perceived susceptibility (r = 0.372, p < 0.01), perceived severity (r = 0.271, p < 0.01), perceived benefits (r = 0.399, p < 0.01), and perceived barriers (r = -0.175, p < 0.01) were significantly related to eating behaviors. Also, perceived benefits (β = 0.425, p < 0.001), perceived barriers (β = -0.139, p < 0.05) and perceived severity (β = -0.218, p < 0.05) were predicting factors of eating behavior. Riounin (2007) studied the relationship between health belief and disease control behavior (dietary control, exercise, medication taking, stress management and follow-up visit) among persons with hypertension. The results showed that health belief was associated with dietary control (r = 0.34, p < 0.05), exercise (r = 0.334, p < 0.05), medication taking (r = 0.309, p < 0.05), stress management (r = 0.341, p < 0.05) and follow-up visit (r = 0.270, p < 0.05). Also, in an exercise study in hypertensive patients it was found that perceived benefits and perceived barriers were predicting factors of exercise behavior (Tantayothin, 2003). From the study of Metha (2001) who studied relationship between health beliefs and food consumption behavior of hypertensive patients, the result indicated that perceived severity was positively associated with food consumption behavior (r = 0.310, p < 0.05).

In conclusion, most of the empirical evidence indicated that health belief was associated with adherence to therapeutic regimens for both medication and lifestyle modification. Health belief can be modified by giving information to increase patients' perception regarding perceived susceptibility of risk for complications of hypertension, perceived severity of hypertension, perceived benefits of performing recommended behaviors, and perceived barriers of performing recommended behaviors among hypertensive patients. Thus, health belief was used

as one factor affecting adherence to therapeutic regimens among persons with hypertension.

Measuring health belief. Health belief is applied to the theoretical framework of many researches in many populations such as hypertensive patients. There are many scales which have been developed to measure health belief among hypertensive patients. These scales are described as follows:

1. The Health Belief Scale modified by Reunchan (1992) from the Health Belief Scale developed by Bikaew (1985, as cited in Reunchan, 1992) to measure the 6 constructs of the Health Belief Model including general health motivation, perceived susceptibility, perceived severity, perceived benefit, perceived barrier and modifying factors. This scale consists of 35 items with a 6-point rating scale, ranging from 1 (mostly disagree) to 6 (mostly disagree). The inverse score is used when the item has a negative wording. The possible total score of this scale is 35-210. The interpretation of the score is not presented. The content validity of the scale was evaluated by 12 experts and before applying to evaluate reliability it was revised by following with the suggestions of the experts. The reliability of the scale which was examined by applying to 20 hypertensive patients was 0.82.

2. The Health Belief of Persons with Hypertension Questionnaire modified by Auttama (2006) from the Health Belief Scale which was developed by Reunchan (1992). Four constructs, including perceived susceptibility of complications (8 items), perceived severity of complications (6 items), perceived benefits of performing appropriate behavior (5 items) and perceived barriers of performing appropriate behavior (11 items) are applied to measure health belief among hypertensive patients. The answer of each item is coded on a 4-point scale ranging

from 1 = mostly disagree, 2 = disagree, 3 = agree, and 4 = mostly agree for positively worded items, while given opposite coding for the negatively worded items. The total score of the scale is divided into three levels including high (90.01-120.00), moderate (60.01-90.00), and low (30.00-60.00). The content validity was tested by three experts, then the content validity index (CVI) was evaluated and its value was 0.87. This scale was tested with 10 hypertensive patients who have the same characteristics with the sample for testing internal consistency. Chronbach's coefficient alpha of the scale was 0.88.

3. The Health Belief Questionnaire developed by Riounin (2007) is based on Becker's Health Belief Model. It measures four constructs of the model. The 24 items with a 3-point rating scale contain 7 items of perceived susceptibility to induce complications, 5 items of perceived severity of complications, 7 items of perceived benefits to perform disease control behavior, and 5 items of perceived barriers to perform disease control behavior. Each item with positive wording is coded on 3 rating ranging from 1 (not agree), 2 (not sure), and 3 (agree). But items with negative wording are coded ranging from 1 (agree), 2 (not sure), and 3 (not agree). An average of the score is assigned to 3 categories including high (2.00-3.00), moderate (1.00-1.99), and low (0.01-0.99). The content validity was tested by three experts, then the content validity index (CVI) was evaluated and its value was 0.89. This scale was tested with 30 hypertensive patients who had the same characteristics with the sample for testing internal consistency. Chronbach's coefficient alpha of the scale was 0.81.

All of the presented scales can be applied to measure health belief among hypertensive patients. This study modified the health belief questionnaire which was developed by Riounin (2007), because this scale measures the same construct of

health belief concept, in the same population and the internal consistency coefficient testing is acceptable.

Perceived Self-efficacy

Self-efficacy theory refers to an individual's confidence in his or her ability to perform a specific behavior. Self-efficacy theory was developed from social cognitive theory by Albert Bandura (1997, as cited in Lenz & Shortidge-Baggett, 2002). Social cognitive theory favors a conception of interaction based on triadic reciprocity among person, environment and behavior. Occurring and changing behavior of persons are influenced not only by environmental factors but also personal factors. The interaction of three factors is operated as determinants of each other. Reciprocity is not influenced equally in determination and the influence of the three factors has not occurred simultaneously (Resnick, 2004). There are times when environmental factors may be the driving force in behavior, and other times when the individual's behavior and its intrinsic feedback are the central factors in determining behavior (Resnick, 2004). Two concepts which are used to describe and predict personal behaviors by Bandura are efficacy expectations and outcome expectation (Bandura, 1997).

Efficacy expectation or perceived self-efficacy. Efficacy expectation or perceived self-efficacy is the personal belief or confidence that an individual is able to perform behavior to achieve a goal. Before individuals will initiate a new behavior, they evaluate information about their ability to perform the behavior. People who perceive high self-efficacy will activate sufficient intention to begin new behaviors.

Self-efficacy of individuals varies on three dimensions that have important performance implications (Bandura, 1997). Firstly, level is described as how difficult or simple tasks are to perform behaviors. When individuals perceive that behaviors or tasks are easy to act, they will perceive high self-efficacy. The range of perceived capability for a given person is measured against levels of task demands that represent varying degrees of challenge or barrier to achieve desirable behavior. Secondly, generality refers to successful experience of an individual in one situation which generates one's confidence to perform behavior in similar situation, including the degree of similarity of activity, the modalities in which capabilities are expressed (behavioral, cognitive, affective), qualitative features of situations, and the characteristics of persons. People, who have the ability to perform a required behavior in one situation and refer experience to similar situations, will perceive high self-efficacy. Conversely, people who can not refer experience to another situation have a low self-efficacy. Lastly, efficacy beliefs may differ in strength. The strength refers to personal judgment of confidence to perform a specific task or behavior. Individuals, who have confidence in their ability to perform behaviors, will make the effort to achieve the behavior or activity even if the behavior or activity is complex. In conclusion, people who strongly perceived self-efficacy are more likely perform to successfully.

Outcome expectation. Outcome expectation is the personal judgment of the consequences of performing a specific behavior. Physical, social and self-evaluative effects are three major forms of outcome expectations (Bandura, 1997). Each form has both positive and negative outcomes. Positive expectations serve as incentives, the negative ones are disincentives. For example, positive physical effects

include pleasant sensory experiences and physical pleasures, whereas negative effects are aversive sensory experiences, pain, and physical discomfort. Secondly, social positive outcomes include expression of interest, approval, social recognition, monetary compensation, and conferral of status and power; on the negative side include disinterest, disapproval, social rejection, censure, deprivation of privileges, and imposed penalties. Lastly, on the positive side of self-evaluative outcomes include self-satisfaction, sense of pride and self-worth, on the negative side include self-dissatisfaction, self-devaluation, and self-censure. When an individual perceives the positive outcome expectations of performing a behavior, one is more likely to act the desired behavior than one who perceives the negative side.

The relationship between perceived self-efficacy and outcome expectations affects personal judgments. People who perceive a high level for both self-efficacy and outcome expectation have the desire to perform the behavior, and try to be successful. But people who have low perceived self-efficacy and a high or low level of outcome expectation tend to certainly reject to perform the required behavior.

Sources of Self-efficacy. Self-efficacy beliefs are constructed from four principal sources of information: enactive mastery experiences or performance accomplishments, vicarious experience, verbal persuasion and physiological and affective states arousal (Bandura, 1997).

1. Enactive mastery experiences or performance accomplishments. This is the most influential source of perceived self-efficacy because it is the direct experience of accomplishment. A success induces a strong belief in one's personal efficacy. People who accomplish repeatedly in performances will increase their perceived self-efficacy. Because successful performance depends upon, among other

factors, their preconceptions of their capabilities, the perceived difficulty of the tasks, the amount of effort they expend, the amount of external aid they receive, the circumstances under which they perform, the temporal pattern of their successes and failures, and the way these enactive experiences are cognitively organized and reconstructed in memory (Bandura, 1997).

2. Vicarious experience is seeing others perform successfully in similar situations. Successful performance by others serves as a role model and supplies information to people to increase their ability to act appropriately in the relevant situation and also it occurs by observation. A role model will stimulate a person to try to perform activities if the role model shares common attributes with him or her, such as having the same age, sex, and illness condition. Observing others is a weaker source of self-efficacy than direct experience, but can contribute to a person's judgment of his or her own self-efficacy (Lenz & Shortridge-Baggett, 2002). Self-modeling and symbolic-modeling are two methods to improve self-efficacy (Bandura, 1997).

3. Verbal persuasion is the most often used source of self-efficacy. Giving instructions, suggestions and advice by others who have credibility, expertise, and trustworthiness, such as parents and closed friends, are used to convince people to have the ability and make the effort to perform the needed behavior. Verbal persuasion affects performance in the short term, and should be combined with performance accomplishments to increase efficacy belief.

4. Physiological and affective states are the last source of self-efficacy, which persons use to evaluate their ability to act a specific behavior. For judging their own abilities, persons use information about their physiological and emotional

situations. Persons tend to perceive psychological and/or emotional stimulation as signs of personal deficiency such as pain, discomfort, tension, and anxiety. Since an increase of these signs may interrupt their activities, persons may perceive low efficacy and less intention to perform behavior.

Bandura (1997) suggested that efficacy belief which affected an individual's behavior was produced through four processes, including cognitive, motivational, affective and selective processes. *Cognitive process* generates personal behavior by organizing their thought whose function is to enable people to predict events and develop ways to control that event. *Motivational process* is the process in which people motivate themselves and guide their activities. Motivations are led by perceived self-efficacy and outcome expectation to make a plan to reach a target goal. People who have high self-efficacy will motivate themselves and link their behaviors in a positive way. *Affective process* is the process in which people evaluate their ability to control the situation. People, who believe that they are able to control the situation, will increase their confidence to perform the required behaviors. On the other hand people who don't have confidence to control their situation will perceive dangers all around them and success is then beyond their ability. *Selective process* is described as choices which people select from their environment are influenced by belief of personal efficacy. People will avoid some situations and activities that they believe are beyond their ability but they are ready to face the challenge of activities that they have selected after consideration. The social influences operating in selected environments continue to promote competence, value judgment and interest as long as they make an effective decision.

Self-efficacy theory concerns the confidence of an individual's capability to produce a specific behavior. People, who have high perceived self-efficacy and high outcome expectation, are likely to perform a specific behavior. In contrast, people who have low perceived self-efficacy and high or low outcome expectation are not likely to perform the behavior. Also, there are four sources of information to develop self-efficacy, including enactive mastery experiences or performance accomplishments, vicarious experience, verbal persuasion and psychological arousal. Thus, self-efficacy is positively associated with adherence to regimens among hypertensive patients.

Perceived self-efficacy and medication adherence. The finding from many researches supported that self-efficacy was associated with and also predicted adherence to regimens in hypertensive patients. Dongyan (2000) studied self-efficacy and compliance with medical regimens among hypertensive patients and found that there was a strong positive relationship between self-efficacy and compliance ($r = 0.802$, $p < 0.01$). Additionally, self-efficacy was associated with better adherence (OR = 1.41, 95% CI = 1.20-1.67, $p < .001$) (Kressin et al., 2007).

Perceived self-efficacy and lifestyle modifications. Perceived self-efficacy had a positive association with the nutritional behavior of the elderly with primary hypertension ($r = 0.417$, $p < 0.01$) and could predict the nutritional behavior by 17.4 percent (Charoenkij, 2000). Furthermore, Charoenkitharn (2000) who studied perceived self-efficacy and exercise behavior in the elderly with essential hypertension found that perceived self-efficacy could predict the exercise behavior by 49%. Tantayothin (2003) who studied factors influencing nutritional and exercise behaviors of hypertensive patients also found that perceived self-efficacy was

positively associated with nutritional behaviors ($r = 0.53$, $p < 0.01$) and it had the highest predictive power of 36.9%. Moreover, perceived self-efficacy was positively associated with exercise behaviors ($r = 0.42$, $p < 0.01$) and it had the predictive power of 33.8%. Perceived self-efficacy also was a strong predictor to adherence among Korean with hypertension (Roh, 2005).

Perceived self-efficacy is a mediating factor between adherence to therapeutic regimens and social support, knowledge of hypertension and provider-patient communication. Roh (2005) who developed modeling adherence to therapeutic regimens in patients with hypertension reported that perceived self-efficacy was the strongest factor influencing patient adherence. Perceived self-efficacy also was a mediator between adherence to regimens and provider-patient relationship. In other chronic illnesses, a study in type 2 diabetes reported that perceived self-efficacy had a positive direct effect on self-management which was defined as a set of behaviors that patients with diabetes perform daily to achieve diabetes control (regulating diet, engaging in exercise, taking medications, self-monitoring blood glucose levels, and maintaining foot care), and perceived self-efficacy was a mediator between self-management and provider-patient communication, social support, and knowledge (Xu, 2005).

All of the studies of self-efficacy showed the same finding that perceived self-efficacy is a powerful factor influencing adherence to therapeutic regimens. They indicated that patients who had a high perceived self-efficacy had better health outcomes, including adherence to regimens. Also, knowledge of hypertension, social support and provider-patient communication are associated with perceived self-efficacy among persons with hypertension. Thus, perceived self-efficacy may a

mediator between adherence to therapeutic regimens and related factors among persons with hypertension. The proposed relationships between perceived self-efficacy and related factors in this study are illustrated as figure 2-5.

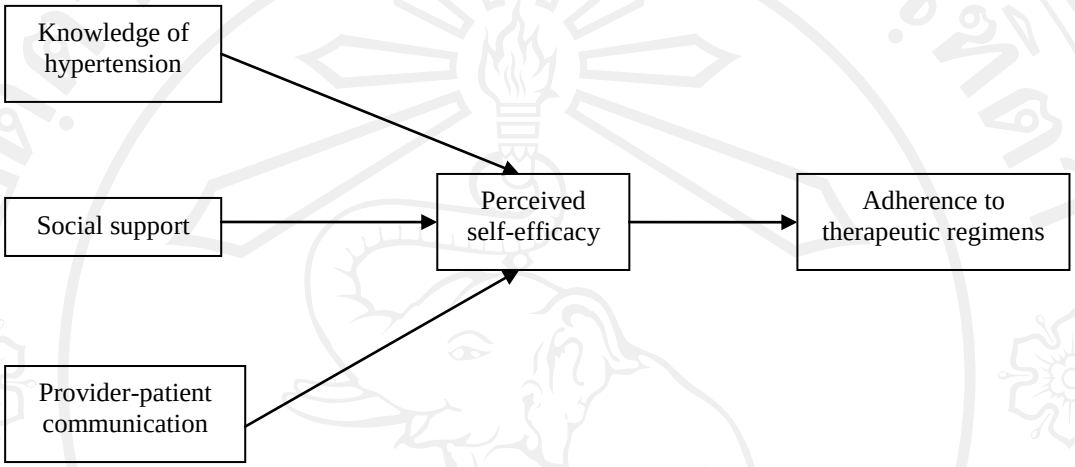

Figure 2-5. The proposed relationship between perceived self-efficacy and related factors

Measuring self-efficacy. A psychometrically measure of self-efficacy, provided by Bandura (1997), is divided into two dimensions. The magnitude of self-efficacy measures the level of task difficulty that a person believes he or she is capable to perform. The strength indicates that the individual's judgment about confidence is strong to produce coping efforts or weak and easily questioned in the face of difficulty. The items are phrased in terms of can do rather than will do. Can is a judgment of capability; will is a statement of intention. Self-efficacy scales should measure people's beliefs in their abilities to fulfill different levels of task demand within the psychological domain selected for study (Bandura, 1997).

The traditional measurement of self-efficacy started from the idea that an individual responded dichotomously (yes or no) to whether he or she was capable of

performing a specific task at various levels of difficulty. For each response, confidence is rated on a 100-point scale, ranging in 10-unit intervals from 10 (little certainly) through intermediate degrees of assurance, 50 (moderately certain can do) to complete assurance, 100 (highly certain). The sum of the confidence ratings is the strength of self-efficacy (Bandura, 1997). A second, more common and convenient approach to assess self-efficacy is usually designed for assessing two judgments into a single item by separating to two columns. One column assesses the strength of perceived self-efficacy and the other assesses the different levels of performance regarding the activities domain (Lenz & Shortridge-Baggett, 2002). The sum of each column indicates the strength and level of self-efficacy. Previous studies regarding to self-efficacy among hypertensive patients developed a scale for assessing self-efficacy. These scales are described as follows.

1. The Hypertensive Self-efficacy Scale (HSES) was developed by Dongyan (2000) for measuring hypertensive patients' decisions as to whether or not they can complete each activity of medical regimen successfully. There are 28 items based on 7 regimens including antihypertensive medication taking (7 items), dietary modifications (8 items), weight control (2 items), smoking cessation (2 items), alcohol intake limitation (1 item), physical exercise (3 items), and stress management (5 items). Each item is rated on a 6-point Likert scale ranging from 0 (not applicable) to 5 (very certain). The total scores of HSES, ranging from 28 to 140, are classified into three levels, high (102.7-140), moderate (65.4-102.6), and low (28-65.3). The higher the score means the higher the level of self-efficacy, whereas a lower score indicates a lower level of self-efficacy. The content validity index (CVI) of this scale was 0.81

and the stability coefficient applied to 15 hypertensive patients and it value was 0.93 (Dongyan, 2000).

2. The Perception of Self-efficacy Questionnaire developed by Kairoj (1999) who studied the effect of self-efficacy perception on the health practice of middle aged women with hypertension to measure the perception on self-efficacy of 6 behaviors including taking medicine (5 items), dietary control (6 items), physical exercise (5 items), risk factors control (5 items), stress management (6 items), and follow-up visit (2 items). There are 29 items with a 5-point rating scale ranging from 5 (most confidence to perform) to 1 (no confidence to perform). The result of perceived self-efficacy is an average score which is divided in to 5 categories including lowest (1.00-1.49), low (1.50-2.49), moderate (2.50-3.49), high (3.50-4.49), and highest (4.5-5.00). The content validity was evaluated by 5 experts and it was revised following the recommendation before using it to collect data. The revised questionnaire was applied to 30 participants who had similar characteristics for finding weakness of questionnaires concerning the understanding and clarity of each item and it was revised again. Then, the revised questionnaire was evaluated for the internal consistency. Its value was 0.80.

3. The Perceived Self-efficacy Questionnaire for Hypertensive Patients was developed by Onchim (2002). It consists of the situations that patients have to use their self-efficacy that they can manage or solve the problem. This questionnaire consists of 13 items with a 5-point rating scale ranging from 5 (extremely confident to perform the activity) to 1 (not confident to perform the activity). The possible scores of the questionnaire are 13-65 which the criterion for interpretation of total scores on perceived self-efficacy is divided into 3 categories: low (11-33), moderate (34-46),

and high (47-65). The content validity was examined by four experts who are nurse instructors having the experience of self-efficacy for clarifying content and language suitability. Next, the questionnaire was revised according to recommendations given by all the experts. Cronbach's alpha coefficient was used to examine the internal consistency reliability which was tested with a group of 30 hypertensive patients who were similar to the sample in the study. The result was 0.83 which was acceptable for new scale.

Perceived self-efficacy is an individual's perception of their ability to perform specific behaviors. It is an important factor for patients to perform recommended behaviors. Perceived self-efficacy factors can be improved by nursing intervention to increase patients' adherence to regimens among hypertensive patients. Therefore, perceived self-efficacy is one factor influencing adherence to regimens in this study. To measure perceived self-efficacy among hypertensive patients this research will focus on the same items with the adherence to regimens scale. Then, Hypertensive Adherence Scale developed by Limcharoen (2006) was modified and used to measure perceived self-efficacy among Thai persons with hypertension, because this scale was used in hypertensive patients and developed with same items for measuring adherence to therapeutic regimens and the acceptable value of validity and reliability.

Conceptual Framework

The conceptual framework in this study uses the proposed hypothesized model of adherence to therapeutic regimens among persons with hypertension which is based on the integration of selected predictors from the empirical evidences of the relationship between adherence to therapeutic regimens and significant predictors in persons with hypertension and other chronic illnesses. The five selected factors affecting adherence to therapeutic regimens including social support, health belief, knowledge of hypertension, provider-patient communication and perceived self-efficacy. The definition of adherence in this study was derived from the integration of definition given by WHO (2003) and attributes of adherence (Cohen, 2009). It was defined as the extent of agreement and performance of persons with hypertension about the recommended behaviors provided by health care providers including antihypertensive medication taking, dietary modifications, weight control, avoiding risk factors, physical activity, stress management and follow-up visit. Four attributes of concept of adherence, then were integrated into the framework consisting alignment of patients' behaviors and recommendations, mastery of new behaviors, ongoing collaboration with health care providers on treatment plan and their ability to meet optimal blood pressure.

In the proposed hypothesized causal model the factors affecting adherence to regimens focus on modifiable factors which can be influenced by nursing intervention. Social support which is based on the concept by House (1981, as cited in Heaney & Israel, 2002) was defined as the level of emotional, instrumental, information and appraisal support perceived by hypertensive patients in order to

maintain an adherence to therapeutic regimens. Social support was positively related to adherence to therapeutic regimens, knowledge of hypertension and perceived self-efficacy. When persons with hypertension received and perceived social support to help those performing recommended behaviors, they may often increase adherence to therapeutic regimen, knowledge of hypertension and perceived self-efficacy. Thus, social support was hypothesized to have a direct effect on adherence to therapeutic regimens and have an indirect effect on adherence to therapeutic regimens through knowledge of hypertension and perceived self-efficacy among persons with hypertension. Social support was also hypothesized to have a direct positive effect on knowledge of hypertension and perceived self-efficacy.

Health belief was one of the intrapersonal factors which affect individuals' health behaviors and defined as the level of the perception of hypertensive patients including perceived susceptibility to the hypertensive complications, perceived severity of the hypertensive complications, perceived benefits of performing disease control behaviors and perceived barriers to performing disease control behaviors. Hypertensive patients having an appropriate health belief (perceived susceptibility, perceived severity and perceived benefit with a high level and perceived barrier with a low level), were more likely to have better adherence behaviors. Thus, health belief is hypothesized to have direct positive effect on adherence to therapeutic regimens among persons with hypertension.

Knowledge is derived from the cognition process by learning from various sources and then accumulates in terms of understanding, perception, skills, and experience (Bandura, 1997) and defined as the level of understanding regarding hypertension, including etiology, signs and symptoms, complications, medication use

and performing behaviors to control blood pressure. The greater increase in knowledge of hypertension, the more increase in perceived self-efficacy and adherence to therapeutic regimens. Persons with hypertension who have more knowledge of hypertension tend to have an increased ability to perform required behaviors and also improved adherence behaviors. Thus, knowledge of hypertension is hypothesized to have a direct positive effect on adherence to regimens and have indirect effect on adherence to regimens via perceived self-efficacy among persons with hypertension.

Provider-patient communication supports the patients to improve adherence to therapeutic regimens because it indicates trust, confidence, compassion, and helping from the healthcare provider and defined as the level of patients' perception of health care provider's behaviors about general clarity during their talking, explanation of hypertension medication and lifestyle modifications and carefully listening to and responsiveness to patient problems and concerns about hypertension management. Effective provider-patient communication improves adherence to regimens and also increase knowledge of hypertension among hypertensive patients. In addition, when patients receive and share information with health care providers, they may increase their confidence to perform required behaviors. In brief, provider-patient communication is hypothesized to have positive direct effect on adherence to regimens and have indirect effect on adherence behaviors via perceived self-efficacy and knowledge of hypertension. Moreover, provider-patient communication may also have a direct positive effect on knowledge of hypertension and perceived self-efficacy.

Perceived self-efficacy is patients' perceptions about their ability to follow the required behaviors to control blood pressure to the target level. An individual, who perceives that he/she is able to perform an activity, will be successful in performing that behavior. As well as adherence to therapeutic regimens, it was found that persons with hypertension who perceived that they had the ability to perform activity according to the treatment plan at a high level tended to adhere to the treatment plan more than those who perceived that their ability levels were low. Therefore, it can be hypothesized that perceived self-efficacy has a positive direct effect on adherence to therapeutic regimens. The hypothesized causal model of adherence to therapeutic regimens among Thai persons with hypertension is illustrated in Figure 2-6.

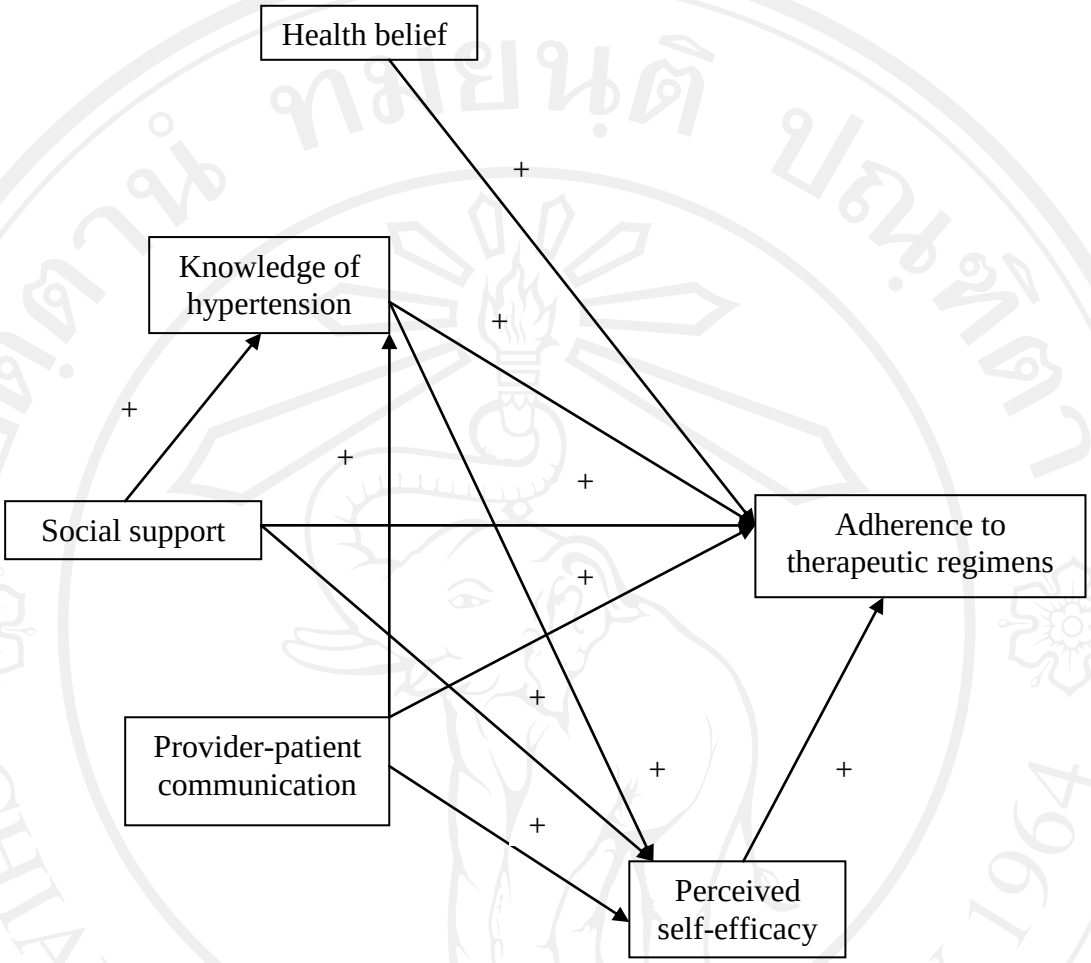

Figure 2-6. The hypothesized causal model of adherence to therapeutic regimens among persons with hypertension