CHAPTER 2

Literature Review

The review of literature relevant to this study is organized into two parts. Part one focuses on literature related to older adults with hypertension including definition, classifications, diagnosis, pathophysiology, complications, impacts, and treatment and care. Part two deals with the concept of adherence to therapeutic regimens among older adults with hypertension including definition, attributes, measuring adherence, adherence models, and related factors described as follows:

Part One: Older adults with Hypertension

Definition of Hypertension and Classification

Hypertension is defined commonly worldwide by the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure [JNC-7] as systolic blood pressure (SBP) equal or more than 140 mmHg or diastolic blood pressure (DBP) equal or more than 90 mmHg. This definition is based on the mean of 2 or more properly measured seated blood pressure readings on each of 2 or more office visits (Chobanian et al., 2003). The classification of hypertension is commonly based on JNC-7 which is used widely to provide the criteria for diagnosis of hypertensive patients aged ≥ 18 years. It is described as follows:

1. Normal blood pressure is defined as SBD less than 120 mmHg and DBP less than 80 mmHg.

2. Pre-hypertension is defined as SBP equal 120-139 mmHg or DBP equal 80-89 mmHg.

3. Stage 1 hypertension is defined as SBP equal 140-159 mmHg or DBP equal 90-99 mmHg.

4. Stage 2 hypertension is defined as SBP ≥ 160 mmHg or DBP ≥ 100 mmHg.

For classifying the level of hypertension, the classifications of JNC-7 are used to screen people who are at risk of developing hypertension. This study used the classification of hypertension for identifying elderly with hypertensive patients. Thus for diagnosis older adults with hypertension based on JNC-7 is referred to the SBP ≥ 140 mmHg and DBP ≥ 90 mmHg.

Diagnosis of Older Adults with Hypertension

Older adults with hypertension is defined as the elderly people who have a systolic blood pressure (SBP) ≥ 140 mmHg and DBP ≥ 90 mmHg or a physician already has diagnosed them as having hypertension (Bertoia et al., 2011; Chobanian et al., 2003; Thailand Hypertension Society, 2012). Normally, around 95% of all cases of hypertension are essential hypertension (Carretero & Oparil, 2000). Moreover, most common older adults with hypertension are diagnosed with primary hypertension or essential hypertension. The primary hypertension or essential hypertension is defined as a rise in blood pressure of unknown cause that increases the risk for cerebral, cardiac, and renal events (Messerli et al., 2007). Also, it is defined as high blood pressure in which secondary causes such as renovascular disease, renal failure, aldosteronism, or other causes of secondary hypertension are not present (Carretero & Oparil, 2000).

The JNC-7 report presenting guidelines for classifying blood pressure level applies to people aged of 18 and older, thus it can be used for diagnosis of older adults with hypertension. However, considering the diagnosed hypertension in older people, there should be more careful screening and concerning others factors related to advancing age especially the difference of pathophysiological characteristics from adults (Aronow et al., 2011).

Pathophysiology of Hypertension in Older Adults

The pathophysiology of older adults with hypertension is described through the mechanism of the biological age reflecting the age associated with decrement of physical function (Bloch & Basile, 2007; Fukutomi & Kario, 2010). There are four key mechanisms of pathophysiology which result from the advancing age and increased blood pressure among older adults. It is explained as follows:

Age-associated with changing the function and structure of arteries. The remarkable changes of arterial function and structure are associated with the advancing age throughout the lifetime of humans (Aronow et al., 2011; Fukutomi & Kario, 2010). Firstly, reflecting that biological age induces increased blood pressure levels result from the changing structure of the large vessels such as the aorta (central artery) (Aronow et al., 2011). It is due to the decreasing elasticity of arteries and also increased vascular stiffness (Aronow et al., 2011; Fukutomi & Kario, 2010; Lakatta, 2003). The causes of these alterations result from the major changes of intimal wall thickening and dilatation that occur during the human aging process (Lakatta, 2003). The structure having thickened intimal walls consists of increased matrix proteins which include collagen, fibronectin, proteoglycans and vascular smooth muscle cells (Lakatta, 2003). The result from the stiffening of the large artery of older people is the isolated systolic hypertension (ISH) which is most commonly seen in hypertensive older adults (Fukutomi & Kario, 2010). The functional changing from advancing age is associated with endothelial dysfunction or endothelia stiffness which is caused by the continuously impaired the nitric oxide (NO) pathway and increased oxidative stress leading to systemic vasoconstriction and then its effect on increasing blood pressure especially contributing to development of ISH in elderly people (Aronow et al., 2011; Fukutomi & Kario, 2010).

Age-associated change of renal function. In general, several studies have well documented that kidneys play a central role of blood pressure control by its ability to regulate an appropriate level of body fluid volume through rapid increased pressure natriuresis. Advanced age can cause impaired capacity of the kidney to a sodium load resulting in development of blood pressure elevation (Aronow et al., 2011). Also, most common with advanced age, it has been shown that after the 40s decade of life, the kidneys progressively decline both in weight and size. Moreover, the results from advancing age are caused by adverse changing kidney function including decreased glomeruli, glomerulosclerosis, tubular atrophy and arterial intimal fibrosis leading to decreased creatinine clearance and glomerular filtration rates. Therefore, regarding many results of regressive renal function principally having dysregulation of effective sodium excretion contributes to hypertension in elderly. (Aronow et al., 2011; Fukutomi & Kario, 2010; Martin & Sheaff, 2007).

Age-associated changes of the sympathetic nervous system. Many studies related to progressive human aging have shown a significant correlation between the activity of the sympathetic nervous system (SNS) and increased blood pressure in humans (Fukutomi & Kario, 2010; Hart et al., 2009; Narkiewicz et al., 2005). It is important to note that the excessive activity of SNS contributes greatly to the development of essential hypertension because of gradually increasing human aging (Fukutomi & Kario, 2010; Hart et al., 2009). This mechanism may be described from the threshold level of SNS activity affecting increased vasoconstriction and may contribute to raise blood pressure which is related to progressive aging (Hart et al., 2009).

Age-associated change of the renin-angiotensin-aldosterone system (RAAS). In general, increasing age is congruently changing in the responsiveness of human hormonal systems such as renin-angiotensin-aldosterone system (RAAS) (Fukutomi & Kario, 2010). The RAAS is an important system related to changing blood pressure level. The critical function of this hormonal system is the physiological regulation of blood pressure and volume homeostasis, whereas its pathogenesis causes hypertension and cardiovascular disease (Cat & Touyz, 2011). The RAAS contains two types of hormones, including renin angiotensin (Angitensin II) and aldosterone. The Angiotensin II is a crucial hormone causing vasoconstriction and is a leading cause of increased blood pressure (Aronow et al., 2011). New knowledge of Angiotensin II production has shown that it is not only generated in the circulation, but also produced in kidney vessels, heart, adrenal gland, eye, testis and brain (Cat & Touyz, 2011; Fukutomi & Kario, 2010). According to progression of aging causing the thickening of intimal media of aged central arteries, it may affect the action of increased angiotensin II and then resulting in increased blood pressure (Fukutomi & Kario, 2010). The function of angiotensin II is regulating the sympathetic tone and baroreceptor reflex which caused increasing greatly in SNS and blood pressure (Fukutomi & Kario, 2010). However, it is unclear whether the RAAS activation is related to the advancing age-associated hypertension because founding the decreased hormonal system throughout the process of aging (Aronow et al., 2011; Fukutomi &Kario, 2010).

In brief, the pathophysiology of hypertension in elderly people is different from other adults because of its correlation with advancing age. Mostly elderly people have a greater development of essential hypertension or primary hypertension with unknown causes. Explaining the mechanisms for development of high blood pressure in older adults should mainly focus on the concept of advanced aging which is affecting to degeneration in several organ systems in the human body especially organs directly related to hypertension such as the kidney and vascular system.

Complications of Hypertension

Prolong uncontrolled blood pressure in elderly with hypertension are at risk of the major complications or the adverse effects of hypertension which deteriorate the key three target organs, including heart, brain and kidney. These complications are described as follows:

1. The major complications related to cardiovascular disease affecting hypertensive elderly who have uncontrolled hypertensions for a long time period include coronary heart disease (CHD) and heart failure (Ogedegbe & Pickering, 2011). Several studies have shown the strong relationship between both systolic blood pressure and diastolic blood pressure and the risk of CHD events in middle and older age and also the consequence of CHD may induce ischemic heart disease or myocardial infarction (Ogedegbe & Pickering, 2011). Another complication is heart failure which is a major leading cause of hospitalization for older adults. Developing ventricular hypertrophy is firstly detected as a result of having long-term high blood pressure and it also led to an atherosclerotic coronary artery disease and cardiac arrhythmia until having an unfavorable consequence from heart failure (Kotchen, 2008; Ogedegbe & Pickering, 2011). These conditions result from arterial pressure increasing posits an excessive burden on the heart, or afterload (Ogedegbe & Pickering, 2011).

2. Development of stroke is a critical condition from high blood pressure. Stroke is the third most common cause of death worldwide (Ogedegbe & Pickering, 2011). Hypertension is the major cause for the development of stroke. In particular, older adults with hypertension have a 2-4 times greater risk of the incidence of stroke compared with older adults without hypertension (Kaplan, 2006). High blood pressure

causes the risk of brain infarction approximately 85% then leading to intracerebral hemorrhage (Kotchen, 2008).

3. Kidney dysfunction, such as chronic kidney disease and kidney failure, results from long-term high blood pressure or uncontrolled blood pressure, especially the risk of the severe hypertensive complications developing into the end stage renal disease. Having atherosclerosis can cause high blood pressure and lead to kidney dysfunction such as renal ischemia, and glomerulopathy (Kotchen, 2008; Ogedegbe & Pickering, 2011).

Impacts of Hypertension on Older Adults

The impacts of hypertension on older adults are a great problem of the healthcare system because of its impact leading to morbidity and mortality worldwide. It is well documented that hypertensive older individuals are a group at high risk for cardiovascular and renal diseases (Appel et al., 2006). In particular, among older adults with hypertension who do not have well control blood pressure in the long-term, may suffer from illness directly affecting themselves with severe complications and their family members who take the role as elderly caregivers. WHO has reported that in 2011 hypertension in the world population caused death totally 12.8% and also loss of physical ability approximately of 57 million people or 3.7% of world population (WHO, 2010). Among older people who have uncontrolled blood pressure for long periods may be associated with a high risk of cardiovascular and cerebrovascular diseases leading to a cause of disability and death (Kim et al., 2008). The higher level of uncontrolled blood pressure among older adults with hypertension may cause increased burden on both the family and society in the next decades (Aronow et al., 2011). Also, this problem can congruently induce psychological impacts in long-term illness from hypertension disease. The psychological impact mostly results from psychological distress such as anxiety and depressive symptoms which may be because of a direct effect of elelvated blood pressure, adverse effects of treatment, or the consequences of labeling hypertension diagnosis (Hamer et al., 2012). WHO indicated that the impact of chronic illness on mental health can affect the optimal goal of treatment especially poor self-care and adherence to therapy which could increase mortality rates (World Federation for Mental Health [WFMH], 2010). Moreover, hypertension not only affects

patients but also family caregivers who are the key persons providing care, financial support, emotional or spiritual and social support. The impact of elderly with hypertension on family caregivers includes fatigue, irritable emotion, and undesirable and unsuccessful goals of care (Shieh et al., 2012).

Hypertension Treatment and Management in Older Adults with Hypertension

The main outcome goal of hypertension management for the elderly with essential hypertension is achieving optimal blood pressure control less than 140/90 mmHg in order to decrease crucial complications from cardiovascular disease which is based on the guideline of the JNC-7. It is well documented that successfully controlled hypertension in the older persons resulted from both pharmacological and nonpharmacological treatment (Fischer, 2009). Therefore, the proper management older adults with hypertension based on JNC-7 should adopt with both pharmacological (taking medications) and nonpharmacological therapy (lifestyle modification) (Chobanian et al., 2003). It can be described as follows:

Nonpharmacological therapy. The desirable goal for blood pressure control is less than 140/90 mmHg. According to the guidelines of JNC-7 which recommends that hypertension management should adopt lifestyle modification which is a nonpharmacological therapy as the first strategy for lowering blood pressure (Blumenthal et al., 2010; Chobanian, 2009b). Elderly with hypertension should modify their lifestyle for controlling blood pressure and preventing complications, including weight reduction, adoption to Dietary Approaches to Stop Hypertension (DASH) eating plan, dietary sodium reduction, physical activity, and moderation of alcohol consumption.

Weight reduction. Many studies are well documented that obesity is a direct cause of hypertension. Proper control of weight can decrease blood pressure. For instance, the Flamingham Heart Study found that the prevalence of hypertension in obese individuals is 2 times more likely than individuals without obesity. Also, the relationship between blood pressure and weight gain showed that each approximate 10% increase in body weight is associated with an increase in the level of systolic blood pressure of 6.5 mmHg (Pi-Sunyer & Kokkoris, 2007). Therefore, a favorable outcome target for controlling blood pressure should be to control body weight and body mass

index (BMI) to a normal level. A recommendation from the guideline of JNC-7 demonstrates that when individuals can keep their BMI to 18.5-24.9 kg/m2 and reduce body weight by 10 kg, the systolic blood pressure will be decreased around 5-20 mmHg (Chobanian et al., 2003). Moreover, one meta-analysis study has been found that a net body weight reduction of 5.1 kg reduced systolic and diastolic blood pressure by 4.4 and 3.6 mmHg respectively (Neter et al., 2003).

Adoption of Dietary Approaches to Stop Hypertension (DASH) eating plan. The adoption of the Dietary Approaches to Stop Hypertension (DASH) diet to lower high blood pressure from JNC-7 is widely used for the recommended guidelines in hypertension treatment over the past decades because of its benefits for lowering high blood pressure and prehypertension (Chobanian, 2009a; Chobanian et al., 2003). The DASH is mostly defined as a total diet plan based on increased intake of vegetables, fruits, and low fat dairy, and low in saturated and total fat content (Rankins, Sampson, Brown, & Jenkins-Salley, 2005). The recommended guideline from JNC-7 by adopting DASH eating plan such as a consumption diet emphasizing on fruit, vegetable, food low in saturated fat, cholesterol, and total fat, complex carbohydrates and low sugar dietary results in blood pressure reduction 8 to 14 mmHg (Chobanian 2009b; Chobanian et al., 2003). Also, some studies have shown that adoption of the DASH eating plan could effectively lower blood pressure both SBP and DBP among hypertensive patients (Blumenthal et al., 2008; Parikh, Lipsitz, & Natarajan, 2009; Rankins et al., 2005). It is well documented that the DASH eating plan is a helpful form of dietary intervention for greater blood pressure reductions and also substantial risk reductions for cardiovascular disease in the hypertensive elderly (Appel et al., 2006). One study has shown that DASH diet can lower SBP by 11.4 mmHg and DBP by 5.5 mmHg and also combining the DASH diet with a reduced sodium intake has a greater effect than only using DASH diet for intervention (Parikh et al., 2009). Likewise, Blumenthal et al. (2008) conducted a randomized controlled trial (RCT) in a tertiary care medical center in 144 obese participants with high blood pressure who adopted DASH alone and found that their blood pressure levels were significantly reduced both SBP and DBP by 11.2 and 7.5 mmHg respectively compared to baseline ($p < .001$). Thus, it is well documented that hypertensive older adults should adopt and sustain the DASH eating plan or

consumption of an overall healthy dietary pattern in order to greater blood pressure control (Appel et al., 2006).

Dietary sodium reduction. Many studies have well established that reduced consumption of dietary sodium is associated with lowering blood pressure (Appel et al., 2006; Chobanian et al., 2003; Rankins et al., 2005). Also, according to many reviews of the literatures, reduced salt intake not only decreases blood pressure to normal, but is also associated with a reduced risk of atherosclerotic cardiovascular events and congestive heart failure (Appel et al., 2006). The recommendations from JNC-7 indicate that general individuals should restrict dietary sodium to less than 100 mmol per day or a low salt diet of less than 2.4 gram per day. Reducing dietary sodium leads to lower blood pressure between 2 to 8 mmHg, therefore it should be adopted for the prevention and treatment of hypertension (Appel et al., 2006; Chobanian et al., 2003).

Physical activity. Regular physical activity can cause continuously reduced blood pressure (Appel, 2007). To recommend doing exercise or physical activity and concomitant weight reduction are appropriate nonpharmacologic treatments of hypertension in the hypertensive elderly (Fischer, 2009). The recommended guideline of JNC-7 for suitable exercise prescriptions in hypertensive patients is that they should perform aerobic exercise, especially brisk walking for at least 30 minutes a day, and several times per week. This regular aerobic exercise can reduce systolic blood pressure by 4 to 9 mmHg (Chobanian et al., 2003).

Moderate alcohol consumption. Alcohol consumption has been an important modifiable risk factor of hypertension in recent decades (Skliros et al., 2012). The guideline of JNC-7 for limiting alcohol consumption is that there should be no more than two drinks per day for men and one drink per day for women (Chobanian et al., 2003). The reduced systolic blood pressure from achieving moderation of alcohol consumption averaged 2 to 4 mm Hg (Chobanian, 2009b; Chobanian et al., 2003). Moderate alcohol intake based on the American Heart Association 2006 scientific statement of hypertension management is defined as a maximum of 2 alcoholic drinks per day in men and 1 alcoholic drink per day in women (Appel et al., 2006). Also, available evidences strongly supports that moderate alcohol consumption among people who still drink alcohol have an effective approach to lower blood pressure (Appel et al.,

2006). In contrast, the study on relationship between alcohol consumption and control of hypertension among elderly Greeks found that older individuals who are heavy drinkers (>300 g/week) were found to be related with hypertension control (Skliros et al., 2012). However, this finding was found only specifically in elderly Greeks, caution is required in giving recommendations for alcohol consumption for the general older adults with hypertension (Skliros et al., 2012).

In conclusion, the outcome goal for nonpharmacotherapy in older adults with hypertension is appropriate management in older adults who are in the first stage of hypertension (have a low level of blood pressure ranged systolic blood pressure as 120-139 mmHg to diastolic blood pressure as 80-90 mmHg) by promoting sustained lifestyle modification (Aronow et al., 2011). Thus, older adults with hypertension should follow a recommended lifestyle modification for controlling blood pressure and preventing complications.

Pharmacological therapy. Hypertension treatment in the elderly usually is recommended by adoption of pharmacological treatment, after older individuals unsuccessfully tried to lower their blood pressure with nonphamacological therapy or lifestyle modification and also repeated blood pressure measurement ≥140/90 mmHg that are still found uncontrolled blood pressure (Chobanian et al., 2003). Normally, hypertension treatment by taking antihypertensive medication is more important to control blood pressure especially with good medication adherence which is the key factor related to ensure optimal control of hypertension (WHO, 2003). The key principles of management hypertension in older people with pharmacological treatment based on JNC-7 are described as follows:

1. Considering with isolate systolic hypertension is commonly found in older adults with hypertension which is a key factor leading cause of cardiovascular disease, it should be started firstly with thaizide-type diuretics in order to reduced cardiovascular events (Arownow, 2008; Chobanian et al., 2003; Dickerson & Gibson, 2005; Luckson, 2010). When hypertensive older adults are prescribed with a diuretics drug, they should appropriately monitor serum electrolyte levels, because it usually has a critical side effect of hypokalemia which should be treated with the addition of a potassium-sparing diuretic medication (Dickerson & Gibson, 2005). Also, regarding the other side effects

from diuretics medication, mainly dehydration and postural hypotension, the elderly should be evaluated for orthostatic hypotension and suggested preventing falls (Aronow, 2008; Dickerson & Gibson, 2005; Luckson, 2010).

2. The key point in initially prescribing antihypertensive drugs to older patients is to start at the lowest dose and then increase gradually until blood pressure levels respond to the maximum dose toleration indicated a successfully initiated treatment with medication. However, one more medication from another class will be added if the initial drug with full dose is an inadequate response to blood pressure control (Aronow, 2008; Aronow et al., 2011; Chobanian et al., 2003). If the full dose of 2 classes of drugs are inadequate for blood pressure control, then a third drug from another class should be added and so on (Aronow, 2008; Aronow et al., 2011).

3. In general, according to the recommendation from JNC-7 for hypertensive patients who are in stage 1 (SBP = 140-159 or DBP = 90-99 mmHg) drug prescription should be started firstly with thiazide-type diuretics for most and may consider combination with others classes such as angiotensin converting enzyme inhibitors (ACEIs), angiotensin receptor blockers (ARBs), beta-blockers (BBs), and calcium channel blockers (CCBs) (Chobanian et al., 2003).

4. The appropriate treatment for hypertensive patients with stage 2 hypertension (SBP $\geq$ 160 or DBP $\geq$ 100 mmHg) should be initiated with a two-drug combination for most usually including thiazide-type diuretics and ACEIs, or ARBs, or BBs, or CCBs. Keeping doctor's appointments is more crucial for patients with stage 2 hypertension who usually have complications. They should be monitored for serum creatinine and potassium at least 1-2 times a year. The duration period of follow-up visits should be adjusted around 3 to 6 month intervals depending on blood pressure level to resulting optimal goal or stable (Chobanian et al., 2003).

5. In older adults with hypertension who initially have a measured blood pressure more than 20/10 mmHg above the goal blood pressure based on JNC-7 (blood pressure goal <140/90 mmHg) should be treated initially with 2 antihypertensive drugs and one of medications should be a thiazide-type diuretic (Aronow, 2008; Aronow et al., 2011).

In conclusion, considering pharmacological treatment to achieve the optimal goal mainly having both blood pressure controlled and without complications in the older adults with hypertension, is a more important task for management. The appropriate

pharmacological treatment in these groups may result in a greater absolutely decreased risk of cardiovascular disease, stroke and renal dysfunction (Luckson, 2010). Monitoring intimately side effects of antihypertensive drugs such as orthostatic hypotension and hypokalemia and also detecting early their signs and symptoms are more important for pharmacological treatment in older adults with hypertension, because these factors may affect adherence to their therapeutic regimens leading to undesirable outcomes of therapy.

Part Two: Adherence to Therapeutic Regimens

Definition of Adherence

In recent times, the term of adherence has been used more widely in health care systems regarding treatment in patients with chronic disease such as hypertension because, this concept is mostly focused on patient's authority while having an active participation in the treatment (Levesque, Li, & Pahal, 2012). The term of compliance, an older concept, which is close to the meaning of adherence in the health care system or its interchangeable the term adherence. It is defined as the extent to which patients' behaviors agree with the recommendation or advice for health from health care providers without participative decision-making and involvement in their treatment (Horne et al., 2005; Krousel-Wood, Thomas, Muntner, & Morisky, 2004). The term compliance also suggests a passive approach to health care in treatment (Carpenter, 2005).

In contrast, the term adherence focuses on patients' ability, willingness, and agreement to perform behaviors matching a prescribed therapeutic regimen which is different emphasis (Horne et al., 2005; Krousel-Wood et al., 2004). Also, the term adherence is focused on promoting the patient's role as patient-centered which involves transferring power and authority away from health care professionals and towards patients (Russell, Daly, Highes, & Hoog, 2003). It implies active participation of the patients in their treatment regimens which is opposite from the compliance term (Carpenter, 2005). Thus, many experts in health arena recommend using adherence term rather than compliance. Therefore compliance is replaced by adherence at the present time, because it is a well established term for improving the effective treatment

regimens through its emphasis on the role patients play as active participants and agreement with their prescribed treatment from health care providers leading to the desired health outcome (Horne et al., 2005; Levesque et al., 2012). Therefore, this study will prefer to use the term of adherence rather than compliance throughout the study except in the literature review obtained from other studies which use the term compliance. The term of adherence is defined as follows:

The definition of adherence defined by WHO is the extent to which a person's behavior corresponds with agreed recommendations from a health care provider which emphasizes taking medication, following a healthy diet, and executing changing lifestyle (WHO, 2003).

Shay (2008) defined adherence as the ability of individuals for maintaining their health behaviors associated with a plan of care prominently including medications taking and lifestyle modification and continued follow-up visits.

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

Considering this definition of adherence, it emphasizes patients as taking a center role based on having active participation, agreement with their given treatments from health care provider and also having mutual responsibility in encounter treatment between patients and health care providers. For this study, the definition of adherence to therapeutic regimens in older adults with hypertension is defined as the extent in which the behaviors of older individuals, including antihypertensive drugs taking and lifestyle modification consisting of DASH dietary, weight control, smoking cessation, physical activity, alcohol intake limitation, and stress management.

Attributes of Adherence

The attributes of adherence are consistent with the recommendation of health care personnel derived from concept analysis of Cohen (2009) who conducted concept analysis to long-term cardiovascular health recommendation which analyzed attributes of adherence into four major aspects, including alignment of patient behavior and health

recommendations, mastery of a new behavior and health knowledge, ongoing collaborative relationships between the patient and health care provider, and their perceived ability to meet the outcome targets. These attributes are described as follows:

1. Alignment of patient behavior and health recommendations. To achieve the desired health outcome of hypertensive patients, they should perform both regularly and continuously behaviors, including taking medication and lifestyle modification arranged by health care providers.

2. Mastery of a new behavior and health knowledge. The key points for achieving adherence to therapeutic regimens, patients should have appropriate knowledge and therapy- related health behavior such as having knowledge of treatment, medication use and side effects, and the best way to prevent disease complications.

3. Ongoing collaborative relationships between the patient and health care provider. A good collaborative relationship between the health care providers and patients is essential for enhancing patient's adherence to treatment. The success of treatment should be started and emphasized firstly with a good relationship, good communication, and mutual goal setting between patients and health care providers leading to reducing the barriers affecting adherence to their treatments.

4. Perceived ability to meet the outcome targets. One critical way for enhancing patient's adherence to therapeutic regimens is for the health care provider taking action by giving encouragement and empowerment to patients in order to improve the ability of reducing barriers influencing adherence to therapeutic regimens.

In brief, these attributes are practical for use in chronically ill patients, especially hypertension with its long-term treatment. According to adherence to therapeutic regimens among older adults with hypertension based on the attributes of Cohen (2009), adherence can be defined as the level of agreement and performance of older adults with hypertension in the recommended of health behaviors prescribed by health care providers including both taking antihypertensive medications and lifestyle modification in their daily life, having simultaneous collaboration with health care providers to set mutual optimal goal for success controlling blood pressure, and also having the ability to achieve to their outcome targets.

Adherence to Therapeutic Regimens Among Older Adults with Hypertension

The term adherence focuses on hypertensive patients' ability and willingness to follow a prescribed therapeutic regimen (Krousel-Wood et al., 2004). The desirable outcome goal for achieving blood pressure level control is less than 140/90 mmHg in order to reduce severe complications from cardiovascular disease (Chobanian et al., 2003; Krousel-Wood et al., 2004). Thus, adherence to therapeutic regimens among older adults with hypertension is necessary for achieving control of blood pressure and preventing its complications. In order to achieve the outcome goal, older adults with hypertension should make their treatment effective by performing both adherence to medication and lifestyle modification.

Adherence to medication. Adherence to antihypertensive medication is essential for blood pressure control in older adults with hypertension, because it reduces morbidity and mortality from cardiovascular disease. Osterberg and Blaschke (2005) defined adherence to medication as the patient taking the prescribed number of pills each day and within the timing of doses. Having good adherence to a prescribed antihypertensive regimens is significantly associated with better controlling of blood pressure and also improving favorable health outcomes in the long-term (Bramley, Gerbino, Nightengale, & French-Tamas, 2006; Chobanian et al., 2003). Many studies have well documented that hypertensive patients performing adherence to antihypertensive medications tend to decrease serious complications such as cardiovascular disease and stroke (Carpenter, 2005; Chobanian et al., 2003; Chobanian, 2009a; Mancia et al., 2007; Mazzaglia et al., 2009). Moreover, several studies have shown the unsatisfactory results of poor adherence leading to adverse health outcomes. WHO (2003) demonstrated that hypertensive patients' adherence with medication therapy varies between 50% and 70%. In particular, several studies have found a lower rate of adherence to therapy among older adults with hypertension (Benner et al., 2002; Elliott et al., 2007). The study of Lin et al. (2007) conducted to study adherence to antihypertensive medications among the Taiwanese elderly reported that the medication adherence rate was only 57.6%. Likewise, one study has found that the rate for adherence to antihypertensive medications among elderly Chinese Americans was 52% (Hsu et al., 2010).

Therefore, to improve medication adherence for achieving optimal blood pressure control not only depends on patients performing adherence to medication, but also on having good management from health care providers. The health care providers should provide simple medication regimens for older adults with hypertension such as reducing the number of pills and the frequency for dose taking (Mansur, Weiss, Hoffman, Gruenewald, & Beloosesky, 2008; WHO, 2003). Many studies have well documented that achieving adherence to medication taking behaviors should be improved by using behavioral approaches such as the use of specialized packaging such as blister and reminder packaging, medication reminder charts, multi-compartment compliance aids, pill boxes, self-monitoring of pills, direct observation of therapy and patient medication feedback (Banning, 2009). Also, WHO (2003) provides recommendations for taking medication in general patients with hypertension that the regimens given to patients should be individualized to fit each patient's schedule and their lifestyle. Moreover, patients should be monitored and minimized the side-effects, adverse drug reactions and a history of drug allergy. Good communication between providers and patients is an important method to improve regularly and frequency of taking medication in hypertensive patients (Braverman & Dedier, 2009; Schoenthalar, Chaplin, et al., 2009; WHO, 2003). For hypertensive patients, Abram, Lammon, Pennington, and Goldsmith (2009) have demonstrated that patients should remind themselves not to forget taking medication, to take the complete daily dose at the right time, not to decrease or increase the dosage by oneself, not to stop taking medicine when feeling great and the symptoms disappear and also memorize the details of medicine taking each day such as the name of the medicine, dosage, and the number of medicine types.

Adherence to lifestyle modification. One significant strategy for hypertension management is adherence to lifestyle modification which sustains the lowering of blood pressure and enhances effective antihypertensive drugs leading to achievement of blood pressure control and reduction of the risk of cardiovascular disease (Chobanian et al., 2003). Adherence to lifestyle modification is an effective significant strategy as well as adherence to medication in hypertension management (Uzun et al., 2009). For instance, lifestyle modification or nonpharmacologic treatment is a substantial strategy for effectively lowering blood pressure when it is combined with the Dietary Approaches to Stop Hypertension (DASH) eating plan and sodium restriction (Nguyen et al., 2013).

Hence, it should be a necessarily promoted adherence to lifestyle modification for elderly with hypertension as well as medication adherence in order to access favorable health outcomes with blood pressure control less than 140/90 mmHg and preventing complication of cardiovascular disease based on JNC-7 (Chobanian et al., 2003). Older adults with hypertension should perform adherence to lifestyle modification described as follows:

Adherence to weight reduction and weight control. A favorable outcome target for controlling blood pressure is to reduce body weight and body mass index (BMI) to a normal level. The recommendation from the guideline of JNC-7 is that when individuals can keep their BMI at 18.5-24.9 kg/m^2 and reduce 10 kg of body weight, the systolic blood pressure will decrease around 5-20 mmHg (Chobanian et al., 2003). Moreover, one meta-analysis study has found that a net body weight reduction of 5.1 kg reduced systolic and diastolic blood pressure by 4.4 and 3.6 mmHg respectively (Neter et al., 2003). It is well recommended that appropriate method for weight reduction in hypertensive persons, including increased physical activity and dietary control by reducing caloric intake (Appel et al., 2006).

Adherence to dietary control. Hypertension can be controlled by adherence to both the Adoption to Dietary Approaches to Stop Hypertension (DASH) eating plan and dietary sodium reduction.

Adherence to Adoption to Dietary Approaches to Stop Hypertension (DASH) eating plan. The recommended guideline from JNC-7 is to adopt the DASH eating plan, a consumption diet emphasizing a rich in fruit, vegetable, low in saturated fat, cholesterol, and total fat, and low sugar dietary results in a blood pressure reduction of 8 to 14 mmHg (Chobanian et al., 2003). Hypertensive patients should adopt the DASH eating plan in daily life because it is well documented to be helpful for dietary intervention for greater blood pressure reduction and also substantial reductions of risk of cardiovascular disease in the hypertensive elderly (Appel et al., 2006). It is well established that in order to reduce blood pressure to normal level, all patients with hypertension should adopt the DASH eating plan which recommends low saturated fat, cholesterol, and total fat such as fat-free or low-fat milk and milk products, whole

grains, poultry, fish and emphasizing taking more fruit, vegetable, and limiting sugar in food (Appel et al., 2006; National Heart, Lung, and Blood Institute [NHLBI], 2006).

Adherence to dietary sodium reduction. The recommendations from JNC-7 indicate that individuals should restrict dietary sodium to less than 100 mmol per day or low salt dietary to less than 2.4 gram per day. The result from reducing dietary sodium leads to lowering blood pressure between 2 to 8 mmHg, therefore it should be adopted for the prevention and treatment of hypertension (Appel et al., 2006; Chobanian et al., 2003). In order to lower blood pressure, persons with hypertension should adopt the DASH eating plan through sodium intake not greater than 1,500 milligrams per day and also should choose some food that limits the amount of added salt (Appel, 2007; NHLBI, 2006). In Thailand, according to a practical guideline for health behavioral modification to reduce multiple risk factors on cardiovascular disease, it was recommended that the hypertensive persons should not intake salt more than or limit of 1 teaspoon per day or limit fish sources of 1.5-2 tablespoons per day (Bureau of Non Communicable Disease, Ministry of Public Health, 2010). In addition, the Thai Bureau of Nutrition, Ministry of Public Health (2011) has emphasized that persons with hypertension should avoid some foods with high sodium, including salty seasoning (fish sauce, soy sauce, oyster sauce, tomato sauce, chili sauce), salty food (fermented food, snack, and potato chip), canned food (canned fish, canned curry), baking powder, convenience food (noodle, rice porridge, and soup).

Adherence to physical activity. Regular physical activity can cause sustained reduced blood pressure (Appel, 2007). The recommended guideline of JNC-7 for suitable exercise prescriptions in hypertensive patients is that patients should perform aerobic exercise, especially brisk walking for at least 30 minutes a day and several times per week. This regular aerobic exercise can cause a reduction of systolic blood pressure by 4 to 9 mmHg (Chobanian et al., 2003). The European Society of Hypertension have recommended an effective exercise for sedentary patients that should often take up exercise of moderate intensity around 30-40 minute per day by addressing the endurance physical activity such as walking, jogging, and swimming. Likewise, the American Heart Association (AHA) has strongly recommended persons with hypertension should maintain performing moderate intensity aerobic physical activity

for a minimum of 30 minute for five days per week or taking 20 minute for vigorous intensity aerobic exercise for three days per week (Haskell et al., 2007). However, the uncontrolled hypertensive patients should avoid the intensive isometric exercise such as heavy weight lifting and excessive physical excise because it will affect directly heart by inhibiting blood flow to heart (Frango, Oparil, & Carretero, 2004; Mancia et al., 2007). Also, the proper exercise for the elderly with hypertension should be concerned about their limited physical function.

Adherence to moderate alcohol consumption. Hypertensive patients should perform adherence to reducing or quitting alcohol consumption. Intake of alcohol in systemic hypertension is an important modifiable risk factor in recent decades (Skliros et al., 2012). For individuals who drink alcohol, they should limit alcohol consumption to no more than two drinks per day for men and one drink per day for women based on JNC-7 (Chobanian et al., 2003). Also, available evidence strongly supports that moderate alcohol consumption among people who still drink alcohol is an effective approach to lower blood pressure (Appel et al., 2006). Moderate alcohol intake based on the American Heart Association 2006 scientific statement of hypertension management is defined as a maximum of 2 alcoholic drinks per day in men and 1 alcoholic drink per day in women (Appel et al., 2006). The reduction in systolic blood pressure that is achieved with moderation of alcohol consumption have averaged 2 to 4 mmHg (Chobanian, 2009; Chobanian et al., 2003). Also, it is important to note that 1 drink is equal to 12 ounce of regular beer, 5 ounce of wine (12% alcohol) (Appel et al., 2006).

Adherence to follow-up visits. General hypertensive patients should regularly keep appointments for follow-up visits for evaluating health and treatment outcome. The guideline from JNC-7 recommends for patients with stage 2 hypertension, who usually have complications, should have serum creatinine and potassium monitored at least 1-2 times a year. Also, for achieving the optimal goal of blood pressure control, the duration period of follow-up visits should be adjusted to around 3 to 6 month intervals depending on blood pressure levels (Chobanian et al., 2003).

Adherence to stress management. Many studies have well established that having an effective stress management technique is essential for hypertensive individuals to

reduce their blood pressure level. For instance, Dusek et al. (2008) conducted an RCT study for examining the effect of stress management and lifestyle modification on systolic hypertension and medication elimination in American hypertensive patients aged ≥ 55 years. The study was found that experimental patients who were engaged in the program which include stress management, specifically relaxation response training and lifestyle modification for 8 weeks significantly decreased both systolic blood pressure of 9.4 mmHg and diastolic blood pressure of 1.5 mmHg ($p < 0.0001$). Also, patients who were trained in the relaxation program were more likely to successfully eliminate an antihypertensive medication (OR = 4.3, 95% CI = 1.2-15.9, $p < .03$). It can be noted that stress management decreased both systolic and diastolic blood pressure. Therefore, stress management is an important method for elderly with hypertension to control blood pressure. The Department of Mental Health (1999) has recommended many techniques for the hypertensive persons which consist of long deep breath both exhalation and inhalation until lungs expanding fully, reducing stress by sharing feeling with close persons, doing activities which diminishes stress such as gardening, doing handicraft work and listening to soft music or Buddhist teaching, also performing muscles stretching extremities for a short duration around 5 to 10 seconds.

In conclusion, adherence to lifestyle modification is essential for older adults with hypertension, because it can improve blood pressure control, reduce the use of antihypertensive drugs and enhance the efficacy of antihypertensive drugs. The benefits of adherence to lifestyle modification in hypertensive patients lead to crucial health outcomes, particularly prevention of severe complications from high blood pressure such as cardiovascular disease, stroke and kidney failure and also result in a lower cost of treatments and lower rate of hospitalizations.

Measuring Adherence

Measuring adherence to treatment does not have gold standard scales for adherence evaluations. Some studies have suggested using combined methods for accurately measuring adherence and giving the most benefits for patients (Vitolins, Rand, Rapp, Ribisl, & Sevick, 2000). The methods for measuring adherence include both direct and indirect measurement and some methods have difference both advantages and limitations (Hawkshead & Krousel-Wood, 2007; Osterberg & Blaschke,

2005). The benefits of direct measurement which is mostly evaluated from laboratory detection of drug throughout specimens with urine or blood are accurate and reliable data. However, the direct methods are less practical in outpatient's hypertension clinic for monitoring adherence to medication, because hypertensive patients require taking medication in daily dose of drugs for a long-term period rather than days or weeks. Also, the direct methods are more expensive and complicated process for health care providers (Hawkshead & Krousel-Wood, 2007). The indirect methods are the first step for developing an understanding of poor patients' adherence behaviors and also preventing the problems of uncontrolled blood pressure and negative health outcomes (Hawkshead & Krousel-Wood, 2007). Mostly, the indirect method measuring adherence to treatment using self-reporting is available evaluation of adherence because of having more simplicity, convenience and economical cost. While, the limitations of self-reporting of adherence to regimens include recall bias and reporting with over estimation which lead to under estimate evaluation of adherence scales (Hawkshead & Krousel-Wood, 2007). Two indirect methods for measuring adherence regardless in self-report which are used worldwide because of being short and easy to answer are the Morisky Medication Adherence Scale (MMAS) and the Hill-Bone Compliance to High Blood Pressure Therapy Scale (Hill-Bone-Scale) (Hawkshead & Krousel-Wood, 2007; Koschack, Marx, Schnakenberg, Kochen, & Himmel, 2010; Krousel-Wood, Muntner, Islam, Morisky, & Webber, 2009; Morisky, Ang, Krousel-Wood, & Ward, 2008). The instruments are presented as follows:

1. The Morisky Medication Adherence Scale (MMAS) is a self-report medication adherence scale consisting of 8 items which are used for measuring medication adherence among hypertensive outpatients. The answer to each question is a dichotomous response (yes or no) for each item and a 5-point Likert scale response. The Likert score has a range of 0-8 and divided into 3 levels including high adherence (score 8), medium adherence (score 6 to <8) and the low adherence (score <6). The psychometric properties are acceptable. The reliability of the scale is 0.83 and also the scale was significantly associated with blood pressure control in hypertensive patients ($p < .05$). When using the cutoff point of scores less than 6, the sensitivity and the specificity of this scale were 93% and 53% respectively (Morisky et al., 2008).

2. The Hill-Bone Compliance to High Blood Pressure Therapy Scale. The Hill-Bone-Scale is used for evaluating adherence behaviors to therapeutic regimens in hypertensive patients. This scale consists of 14 items and is divided into three main parts: reduced sodium intake (3 items), appointment keeping (2 items), and medication taking (9 items). The response is a four point Likert typescale with each item having a response ranging from 1 (none of time) to 4 (all of time). When summed, the total score has a range from 14 (minimum) to 56 (maximum). The internal consistency reliability which reports with the alpha coefficient was 0.85. (Kim, Hill, Bone, & Levine, 2000).

In Thailand, the Hypertensive Adherence to Therapeutic Regimens Scale (HATRS) is only one inventory developed by Pinprapapan (2013). This scale is developed based on attributes of adherence (Cohen, 2009). It is used for measuring both adherence to medication and lifestyle modification in hypertensive patients. The scale is comprised of 29 items with four attributes, including alignment of patients' behaviors and recommendations (16 items), mastery of new behaviors (4 items), ongoing collaboration with health care providers on a treatment plan (7 items) and patients' perceived ability to meet optimal blood pressure (2 items). Each item will have a response on a 4 point-Likert scale ranging from 1 (not true) to 4 (strongly true). The total score ranged from 29-116. A higher score level means a higher level of adherence to therapeutic regimens. The psychometric properties were acceptable. Five experts approved the content validity and the value of SCVI was 1.00. The internal consistency reliability using the Cronbach's alpha coefficient was .92.

Measuring adherence to treatment in hypertensive patients based on the definition of adherence from WHO and the attributes of adherence given by Cohen (2009) is recognized in most term adherence. However, the two first instruments are not used to measure all the main attributes of adherence, especially the mutual agreement of recommendations between patients and health care providers, mastery of new behavior and health knowledge, ongoing collaborative relationship between the patient and health care providers, and their perceived ability to meet the outcome targets. Thus, for achieving the health outcome of enhancing adherence to antihypertensive regimens in elderly patients, all attributes of adherence should be measured in terms of adherence to medication and lifestyle modification.

Model and Related Factors of Adherence to Therapeutic Regimens Among Older Adults with Hypertension

Model of adherence. According to the literature review for this study, the existing development model of adherence to therapy can be described by four models, including The Five Dimension Model of Adherence, Johnson's Medication Adherence Model, The Hill-Levine Model and Medication Adherence Model by Park and Jones. These models are described in details as follows:

The five dimension model of adherence. This model developed by WHO (2003) explains factors affecting adherence to therapeutic regimens widely covering chronically ill patients. It is classified into a cluster of five factors relating to adherence to treatment in chronically ill patients.

1. Social and economic factors are defined as demographic or personal factors that may affect adherence to therapy such as family income, educational level, responsibility and social status. These factors are differentiated in aspects of social or cultural in individuals that may influence adherence to treatment. Health care providers may evaluate patient's adherence by considering these factors in order to concur with improving adherence to regimens.

2. Health care team and system-related factors are recognized as one set of factors related to patient's adherence to regimens, especially communication between patients and health care providers, which many studies have well documented significantly affecting adherence to treatment. These important factors affecting adherence such as a lack of knowledge and training treatment management of health care providers, giving a short time for consultations, and lack of training in changing behavior of nonadherent patients should be considered in developing a program enhancing adherence to therapy.

3. Condition-related factors refer to being faced with illness in patients that affect adherence to treatment, especially patients suffering from a severe level of illness or disability. This set of factors may affect a patient's nonadherence, mainly not keeping follow-up appointments and stop taking prescribed medications which are the leading cause of undesirable health outcomes.

4. Therapy-related factors mostly concern patients who have experienced negative treatments such as side effects of medication, and previous treatment failure. Also, the complexity of regimens strongly affects adherence to treatment.

5. Patients-related factors represent the resources, knowledge, attitudes, beliefs, perceptions and expectations of the patient which are the set of factors mostly related directly patients. These factors can be modified by health care providers.

This model is not possible to clearly indicate directly and indirectly predicting factors of adherence to regimens especially focused on older adults with hypertension. Also, some factors cannot be adjusted only by nurses' role such as socioeconomic factors, condition-related factors, and therapy-related factors. However, two out of five dimensions including patients-related factors and health care team- related factors, it can be claimed widely that these dimensions affect adherence to therapy in several chronic diseases such as hypertension, diabetes and cancer. The dimension of patients-related factors normally includes knowledge, attitudes, beliefs, perceptions, forgetfulness, expectations of the patient, and physical function which are the set of factors mostly and directly affected patients. These factors may have a direct effect on adherence to therapeutic regimens among older adults with hypertension. Focusing on dimension of health care team- related factors, this dimension is well documented that having good patient-provider relationship may improve adherence to therapeutic regimens in chronically ill patients by increasing patient's trust, satisfaction, and confidence to perform adherence behavior (WHO, 2003).

The Hill-Levine model. This model was developed from Green and Krueter's PRECEDE-PROCEED consisting of the predisposing factors or personal factors which are related to hypertensive patients such as income, educational level, knowledge and belief, the enabling factors focusing on interpersonal factors such as health care resources, health care insurance, and regular treatment of physician, and the reinforcing factors or environmental factors such as social support from family and friends (Fongwa, Evangelista, & Doering, 2006). This model has focused on sets of factors influencing adherence to therapeutic regimens including personal, interpersonal and environments factors which may be helpful to develop intervention for enhancing adherence behaviors in older adults with hypertension. However, this model has a

limitation in describing factors directly and indirectly predicting adherence to treatment among older adults with hypertension. Moreover, some parts of interpersonal factors are not able to be managed by nurses only, especially health care insurance, physician's treatment, and health care resources which depend on collaboration among multidisciplinary health care team.

The Johnson's medication adherence model. It was developed by Johnson (2002) based on the process of medication adherence among hypertensive patients. This model has demonstrated two critical components of medication nonadherence, including intentional nonadherence and unintentional nonadherence. Also, this model is proposed into three core constructs that is a prolonged response to antihypertensive medication adherence which are described as follows:

1. Purposeful action is the first intentional decision-making of patients before performing health behaviors in taking antihypertensive medication for blood pressure control.
2. Patterned behavior leads to development of regular use of antihypertensive medication behaviors and also having multiple tips for reminding patients to take medication.
3. Feed back is the way to motivate patients to have the intention to take medication and also indicate sustainable patient taking medication behavior.

This model specifically determines patient-related factors affecting medication adherence among persons with hypertension which may be able to evaluate and manipulate by the nursing role. However, this model has the significant limitation of emphasizing only adherence to medication related to patient's reasons for performing taking medication behavior which does not focus on adherence to lifestyle modification.

Medication adherence model by Park and Jones (1997). This model has described adherence to medication only for elderly persons who have some limitations in cognitive function and physical function rather than younger adults. The model has explained the poor adherence to taking medication among elderly people resulting from various reasons such as neglecting some medication doses, taking the extra doses or extra quantities within dose, taking medication with improper time, and skipping in

following medication instructions. This model has proposed three main constructs directly predicting medication adherence among older adults that may lead to their health and well-being, including illness representation (beliefs about the usefulness of medication), cognitive function (consisted of comprehension, working memory, long-term memory and prospective memory) and external cues (social support in home, reminder devices, or medication organizers) (Park & Jones, 1997). This model recognizes in factors specifically affecting medication adherence in older adults mainly, cognitive function and physical function which are different from adults. However, it is used to explain only the phenomenon of medication adherence and is not able to support adherence to therapeutic regimens among older persons with hypertension who have to perform both adherence to medication and lifestyle modification.

An adequate proper adherence to therapeutic regimens among older adults with hypertension should focus on both adherence to medication and lifestyle modification. To achieve the optimal goal for blood pressure control in these groups, it is important to better understand the factors related to adherence to therapeutic regimens in order to tailor appropriate interventions for enhancing adherence in older adults with hypertension. All models above are useful for underpinning to determine factors affecting adherence to therapeutic regimens among older adults with hypertension which most factors from those model are similar to the five dimension model of WHO (2003).

Thus, several factors related to adherence to therapeutic regimens among older adults with hypertension in this study are based on the five dimension model of adherence of WHO (2003). These factors are described as follows:

Social and economic factors.

Age. Age is one of factors affecting adherence to therapeutic regimens in many studies related to health behavioral changes in chronically ill patients such as hypertension. Most studies have documented that older age patients are more likely to be adherent than younger age (Edo, 2009; Maeda et al., 2013; Taira et al., 2007; Vawter, Tong, Gemilyan, & Yoon, 2008). Whereas, some studies have been revealed that younger age patients (less than 60 years) are more likely to be adherent than older age (above 60 years) (Lee et al., 2013; Yiannakopoulou, Papadopulos, Cokkinos, &

Mountokalakis, 2005). In addition, several findings have demonstrated that age is not significantly correlated with adherence to treatment mainly adherence to hypertensive regimens (Kim et al., 2007; Naewbood, 2005; Schutte, 2006; Turner et al., 2009; Zabihi, Ashktorab, Banaderakhshan, & Zaeri, 2012). As well, some studies have shown that mostly older persons are less adherent than younger (Benner et al., 2002; Elliott et al., 2007). From these empirical evidences, it can be concluded that the relationship between age and adherence to therapy is inconsistent.

Gender. The results from various studies have shown gender differences were likely to correlate with adherence to therapeutic regimens of hypertension. However, this relationship between gender and adherence was inconsistent (Park, Kim, Jang, & Koh, 2012). Various empirical evidence from research studies have been reported that gender was not significantly associated with adherence to antihypertensive medication (Hekler et al., 2008; Heymann, Gross, Tabenkin, Porter, & Porath, 2011; Krousel-Wood et al., 2010; Levesque et al., 2012; Limcharoen, Masingboon, & Kunsongkeit, 2007; Turner et al., 2009; Vawter et al., 2008). Moreover, most studies focused on factors related to adherence to hypertensive treatment have shown that females were more likely to be adherent to regimens compared to males (Trivedi, Ayotte, Edelman, & Bosworth, 2008; Warren-Findlow et al., 2012). From these studies, it can be concluded that gender is the inconsistent factor affecting adherence to hypertensive treatment.

Income. Income is the one of demographic significant factors affecting adherence to treatment among chronically ill patients. Numerous studies have well documented that being economically disadvantaged, mainly lower income, is an important barrier leading to poor adherence and adverse health outcomes (Mishra, Gioia, Childress, Barnet, & Webster, 2011). Some studies have reported that higher income had a significant correlation with antihypertensive medication adherence (Hussain, Boonshuyar, & Ekram, 2011; Kim et al., 2008). However, the relationship between income and adherence to hypertensive treatment is unpredictable. Many studies related to factors affecting antihypertensive medication reported that income was not correlated with medication adherence (Braverman & Dedier, 2009; Schoenthaler, Chaplin et al., 2009; Schoenthaler, Ogedegbe, & Allegrante, 2009). It can be noted that the relationship

between income and adherence to treatment among hypertensive patients is inconsistent.

Marital status. In general, hypertensive patients living with their spouse are more likely to be adherent than single patients. It may be implied that assistance or support from their spouse may lead to increased patients' adherence to regimens (Okoro & Ngong, 2012). Some studies have shown that being married was associated with improved adherence to antihypertensive therapeutic regimens (Morris et al., 2006; Krousel-Wood et al., 2011) and adherence to treatment among diabetic patients (Shams & Barakat, 2010). However, regarding studies in medication adherence, one study has reported no significant relationship between marital status and medication adherence among persons with hypertension (Hadi & Rostami-Gooran, 2004), whereas one study has found that unmarried persons were correlated with poor compliance with lipid-lowering medications (Kaplan, Bhalodkar, Brown, White, & Brown, 2004). Marital status has incoherent correlation with adherence to treatment in some studies. Thus, this variable may not be a good predicting factor of adherence for this study.

Educational level. Among chronically ill patients who are well educated, from hierarchical education starting from primary school until university, are more likely to be adherent to therapeutic regimens because of the greater availability to access health care services and information. Some studies have been shown that a high educational level is significantly associated with better adherence to antihypertensive medications (Hashmi et al., 2007; Kim et al., 2008; Lowry, Dudley, Oddone, & Bosworth, 2005; Taira et al, 2007; Yiannakopoulou et al., 2005). In contrast, some studies have not found a relationship between educational level and adherence to antihypertensive treatment (Heymann et al., 2011; Huther et al., 2013; Natarajan, Putnam, Aarsen, Lawson, & Burge, 2013; Vawter et al., 2008; Zabihi et al., 2012). Educational level is not steady in its relationship with adherence to hypertensive regimens among hypertensive patients.

Condition-related factors.

Number of illnesses or comorbidity. In general, older adults are suffering from multimorbidity because of advancing age. Also, many older adults with multiple comorbid conditions are well documented as chronic disease, and also often tend to use many types of medication for proper treatment (Corsonello et al., 2010; Gellad,

Grenard, & Marcum, 2011). Many studies demonstrate that among hypertensive patients with multiple chronic diseases there is more likely to be a gradual decreased adherence to antihypertensive treatment (Benner et al., 2002; Hashmi et al., 2007; Lagu et al., 2009; Taira et al., 2007). However, the relationship between comorbidity and medication adherence is not constant in some studies. Some studies have found that comorbidities are not associated with antihypertensive adherence (Hadi & Rostami-Gooran, 2004; Inkster, Donnan, MacDonald, Sullivan, & Fahey, 2006; Lagu et al., 2009; Schoenthaler, Chaplin, et al., 2009; Schoenthaler, Ogedegbe, et al., 2009). Notably, it can indicate that the correlation between the number of illness and adherence to antihypertensive medication has not exactly determined its direction.

Depression. Depression is generally one of the factors affecting adherence behavior among elderly persons with chronic disease such as hypertension. The type of depression of elderly people, aged 65 years and older, is commonly reported as the late-life depression which refers to depressive syndromes. Thus, patients who are diagnosed with depressive syndromes are more likely to have depressed moods or loss of interests or pleasure (Alexopoulos, 2005). Several current studies are focused on patients with depressive symptoms affecting adherence to therapeutic regimens. Notably, depression is a significant barrier to adherence to treatment leading to a poorer health outcome among chronically ill patients, mainly in older people. It should be detected early, before prescribed treatment or medication (Grenard et al., 2011). Many studies have been well documented in the literature that depressive symptoms among hypertensive patients are related to lower adherence to therapeutic regimens (Morris et al., 2006; Krousel-Wood et al., 2009; Krousel-Wood et al., 2011; Turner et al., 2009). The depressed elderly patients are more likely to have worse adherence to antihypertensive therapeutic regimens. However, some studies have not found this relationship. It may be concluded that depression has an inconsistent correlation with adherence to therapy and should be examined in further study.

Therapy-related factors.

Number of pills taken each day or polypharmacy. Polypharmacy usually has a negative effect on patient adherence to treatment due to complicated treatment contributing its difficulty of understanding and organizing their scheduled regimens

(Munger, van Tassell, & LaFleur, 2007). Moreover, several studies have documented that among hypertensive patients taking fewer prescribed medications are more likely to be adherent than those taking various medications (Chapman, Petrilla, Benner, Schwartz, & Tang, 2008; Fung, Huang, Brand, Newhouse, & Hsu, 2007; Gazmararian et al., 2006). However, some studies revealed that increasing the number of antihypertensive drugs was significantly associated with improving medication adherence (Foder et al., 2005; Hashmi et al., 2007; Natarajan et al., 2013; Okoro & Ngong, 2012; Sung et al., 2009). In addition, numerous studies have shown inconsistency of the correlation between the number of medications and adherence to hypertensive therapeutic regimens.

Regimen complexity. Regimen complexity defined by George, Phun, Bailey, Kong, and Stewart (2004) refers to the variety in the medication regimen including dosage forms, doses frequency, and additional instructions. Similar to Stone et al. (2001) who defined regimen complexity as the multiple characteristics of the prescribed regimen, including the number of different medications, the number of daily dose, the number of pills per dose, and the total number of daily pills. In addition, a significant component of medication complexity consists of both dosing frequency and a variety of dosage forms (Libby et al., 2013). Some studies have demonstrated that taking fewer hypertensive pills daily dose or reducing complex regimens is significantly associated with increasing patient' s adherence to medication (Hassan et al., 2006; Lin et al., 2007; Stoehr et al., 2008; Tepsuriyanont, 2010). Thus, prescribed medication among elderly people, mostly having cognitive function impairment, should be tailored with simplification of their complex medication regimen (Mansur, Weiss, & Beloosesky, 2012).

Number of side effects. In general, among chronically ill patients who are taking medication tend to suffer from side effects of the drugs. Number of side effects refers to the unintentional effects from medications that are a significant barrier to a patient's adherence (Johnson, 2011). Some studies have shown that side effects of medications among chronically ill patients had a significant association with adherence to medication (Carpenter et al., 2010; Lam, Lum, & Leung, 2007; Okoro & Ngong, 2012). However, one study has reported that the number of side effects had no significant

relationship with antihypertensive medications (Limcharoen et al., 2007). Regarding the literature review, some studies have shown both a relationship and no relationship between the number of side effects and medication adherence. It can be noted that number of side effects are inconsistent with adherence to antihypertensive medication.

Follow-up interval. The schedule of clinical appointments is a significant strategy of a chronically ill patient's treatments particularly leading to improve favorable health outcomes (Ogedegbe, Schoenthaler, & Fernandez, 2007). In general, treatment for chronically ill patients requires long-term follow-up visits. It is also necessary for hypertensive patients who require lifelong performing adherence to therapeutic regimens, mainly medication taking, regular follow-up visits, and lifestyle modification (Chobanian et al., 2003). These activities are an important benefits of continuous follow-up visits, including reminding patients regularly and continuously taking medications (Hadi & Rostami-Gooran, 2004), maintaining patient's lifestyle modification (Harris, Oelbaum, & Flomo, 2007), and enhancing the relationship between health care providers and patients (Parker et al., 2012).

Duration of therapy. Duration of therapy is one of the factors related to adherence to antihypertensive treatment. Many studies have found that hypertensive patients with long-term treatment are more likely to be adherent to prescribed hypertensive treatment (Edo, 2009; Hyre, Krousel-Wood, Muntner, Kawasaki, & DeSalvo, 2007; Lee et al., 2013). Also, patients who were diagnosed with hypertension less than ten years are more likely to have poor medication adherence (Hyre et al., 2007). It can be noted that the factors of long-term duration of therapy include gaining more patient's experience with their disease and its therapy, having a good relationship between patients and health care providers and increasing hypertension knowledge lead all to improve patient's adherence (Lee et al., 2013). However, one study has found no relationship between duration of hypertension and medication adherence (Natarajan et al., 2013). Thus, the correlation between duration of therapy and adherence to hypertensive regimens is not consistent.

Concerning factors associated with adherence to antihypertensive therapeutic regimens among older adults with hypertension in above, it was found that most of factors are non-modifiable factors which cannot be modified by health care providers.

The non-modifiable factors include demographic factors, condition-related factors and factors related to medical therapy. Moreover, these factors also have an inconsistent relationship with adherence to therapeutic regimens. Because of having the various outcomes of behavioral studies related to factors affecting adherence to therapy, it is impossible to devise proper management covering all these factors (Leventhal, Weinman, Leventhal, & Phillips, 2008).

Therefore, achieving a desirable intervention for controlling blood pressure and its complications among older adults with hypertension should firstly be narrowly focused on factors affecting adherence behaviors to therapeutic regimens and then considering factors directly or indirectly influencing adherence behaviors which can be tailored by the health care providers. This study will choose the specific factors that are well established as affecting adherence to therapeutic regimens among older adults with hypertension and can be tailored by the health care team leading to effectively improving adherence to regimens of both medication use and lifestyle modification. These factors consist of ten significant factors based on the five dimensions model of WHO (2003) including, cognitive function, physical function (IADLs), knowledge about hypertension, perceived susceptibility, perceived severity, perceived benefits, and perceived barriers (health belief), perceived self-efficacy to adherence, social support from family, and provider-patient communication. These factors can be described as follows:

Cognitive function. In general, cognitive function is reduced mostly in older adults rather than adult persons. Numerous studies have documented that advancing age is associated with changing cognitive function such as cognitive impairment (Barclay et al., 2007; Miller, 2004; Okuno, Yanaki, & Tomura, 2001; West, Jakubek, & Wymbs, 2002). It is important to note that cognitive function is related to advancing age, because advanced age can affect the central nervous systems which serve up basic information from cognitive function (Miller, 2004). The nature of older adults is more likely to have cognitive function impairment rather than younger adults. The most significant risk factors affecting medication adherence among older adults is cognitive impairment (Okuno et al., 2001). Also, much evidence from several studies has claimed that patients having cognitive impairment, particularly in older adults, often lead to

forgetfulness and poor medication adherence or non-medication adherence (Johnson, 2011; Okuno et al., 2001; Salas et al., 2001; Vawter et al., 2008). Notably, enhancing adherence to therapeutic regimens in elderly population should firstly focus on their cognitive function. Thus, it is reasonable to evaluate cognitive function among older adults with hypertension before providing them with several interventions.

Cognitive function refers to the process by which information is acquired, stored, shared and used including significant intellectual tasks such as thinking, remembering, perceiving, communicating, calculating, and problem solving (Bunten, 2001). Also, Park and Jones (1997) have described the component of cognition function that include comprehension, working memory, long-term memory, and prospective memory which can predict medication adherence. Moreover, the key domains of cognitive function which mostly concern management by health care providers are verbal learning, immediate memory, and delayed verbal memory (Hawkins et al., 2012). As well, it consists of remote memory, orientation, immediate memory, attention, general knowledge, language, abstract thinking, judgment and calculation (Jitapunkul et al., 1996). Thiruchselvam et al. (2012) stated that cognitive function was the major risk factor for medication nonadherence and was commonly examined with two components of cognitive function domain including executive function composed with the ability to prioritize, plan, and organize tasks and memory which referred to the ability to recall information. Cognitive function is a significant process including verbal memory, working memory, processing speed, and reasoning is the vital task of patients for adherence to therapeutic regimens requiring multiple of complex cognitive skills which include accessing medication, understanding the directed prescription, the medication schedule of daily life activities, planning continuous access to medication through acquisition of refills, and the solution of the problem of missed medication doses (Campbell et al., 2012).

From previous studies, it is a well documented that cognitive function is one of key factors affecting medication adherence among older adults, especially its relation with three main sectors including memory, comprehension, and cognitive impairment (Schlenk, Dunbar-Jacob, & Engberg, 2004). When patients take medication they must be given the good advice from health care providers and keep their understanding about

the medication regimen, such as time to take medication, side effects from those medications, and how to deal with them when facing some problems (Van Viet, Schuurmans, Grypdonck, & Duijnstee, 2006). Currently, many studies have investigated cognitive function which result in prospective memory influences significantly medication adherence in a variety of chronically ill patients (Zogg, Woods, Sauceda, Wiebe, & Simoni, 2012). Prospective memory refers to an innovative cognitive construct describing one's ability to remember to do something at a later time (Zogg et al., 2012). Therefore, it is important to note that cognitive function is one of the significant factors contributing to adherence to regimens among the elderly with a chronic disease such as hypertension.

WHO (2003) indicated that one of several factors affecting older people resulting in poor adherence is cognitive function impairment. The impacts of cognitive impairment on individuals may affect them throughout their daily life, including the ability to make decisions, an individual's comprehension with guideline of treatment for which they must give consent before therapy, misunderstanding with given health educational interventions because of a lack of translation and storage information, and performing adherence to therapeutic regimens involved medication and lifestyle modifications (Pereira, Weiner, Scott, & Sarnak, 2005). Osterberg and Blaschke (2005) indicated that cognitive impairment had a strong negative effect on medication adherence. Furthermore, patients with cognitive impairment have a risk of high nonadherence to regimens almost three times compared to those with normal cognitive function (Okuno et al., 2001).

Cognitive function and medication adherence. Many studies have reported about cognitive function, especially cognitive impairment having a significant effect on adherence to therapeutic regimens, especially medication among chronically ill older persons (Campbell et al., 2012; Insel, Morrow, Brewer, & Figueredo, 2006; Stilley, Bender, Dunbar-Jacob, Sereika, & Ryan, 2010; Stoehr et al., 2008; Thiruchselvam, et al., 2012). While numerous studies regarding cognitive function have been associated with medication adherence in chronically ill patients, few studies have been only focused on the relationship between cognitive function and medication adherence among older adults with hypertension.

Cognitive function is commonly a concern for older persons, particularly memory problems. Schutte (2006), who focused on the correlation between medication adherence and neuropsychological functioning in the elderly persons aged 60 and over, reported that retrospective memory was significantly related to medication adherence ($r = .415$, $p < .05$). Tepsuriyanont (2010) found that cognitive function has a positive direct effect on medication adherence behavior ($\beta = .32$, $p < .001$) in older adults with hypertension. This study was concluded that the greater cognitive function, the better the adherence to antihypertensive medication. Moreover, several studies mostly confirmed the effect of cognitive impairment on medication adherence. Hawkins et al. (2012) found that heart failure elderly patients with cognitive impairment had a statistically significant association with poor medication adherence (OR = 2.03, CI 1.20-3.45, $p = .009$). Also, hypertensive patients with cognitive impairment were related to the poor compliance with antihypertensive treatment significantly (OR= 0.53 95% CI = 0.37-0.75, $p < .05$) (Vinyoles et al., 2008).

Cognitive function and adherence to lifestyle modification. This study indicated that hypertensive patients who have cognitive impairment tend to have poor medication compliance. Most studies focused on cognitive function and adherence to medication among patients with chronic disease. For instance, Carpenter (2008), who studied the relationship between cognitive appraisal of perceived threat of illness and adherence to self-management behaviors among persons with type 2 diabetes aged 23 to 64 years, found that cognitive appraisal was as a predictor in the adherence to diet self-management ($R^2 = .36$, $p = .004$). Also, a qualitative study which focused on barriers to and facilitators of self-management adherence in Korean older adults with type 2 diabetes found that limited-cognitive function was a significant barrier to adherence to self-management among older adults with diabetes (Song, Lee, & Shim, 2010).

In summary, several studies have found cognitive function related to adherence to therapeutic regimens among older adults with chronic disease such as hypertension. However, there are fewer previous studies which focused on cognitive function directly or indirectly affecting adherence to therapeutic regimens among older adults with hypertension. In addition, one study found that cognitive function had an indirect positive effect on self-management behavior which composed of adherence to

medication and self-care among the elderly with chronic kidney disease through self-efficacy (Sritarapipat et al., 2012). Also, Tepsuriyanont (2010) demonstrated that cognitive function had a significant positive direct effect on medication adherence behavior. It can be noted that the hypertensive elderly patients with cognitive impairment had a high risk of poor adherence to therapeutic regimens. Thus, cognitive function is one of the factors that may influence adherence to therapeutic regimens among older adults with hypertension and it will be adopted in the hypothesized causal model for this study.

Measurement of cognitive function among older adults with hypertension. Measuring cognitive function is accomplished with several important methods as follows:

The Mini Mental State Examination (the MMSE). The MMSE is widely used as an assessment tool for cognitive function or impairment screening test developed firstly by Folstein in 1975. The MMSE has 30 items (range from 0-30, and scores < 24 are suggestive of cognitive impairment), divided into two parts, for the assessment the cognitive function (Folstein, Folstein, & McHugh, 1975). The first section includes vocal responses only and covers orientation, memory, and attention which has a top score of 21. Another part includes the ability to name, follow verbal and written commands, write a sentence spontaneously, and copy a complex polygon similar to a Bender-Gestalt Figure with a maximum score of 9 (Folstein et al., 1975). The MMSE scores naturally decline with advancing age. Some authors have accepted the cut-off scores for elderly persons as low as 20 or less an indicating cognitive impairment (Woodford & George, 2007). The validity and reliability are acceptable. The validity was determined by the mean of concurrent validity which compared the scores to both the Wechsler Adult Intelligence Scale (WAIS) including verbal and performance scores in the group of selected patients. The results demonstrated a statistically significant relationship between the MMSE versus WAIS throughout verbal ($r = 0.776$, $p < 0.0001$) and performance ($r = 0.66$, $p < 0.001$). The reliability is determined by the means of test-retest which is reliable on 24 hr or 28 day retest by single or multiple examiners with the high correlation by a Pearson coefficient was 0.887 (Folstein et al., 1975).

The Chula Mental Test (CMT). This inventory is used for evaluating cognitive function of Thai older persons and is also widely used in South and Southeast Asian countries. It is a very suitable instrument to use to test people who have some reading and writing problems and is also used for people having visual impairment in the near future (Jitapulkul et al., 1996). The CMT, developed by Jitapunkul and his colleagues, contains 13 items with the domains of cognitive functions, including age (remote memory), time (orientation), registration of three things (immediate memory/attention), month (orientation), person (orientation), basic knowledge (general knowledge/remote memory), do follow (language), proverb (abstract thinking), speak follow (language), decision making at some situation (judgment), count 10 to 20 (attention), naming objects (language/remote memory), and subtraction (attention/calculation) (Jitapulkul et al., 1996; Tepsuriyanont, 2010). The response to items is on a dichotomous scale which is coded as 1 (correct) and 0 (incorrect). Also, other items were added with sub-scales: item 5 and item 12 had two sub-scales, and item 3 and item 13 had three sub-scales. The total score has a range of 0-19 score. The interpretation of the cognitive function's scores are divided into four categories, including normal cognitive function (scores 15-19), mild cognitive impairment (scores 10-14), moderate cognitive impairment (scores 5-9), and severe cognitive impairment (scores 0-4) (Jitapulkul et al., 1996; Tepsuriyanont, 2010).

The validity of the CMT was conducted with both concurrent validity and criterion validity. The concurrent validity was applied to 212 home-dwelling elder persons in Bangkok and simultaneous tests for comparison of the concurrent validity with others significant cognitive function tests including the Mini-Mental State Examination (MMSE) and the Abbreviated Mental Test (AMT). The results showed that the CMT had a strongly significant correlation with the MMSE (r = .78) and the AMT (r = .75). The criterion validity was also tested by detection of clinically diagnosed dementia patients with a sensitivity of 100% and a specificity of 90%. Further, the reliability was examined by two means including test-retest with Kapa coefficient statistical analysis and internal consistency (Chronbach's alpha). The CMT was acceptable in both Kappa coefficient and Cronbach's alpha with 0.65 and 0.81 respectively (Jitapulkul et al., 1996).

Measuring cognitive function in the older adults with hypertension in this study used the Chula Mental Test (CMT) because this inventory is used widely for evaluating the cognitive function of Thai older persons and also has acceptable reliability and validity. This scale has high sensitivity to measure cognitive function in older people with hypertension.

Physical function. Physical function, related to functional performance, is one of the key domains of functional status. Commonly, it refers to the extent to which persons can accomplish the needed basic specific task or activity in daily life. It includes the important tasks of daily life such as basic activities of daily living (BADL) and instrumental activities of daily living (IADL) (Leidy, 1999; Painter, 2005). ADLs refer to the basic tasks of everyday life, such as eating, bathing, dressing, toileting, and transferring (Wiener et al., 1990). Most commonly measuring physical function is assessed through basic task of daily life or BADLs of individuals (Cohen & Marino, 2000; Tanner, 2004). Further, BADLs has been developed primarily in order to assess physical function called the Katz index (Cohen & Marino, 2000). This index was designed to measure the ability of individuals to perform independence in their basic day to day activities. It is also used to assess BADLs among elderly people and chronically ill patients in several settings such as hospitals, nursing homes and communities (Cohen & Marino, 2000). The other physical function is IADLs which deal with more complicated activities in daily life than BADLs, including handling personal finances, cooking, shopping, traveling, doing housework, using the telephone, and taking medication (Cohen & Marino, 2000; Graf, 2008; Lawton & Brody, 1969; Tanner, 2004).

In general, persons who suffer from poor physical function such as having a limitation of movement usually have a major problem with inconvenience in their daily activities of living (Chen & Wang, 2007) and may lead to a lack of adherence to both medication and lifestyle modification. Moreover, it has been well documented that advancing age tends to decline physical function and may affect adherence to regimens. Regarding this issue, older adults mostly are at risk for impairment of physical function subsequently reducing medication adherence (Johnson, 2011; Tanner, 2004). Hence, there are various impacts from impaired physical function among elderly persons

reflecting poor adherence to regimens, such as visual impairment making it difficult to correctly read instructions and distinguish between different colors of pills, loss of muscle strength causing difficultly in opening prescription vials and taking medication independently, limitation of movement from physical impairments resulting in difficulty of accessing doctors, and the condition of osteoporosis causing a greater risk for falls (Jin, Sklar, Oh, & Li, 2008; Johnson, 2011).

Notably, advanced age is a significant factor strongly associated with declining physical function or disability reflecting with BADLs or IADLs changing mainly found in elderly population (Caskie, Sutton, & Margrett, 2010; Chen & Wang, 2007; Sjolund, Nordberg, Wimo, & von Strauss, 2010; Tanner 2004). In general, older persons with chronic illness also commonly have comorbidity which leads to loss of independence because of limitation in mobility and losing muscle strength leading to a poor physical function (Ruscin & Semla, 1996; Seeman & Chen, 2002; Tanner 2004). Also, a common problem of multimorbidity in the elderly is significantly related to increased disability, declined physical function and higher mortality (Schafer et al., 2010). One study on the relationship between hypertension and BADLs/IADLs changing among older adults found that the hypertensive older adults with multiple chronic diseases had a significantly predicted limitations of BADL and IADL ($p < .001$) (Caskie et al., 2010).

Thus, older adults with chronic illness such as hypertension have a high risk to nonadherence to their regimens resulting from have poorer physical function. It is important to note that health care providers providing care for older adults with hypertension should usually assess their physical function before treatment in order to improve adherence to therapeutic regimens leading to the achievement of optimal goal.

Physical function and medication adherence. Studies conducted among chronically ill patients have reported that physical function affects adherence to treatment, adherence to self-management, and self-care behavior (Chen & Wang, 2007; Song et al., 2010; Tanner, 2004). Cardenas-Valladoli et al. (2010), who studied medication adherence in homebound elderly people in primary health care, found that hearing impairment, which is a serious limitation of basic ADLs evaluated by Katz Index was most strongly associated with nonadherence to medication (OR = 2.00 95% CI = 1.17-3.40, p = 0.011). Also, Sowapak (2006) who studied factors related to

medication adherence among Thai older adults with hypertension, reported that the elders with IADLs deficit were 2.19 times more likely to have non-adherence to drug regimen than those with normal IADLs.

Physical function and adherence to lifestyle modification. Several studies focused on physical function affecting self-care or self-management in chronically ill patients. One study examined the relationship between physical function and self-care behavior, including medication taking, exercise and join care among older adult patients with rheumatoid arthritis, found that physical function was significantly and positively related to self-care behavior ($r = .27$, $p < .05$) (Chen & Wang, 2007). Also, one qualitative study conducted in Korean older adults with type 2 diabetes, about the barriers and facilitators of self-management adherence, has shown that the biggest barrier contributing to non-performing adherence to self-management, particularly exercise, was joint pain from arthritis caused by declining physical function (Song et al., 2010). Furthermore, Sritarapipat et al. (2012) revealed that physical function was positively and strongly related to self-management behavior (such as self-care) ($r = 0.61$, $p < .01$). This study was also consistent with the study of Sanjaithum (2006) who showed that physical function evaluated through IADLs was positively and significantly associated with the nutritional self-management ($r = .466$, $p < .001$) and also its predictor with the highest power at 21.7% ($p < .001$).

In summary, physical function assessment is important for chronically ill patients, particularly in elderly people. Normally in elderly with chronic diseases such as hypertension, diabetes, chronic kidney disease who do not have complications can independently take care by themselves. Measuring physical function by evaluating IADLs is more suitable than ADLs. The study of Sritarapipat et al. (2012) conducted a causal model of self-management of elderly with pre-dialysis chronic kidney disease found that physical function in IADLs had a direct positive effect on self-management behavior and it also had indirect effect on self-management via self-efficacy. Further, self-efficacy was the mediating factor between physical function in IADLs and self-management. Thus, this study tested the ability of physical function measured by IADLs to predict adherence to therapeutic regimens among older adults with hypertension.

Measurement of physical function. Physical function can be measured by both self-report and directly observed scores in the form of rating scales or direct measurement of physical performance (Blake & O'Meara, 2004). There are many inventories for currently measuring physical function in various patients especially older persons described as follows:

The Modified Barthel Activity of Daily Living Index (MBAI). The Barthel ADLs index was first developed by Mahony and Barthel in 1965 (Carroll, 2011). In Thailand, Jittapunkul et al. (1994) first translated from the modified version to evaluate functional status and self-care abilities through the basic activity daily living among Thai's older persons in several past years (Tepsuriyanont, 2010). The response scores for all items were not equal. They were classified into three parts, depending on the group of items as follows: The groups of grooming and bathing have two responses on 0-1 scale, namely require assistance (0), and being independent. The items related the groups of feeding; toilet use, dressing, climbing stairs, bowels, and bladder continence have three responses on 0-2 scale, specifically complete assistance or total dependence (0), partial assistance (1), and totally independence (2). The other items, composed of transfer and mobility, have four scales on a 0-3 scale, specifically complete dependence (0), a need for more assistance (1), need less assistance (2), and fully independence (3). The total scores range from 0-20. Interpreting of scores was classified into four levels of physical function as follows: absolute dependence (0-4), severe dependence (5-8), moderate to severe dependence (9-11), and mild dependence (over 12).

The psychometric properties of the Barthel index of the Thai version, translated by Jittapunkul et al. (1994), was also acceptable and was widely applied to evaluate ADLs in the Thai elderly population. It was tested for both validity and reliability among Thai elderly people in Bangkok. Construct validity was selected to analyze with a factor analysis which revealed a factor loading of .50 and over. Reliability, conducted with the inter-rater reliability scrutinized by using Kappa coefficients, was 0.79 and repeatability test was 0.68. Also, reliability, calculated by using Chronbach's alpha coefficient from testing with the elderly group aged 60 years living in Bangkok was reported at 0.77. Hence, this inventory may be suitable utility to measure physical function of the Thai elderly population (Jittapunkul et al., 1994).

The Chula Activity of Daily Living Index (CAI). This inventory was developed originally by Lawton and Brody (1969). Jitapunkul, Kamolratanakul, and Ebrahim (1994b) developed primarily this inventory in Thailand from the literature review. The CAI was used for measuring physical function of Thai older people who are living in several settings in both hospital and community. This scale consisted of five items for self rating of the complexity of activities daily life. It was unequal for each item, having either a three point or four point scales. Walking outdoors, having only one item with four responses on a scale (0-3 scale), was coded with the score of incapable of walking (0), using a wheel chair or partial assistance requiring at least two persons (1), walking with help from one person (2), and walking independently by oneself (3). The items, cooking and transportation have three respond scales including inability for any activities (0), partial assistance from another (1), and independently doing by oneself (2). The others, consisting of money exchange and heavy housework, are dichotomous scales with responses for not doing (0), and independent or doing by oneself (1). The total possible scores for this inventory range from 0 to 9 and interpreted by the range of total scores, the higher the total score, the greater the physical function and the lower the total score, the lower the functional ability (Jittapunkul et al., 1994).

This inventory was tested for reliability in 703 Thai elderly people living in KlongToey district, Bangkok, Thailand. The reliability of the CAI was analyzed by both Kappa coefficients of inter-rater reliability and repeat ability tests and it was 0.79 and 0.68, respectively confirming acceptable reliability. The final scales were devided into five domains to measure physical function or screening disability leading to early detection of the important disabilities among Thai or Asian elderly people (Jittapunkul, et al., 1994). Therefore, the reliability from both studies was acceptable for using the CAI adopting to assess physical function of Thai elderly with chronic disease.

In brief, assessment of physical functional in older adults with chronic illness such as hypertension is necessary for early detection of poor physical function or disabilities among older people. In Thai older adults, whether admitted to hospital or living in the community with or without chronic disease, should firstly be concerned with their competence of physical function in order to prevent severity of complications and disabilities. Adequate assessment of physical function for this study used the Chula

Activity of Daily Living Index (CAI) because this scale has suitable psychometric properties and also is used widely for evaluating older people in general.

Knowledge of hypertension. Knowledge of hypertension in older adults with hypertension is important for performing adherence to therapeutic regimens, because hypertension is one of the chronic diseases requiring suitable lifelong self-care, including drug intake and modification of lifestyle. The scope of hypertension knowledge usually encompasses the definition of hypertension, medication treatment and its adherence, lifestyle modification and its adherence, complications, and continuous follow-up visits (Erkoc et al., 2012; Karakurt & Kasikci, 2012; Limcharoen et al., 2007; Saleem et al., 2011). A lack of knowledge among hypertensive patients may negatively influence both their awareness and behavior which is a significant barrier for controlling blood pressure (Erkoc et al., 2012).

The major first step of hypertension knowledge education is accurate assessment individuals' knowledge of hypertension, because usually knowledge of hypertension is a requirement of patients in performing appropriate hypertensive self-care behavior (Han et al., 2011; Kim et al., 2007). However, studies focused on older adults with chronic disease mostly having the consequence of problems resulting from incomplete knowledge of its treatment have found that they did not know the important benefits of the drugs taken to control their disease (Piette & Heisler, 2006).

Hypertensive patients having good hypertension knowledge are more likely to have better medication compliance (Alm-Roijer, Stagmo, Uden, & Erhardt, 2004; Hadi & Rostami-Gooran, 2004). Several studies have found that knowledge of hypertension is related to adherence to treatment. A lower level of knowledge is associated with poorer behavior of medication management, weight and diet control, and decision-making skills of organizing signs and symptoms by oneself (McCabe, Schad, Hampton, & Holland, 2008) and are the significant barriers for medication adherence (Turner et al., 2009). Further, a lack of knowledge of hypertension is one of the critical factors influencing intentional nonadherence to medication among hypertensive patients. Hence, to reduce intentional medication nonadherence, knowledge of high blood pressure management should be increased in order to achieve adequate blood pressure control and prevent overwhelming major complications (Kim et al., 2007).

Although several studies have focused on patients' knowledge of hypertension associated with adherence to treatment for a few decades, outcomes have still been undesirable (Neutel & Smith, 2003; Saleem et al., 2011). Also, many elderly people tend to have more limited knowledge about diseases and treatments than adults because of declining cognitive function such as poor concentration, memory deficits, and dementia (Schutzer & Graves, 2004). Thus, information provided in health education for patients should address the content including their knowledge of the disease and comprehensive knowledge of the taken medication. Moreover, this method should promote active participation of patients in their treatment (Rubin 2005). As well, necessarily given education for hypertension knowledge among chronically ill patients such as hypertension, and cardiovascular disease should include the standard treatment in both medication and lifestyle modification leading to reducing the rate of nonadherence to therapeutic regimens (Alm-Roijer et al., 2004; Alm-Roijer, Fridlund, Stagmo, & Erhardt, 2006; Usan et al., 2009).

Knowledge of hypertension and medication adherence. Knowledge of hypertension has been concerned widely as a significant factor affecting adherence to medication among chronically ill patients with diseases such as hypertension and CHD. According to Karaeren et al. (2009) who explored the effects of content of knowledge on medication adherence and knowledge based predictors of adherence to treatment in hypertensive patients (mean age 57±12 years), the findings have been demonstrated that knowledge-based variables, including knowing the duration for using the medicine (OR = 6.822, 95% CI = .478-31.241, p = 0.075), the reason for using the medicine (OR= 2.828, 95% CI = 1.445-5.543, p = 0.018) are significantly related to the increased rates of adherence. Moreover, Kim et al. (2007) who investigated the correlation between hypertension knowledge and intentional medication nonadherence among Korean Americans found that patients who had a lower level of high blood pressure knowledge were significantly related to intentional medication nonadherence (OR = 0.89, 95% CI = 0.79-0.99). Additionally, the groups of adherent-patient had significantly more knowledge of hypertension than did nonadherent groups (F = 4.074, p = .018). Limcharoen et al. (2007), who studied factors related to treatment among Thai essential hypertensive patients have found that hypertension knowledge is positively and significantly related to medication adherence (r = .185, p < .001). Also, Naewbood

(2005) who investigated the factors related to medication adherence among Thai hypertensive patients has shown that knowledge of hypertension could explain 17.8% of variance in medication adherence ($\beta = 0.433$, $p < 0.001$; $F = 40.156$, $p = 0.001$).

Knowledge of hypertension and adherence to lifestyle modification. Knowledge of hypertension is also an important factor associated with adherence to lifestyle modification. Uzun et al. (2009), who studied adherence to treatment and medication among hypertensive patients (mean age of 56 years and range 20-81 years), revealed that diet-related adherence was significantly related to being informed (OR = 14.477 95% CI = 5.021-41.410, $p = 0.002$). Also, Sanjaithum (2006) who investigated factors influencing nutritional self-management among older adults with diabetes, found that knowledge of diabetes mellitus was positively and significantly related to nutritional self-management ($r = .144$, $p = .029$). Another study on factors determining eating behavior of hypertensive patients (mean age 64 years) found that knowledge of specific hypertensive diet was mutually related to ($r = 0.368$, $p < .01$) and as a predictors ($\beta = 0.196$, $p < .05$) of eating behavior among hypertensive patients (Nangyaem, 2007).

Apart from these literatures, knowledge was also shown in other studies which contributed to factors affecting, directly or indirectly, self-management among diabetes patients. Xu, Toobert, Savage, Pan, and Whitmer (2008), who focused on factors influencing self-management in Chinese type 2 diabetes people, have revealed that diabetes knowledge indirectly affected diabetes self-management through belief in treatment effectiveness and self-efficacy. Furthermore, a study from Sritarapipat et al. (2012) found that knowledge of chronic kidney disease among Thai elderly had a direct effect on self-management behaviors ($p < .05$). Controlling high blood pressure among the elderly with hypertension should be more concerned with hypertension knowledge influencing adherence to therapeutic regimens. Hence, knowledge of hypertension will be included as one of the significant factors affecting adherence to therapeutic regimens for this study.

Measuring knowledge of hypertension. There are two crucial inventories for measuring knowledge of hypertension described as follows:

The Hypertension Knowledge-Level Scale (HK-LS). It was developed by Erkoc et al. (2012) to measure hypertension knowledge among Turkish adults. The HK-LS was conducted by examining of psychometric properties including validity (face, content, and construct), reliability (internal consistency, test re-test), and discriminative validity. It is a self-report questionnaire consisting of 22 items with sub-dimensions. The items of sub-dimension encompassed the definition of hypertension (2 items), medical treatment (4 items), drug compliance (4 items), lifestyle (5 items), diet (2 items), and complications (5 items). The responses were all dichotomous including correct (worth 1 point), and incorrect (worth 0 point). The scores ranged from a minimum score for 0 to a maximum score of 22. The adequate level of knowledge is considered a total score of 18 and above. This scale was tested by application to 457 individuals ranging in age from 18-82 years.

The psychometric properties were stability over time. The evaluation of the HK-LS was tested by many procedures. The construct validity of six sub-dimensions analyzed by factor analysis encompassed 60.3% of the total variance. The reliability of the total scale analyzed by Cronbach alpha coefficients was 0.82. As well, the Cronbach alpha coefficients in each scale of six sub-dimensions were 0.92 for definition, 0.59 for medical treatment, 0.67 for drug compliance, 0.77 for lifestyle, 0.72 for diet, and 0.76 for complications. Also, the discriminate validity of the total scale score of patients with hypertensive history was significantly higher than those without a hypertensive history ($t = 2.022$, $p = 0.044$) (Erkoc et al., 2012).

The Knowledge of Hypertension Scale (KHS). It was modified by Pinprapapan (2013) for measuring the knowledge of hypertension level among hypertensive patients. This inventory was originally modified from Limcharoen (2006) called the Hypertensive Knowledge Questionnaire. The KHS consists of three main aspects including causes of hypertension, symptoms and complications, pharmacological and non- pharmacological management. It consists of 24 items with three response answers (yes, no, and don't know). The answer response of 1 was undertaken correctly and the answer of 0 was given with incorrect response and don't know. The scores ranged from 0 to 24 and were classified into two groups of hypertensive knowledge level including low level (0-12) and high level (13-24 scores). The psychometric properties were tested for both content

validity and internal consistency reliability with a high coefficient. The validity was examined by five experts who reported that the value of the SCVI was .93. The reliability analyzed by means of the Kuder-Richardson 20 (KR-20) in 20 hypertensive patients having similar to the inclusion criteria of subjects was .83.

This study used the Hypertension Knowledge-Level Scale (HK-LS) developed by Erkoc et al. (2012) for measuring knowledge of hypertension because it has acceptable psychometric properties in terms of both validity and reliability and a rigorous process of development instrument. The HK-LS was translated into Thai language for use in this study.

Health belief. The Health Belief Model (HBM) is an important psychosocial model commonly used to explain and predict health-related behavior (Janz et al., 2002). It has mostly employed as the framework of health behavior education around 1950s (Champion & Skinner, 2008; Rosenstock, Strecher, & Becker, 1988). The Health Belief Model was generated to discover many factors that motivated or inhibited individuals in using the services of health screening programs which were widely concerned among health care providers of public health service program (Edo, 2009). The definition of health belief is the perceptions of an individual as to his/her susceptibility to a disease, the seriousness of the disease and the benefits of taking specific actions to reduce the disease's threat (Janz & Becker, 1984).

Normally, persons who tend to perform and change their behavior, must have belief first and trust the desired outcome (Champion & Skinner, 2008). This model is applied with belief and attitudes among individuals. So, in general persons tend to perceive illness and its treatment throughout their experience of illness and become concerned with decide to perform adherence to therapeutic regimens.

There are seven constructs of health belief model (Champion & Skinner, 2008; Janz & Becker, 1984; Janz et al., 2002). It can be explained as follows:

1. Perceived susceptibility of risk for disease is generally a person's subjective perception of their risk of disease and its complications. When persons have a greater perception of risk for disease, they are more likely to perform action for minimizing the

risk. On the other hand, people whose perception of threats is lower are more likely to pay no attention to them. Among older adults with hypertension, who have more belief that uncontrolled blood pressure can induce severe complications such as cardiovascular disease, chronic kidney disease and stroke, they will engage with adherence to therapeutic regimen to diminish complications from prolonged high blood pressure.

2. Perceived severity of disease refers to the perception of persons about the severity of disease which is subjective estimation. The sources of this perception come from knowledge of treatment or the person's belief in complicated disease that would affect one's life. When older adults with hypertension believe that they can be affected with a severe disease, including complex complications until disability and death, suffering with their daily life, burden of family and relatives, impaired ability to engage in social relationships, and socio-economic impact, of high blood pressure, they are more likely to perform recommended behaviors with adherence to regimens in order to control the level of blood pressure and prevent its serious complications.

3. Perceived benefits of performing a behavior refer to the belief of individuals that performing the new behavior can reduce the risk of progressive illness condition or disease. Persons with hypertension, who perceive the beneficial adherence to their therapeutic regimens, are more likely to modify their behavior to control blood pressure to its optimal goal. Considering perceived benefits, it is a person's perception of the advantage of a new behavior in decreasing progression of their disease and tends to adopt healthier behaviors for decreasing impacts of disease (Janz et al., 2002)

4. Perceived barriers of performing behavior. The definition of perceived barriers refers to an individual's perception about evaluating obstacles to their newly adopted behaviors. These constructs are vital for influencing individuals for changing their behaviors. Hypertensive persons having perceived barriers refer to patients' belief about obstacles to inhibit performing adherence to hypertensive regimens such as the complexity of taking pills, socioeconomic problems, inconvenience of following up hypertensive health care services, and having the hassles of daily life from hypertensive treatment. Therefore, health care-providers should have more concern about perceived barriers of hypertensive patients in order to assist them to have the ability in achieving their optimal blood pressure.

5. Cues to Action: There are many factors generally influencing people to change their behaviors. Cues to action are one of several factors affecting individuals to adopt new behaviors, for example events, illness of a family member, advice from other people, social media, mass media, campaigns, reminder cards, telephone calls or email messages. These activities or events influence persons to increase the perception of threat and awareness with disease after receiving more information.

6. Modifying factors: This construct is related to the personal factors which are the basic factors influencing perception of individuals. Modifying factors consist of three main components, including demographic factors (age, gender, educational level, and marital status), psychological factors (reference group, norm and culture) and fundamental factors (knowledge, skills, past experience and motivation).

7. Self-efficacy: Self-efficacy is the belief of persons in their ability to do specific behaviors required to generate the desired outcome. Self-efficacy has been added to the health belief model to improve power of the model. This construct is one of the factors affecting adherence to therapeutic regimens among older adults with hypertension. This construct was presented separately in more detail.

Applying health belief model into the health behavior change, it should consider the balance between perceived barriers and perceived benefits influencing individual's perceptions of the effectiveness of health behavior (Bell, 2013).

Health beliefs and medication adherence. Several previous studies have revealed that four constructs of the health belief model, including perceived susceptibility, perceived severity, perceived benefits and perceived barriers are related to adherence to hypertensive therapeutic regimens in both adults and elderly patients. Riounin (2007), who studied the relationship between health belief and disease control behaviors among hypertensive patients, found that perceptions of hypertensive complications including perceived susceptibility, severity and benefits were positively and significantly related to disease control behaviors including taking medication ($r = .362$, $p < .05$). This is consistent with Wungthanakorn, Phatidumrongkul, and Khomchan (2008), who studied factors influencing hypertensive medication taking behaviors among patients with hypertension and found that perceived severity, benefits and barriers were taken together to significantly affect medication taking behaviors accounting for 16% of

explained variance in medication taking behaviors (R^2 = 0.16, F= 5.518, p < 0.01). The finding also reported that perceived barriers was the only significant predictor of medication taking behaviors of hypertensive patients (β = -0.347, t = -3.425, p < 0.01). Likewise, one study focused on factors related to medication adherence among the elderly with hypertension which showed that the older people with high perceived barriers were 6.16 times more likely to medication nonadherence compared with those with a low level of perceived barriers (Sowapak, 2006). These results were consistent with the study of Tepsuriyanont (2010) which have found that total health beliefs, including perception among the elderly with hypertension, had a significant positive direct effect on mediation adherence behavior (β =.41, p < .01). Also, the meta-analysis of the relationship between medication adherence and health belief conducted by DiMatteo, Haskard, and Williams (2007) reported that patient's beliefs of the severity of disease which were necessary for prevention and treatment were positively and significantly related to medication adherence (p < 0.001). It is important to note that the higher the perceived disease severity, the better the medication adherence.

Health beliefs and adherence to lifestyle modification. Some studies in patients with chronic disease, such as hypertension, have found that health belief is related to adherence to lifestyle modifications. The study of Riounin (2007), who examined the relationship between health belief and disease control behaviors including diet control, exercise, medication taking, stress management and follow up visit among Thai hypertensive patients, found that three perceptions of hypertensive complications, including perceived susceptibility, severity and benefits were positively and significantly related to disease control behaviors including diet control (r = 0.34, p < 0.05), exercise (r = 0.334, p < 0.05), stress management (r = 0.341, p < 0.05), and follow up visit (r = 0.270, p < 0.05). Also, Nangyaem (2007) studied factors associated with eating behavior among Thai hypertensive patients and the results showed that the predicting factors of eating behavior among hypertensive patients were 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). Congruence with the study on factors influencing nutritional and exercise behaviors among hypertensive patients found that perceived benefits had positively associated with nutritional-exercise behaviors (r = .599, p < .001), and could predict those behaviors by 39% (p < .001) and perceived barriers had a positive

correlation with nutritional-exercise behaviors (r = .241, $p < .001$), and had a predictive power by 44.8% ($p < .01$) (Tantayothin, 2004).

Most of studies focused on health belief, including perceived susceptibility, perceived severity, perceived benefits, and perceived barriers between adherence behavior through all the relationship with adherence to treatment. Shin, Yun, Pender, and Jang (2005), who studied the relationship between the health belief model and the commitment to a plan for exercise among 400 Korean adults with chronic disease, found that perceived benefits and perceived barriers had a direct effect on the commitment to a plan for exercise or adherence to exercise. In addition, Pinprapapan (2013) found that health belief had an indirect effect on adherence to therapeutic regimens through self-efficacy. Consequently, this study selected the health belief as a factor affecting adherence to therapeutic regimens among the elderly with hypertension.

Measuring health beliefs. Health belief is applied to several studies of health behavior in chronic illness patients especially hypertensive patients. There are many inventories developed and modified to measure the health belief as scales of this model. These scales are described as follows:

The Health Belief for Hypertensive Patient Scale (HBHS). This scale was originally developed by Riounin (2007) and modified by Pinprapapan (2013). The scale is based on the Becker's Health Belief Model, including usually four key constructs: perceived susceptibility to induce complications, perceived severity of complications, perceived benefits of action with health behavior for disease control and perceived barriers of performing disease control behavior for hypertensive patients. The HBHS has 26 items with responses to items on a 4-point rating scale. There are four subscales of health belief which contain perceived susceptibility (7 items), perceived severity (6 items), perceived benefits (6 items) and perceived barriers (7 items). The meaning for coding of the 4-point rating scale includes both positive and negative meanings. For the positive meaning, the code ranges from 1 (not agree) to 4 (most agree) while those with negative meaning are coded ranging from 4 (not agree) to 1 (most agree). Thus the total score ranges from 26 to 104. A higher score of health belief indicated a higher level of perceived susceptibility to induce complications, perceived severity of complication, perceived benefits of performing recommended behaviors, and a lower

level of perceived barriers of performing recommended behaviors. The HBHS was examined for both validity and reliability, with general standardized scale. The content validity of the scale was approved by five experts and the value of SCVI was .84. The reliability using with the internal consistency method was applied to 20 subjects who met the same inclusion criteria of the researcher's study. The reliability was accepted due to a value of .89 for Cronbach's alpha coefficient.

The Health Belief Questionnaire. The Health Belief Questionnaire developed originally by Riounin (2007) is based on Health Belief Model of Becker. There are four key main constructs of this model with 24 items and a 3-point rating scale. This scale contains 7 items of perceived susceptibility, 5 items of perceived severity, 7 items of perceived benefits and 5 items of perceived barriers. The items are composed of both positive and negative wording. Each item with positive wording is coded with 1 (not agree), 2 (not sure), and 3 (agree) whereas the negative item wording is coded oppositely ranging from 1 (agree), 2 (not sure), and 3 (not agree). The sum of scores is divided into 3 levels including high (2.00-3.00), moderate (1.00-1.99), and low (0.01-0.99). Three experts examined the content validity and evaluated the content validity index (CVI) at 0.89. Reliability testing used the method of internal consistency which tested 30 hypertensive patients who had the same inclusion criteria with the sample. The Chronbach's coefficient alpha of the scale was 0.81 accepted to standardized reliability.

According to the measurement of health belief, the Health Belief for Hypertensive Patient Scale (HBHS) modified by Pinprapapan (2013) for measuring health belief among older adults with hypertension was selected to use in this study, because this scale has acceptable reliability and demonstrates the relationship with adherence to medication and lifestyle modification.

Perceived self-efficacy. Several current studies of chronic illness have found that self-efficacy has been established as a predictor of health behaviors in a wide range. (Ogedegbe, Mancuso, Allegrante, & Charlson, 2003). Self-efficacy refers to the beliefs of persons which enhance an individual's self confidence concerning their capabilities to perform a specific task behavior for achieving a desired outcome (Bandura, 1977; Lenz & Shortridge-Baggett, 2002; McAlister et al., 2008). Self-efficacy, a concept of the social cognitive theory was developed by a psychologist from Canada, Albert

Bandura. The key concept of social cognitive theory is based on three reciprocal components including person, environment, and behaviors which have a dynamic interrelationship (Lenz & Shortridge-Baggett, 2002). People who have stronger self-efficacy are more likely to perform and continue their recommended healthy behaviors (Bandura, 1977). Also, Bandura (1977) believed that the way in which persons perform their health behaviors depends on combinations between perceived self-efficacy or efficacy expectation and outcome expectation.

Therefore, Bandura (1977) proposed the key basic concepts underpinning self-efficacy as composed of two features, including efficacy expectation and outcome expectations. Efficacy expectation, a significant part of self-efficacy, predicted people performing their health behaviors better than outcome expectations. In general, individuals who perceive efficacy expectation are more likely to have confidence in their ability to perform the required health behaviors. Outcome expectation is people's belief about outcome successfulness resulting from their given behaviors evaluated in terms of physical, social, and self evaluation.

Sources of self-efficacy. There are four principal important sources influencing perceived self-efficacy including performance accomplishments, vicarious experience, verbal persuasion, and physiological information (Bandura, 1977; Lenz & Shortridge-Baggett, 2002).

1. Performance accomplishments or enactive mastery experiences are the most important source of self-efficacy in practice with the owner persons having direct experience by themselves. Persons who have achievement experience or the feeling of mastery usually enhance their self-efficacy. On the other hand, persons who have often had failure experience, especially taking place early in their life, are more likely to have decreased self-efficacy.

2. Vicarious experience is an important source of self-efficacy, seeing others people performing successful behavior in the same status such as gender, age, and illness condition. It is a role model relevant to persons who meet the need to perform a behavior in similar situations. Persons who have direct experience in their learning life process through showing from success of the role model may increase self-efficacy and capacity to perform behavior stimulated by the role model to access the achievement of

setting goals. Also, Bandura (1977) indicated that the vital two methods for improving self-efficacy should consist of both live modeling and symbolic modeling.

3. Verbal persuasion is also an important source of self-efficacy. Lenze and Shortridge-Baggett (2002) revealed that the most source of self-efficacy widely used verbal persuasion, because it is easy to involve. Persons who are convinced by experts, health care providers, family, or close friends giving suggestions, instructions, and advice in their difficult situations or tasks are more likely to perform a behavior. Although, persuasion is more beneficial regarding supplementation with information, enhancing self-efficacy in this way only may be less successful. The previous two sources encompassing performance accomplishments and vicarious experience, making persons perform behavior with their ability are more effective methods than verbal persuasion due to coming from direct experience by themselves.

4. Physiological and affective states are also important sources of self-efficacy by supporting and enhancing the lifestyle of persons. McAlister et al. (2008) revealed that persons who have good status both physically and emotionally find it easy to improve self-efficacy. Persons should positively enhance their health and emotional status in preparing for future threatening events. Also, enhancing constantly self-efficacy with self-esteem and the feeling of happiness in persons makes it easier to improve their self-confidence to achieve their desired goals. Lenz and Shortridge-Baggett (2002) indicated that persons having negative signs of health status in both physical, such as fatigue, pain, hypoglycemia and mental problems, such as depression, anxiety, and tension, affect their self-efficacy.

The four sources of self-efficacy are all important for enhancing self-efficacy. However, the enactive mastery experience is the most important source, having a powerful effect for enhancing self-efficacy in persons, because it is based on one's own direct experience contributing to decision making by themselves. The other three sources are less likely to affect persons due to their indirect information.

Bandura (1993) also stressed that perceived self-efficacy is the beliefs of people about their abilities in performance of behaviors leading to the desirable goal. People having self-efficacy are determined by beliefs with how people feel, think, motivate and behave producing various effects through four important processes including cognitive,

motivational, and affective and selection process. Perceived self-efficacy also is a major factor influencing persons to enable them to control their situations. People who have more confidence are likely to control difficult situations rather than who do not have it. Self-efficacy can enhance decision making of persons confronting with difficult tasks based on belief of their own abilities.

Therefore, it is important to note that self-efficacy related to health behaviors through enhancing an individual's self confidence in their capabilities for performing behaviors leads to desirable behavior goals. It can be assumed that older adults with hypertension have, who have high perceived self-efficacy, are more likely to undertake adherence behaviors to therapeutic regimens because of having high efficacy expectation and outcomes expectation.

Perceived self-efficacy and medication adherence. Several studies have found that perceived self-efficacy most consistently predicted medication adherence among hypertensive patients including adults and older adults groups. Warren-Findlow et al. (2012) who studied self-efficacy associated with hypertension self-care activities, in particular medication adherence among hypertensive patients (aged range 22 to 88), found that patients with good self-efficacy were statistically and significantly related to increase prevalence of adherence to medication (PR = 1.23, 95% CI: 1.08, 1.32). Furthermore, Kressin et al. (2007) found that having better self-efficacy, which the study defined as confidence in one's ability to take medications as prescribed among elderly hypertensive patients, was associated with medication adherence (OR = 1.41, 95% CI = 1.20-1.67, $p < .001$).

Perceived self-efficacy and adherence to lifestyle modification. It is important to note that a relationship between perceived self-efficacy and adherence to lifestyle modification has been generally found among patients with hypertension. For instance, Byrd (2004) who studied adherence to the typical antihypertensive treatment regimen among hypertensive patients, reported that general health-based self-efficacy was related to exercise adherence behavior (r = .302, p = .011), and diet adherence behavior (r = .306, p = .010). Also, Tantayothin (2004) who studied factors influencing nutritional and exercise behavior among hypertensive patients (age range 31-86 years) in communities revealed that perceived self-efficacy was positively correlated with

nutritional behavior combined exercise behaviors (r = .437, $p < .001$), and also could have a predictive power by 39.3% ($p < .001$). Similarly, Warren-Findlow et al. (2012), who conducted the relationship between self-efficacy with lifestyle modification among hypertensive patients, found that good self-efficacy was statistically and significantly associated with increased prevalence of eating a low-salt diet (PR = 1.64, 95% CI = 1.07-2.20), engaging in physical activity (PR = 1.27, 95% CI = 1.08-1.39), not smoking (PR = 1.10, 95% CI = 1.01-1.15), and practicing weight management techniques (PR = 1.63, 95% CI = 1.30-1.87). Congruent with a prior study of Khuwatsamrit (2006), who found that self-efficacy had a positive direct effect on adherence to self care requirements among patients with coronary artery disease ($\beta = 0.72$, $p < .001$).

Relationships among self-efficacy, other psychosocial factors and adherence to regimens. Perceived self-efficacy is also related to other factors influencing adherence to regimens among chronic illness patients. For instance, Xu (2005) revealed that self-efficacy in diabetic patients had a positive direct effect on self-management and self-efficacy and also was a mediator between patient-provider communication to diabetes mellitus self-management. As well, Roh (2005) who developed a model of adherence to regimens among hypertensive patients, found that self-efficacy was the strongest factor influencing adherence to therapeutic regimens among hypertensive patients and had a significant direct effect on patient adherence. In Thai studies, Pinprapapan (2013) found that perceived self-efficacy had a direct positive effect on adherence to therapeutic regimens in both medication and lifestyle modification among hypertensive patients ($\beta = 0.54$, $p < .01$). Furthermore, self-efficacy was a mediator of both social support and health belief in the direct positive effect on adherence to therapeutic regimens. A previous finding of Sritarapipat et al. (2012) revealed that self-efficacy was a mediator between self-management behavior and the other predictors, including physical function in instrumental ADL, cognitive function, knowledge of chronic kidney disease, social support from family, and social support from health care providers in Thai elderly with pre-dialysis chronic kidney disease. Notably, perceived self-efficacy is well known as a mediator of factors contributing to both self-management and adherence to therapeutic regimens among chronic illness patients.

Measuring self-efficacy. There were several studies focused on evaluating perceived self-efficacy among general hypertensive patients through developing its scale. It can be described as follows:

The Hypertensive Self-efficacy Scale (HSS). It was modified by Pinprapapan (2013) for measuring the perception of essential hypertensive patients on their confidence to perform adherence to therapeutic regimens including medication adherence and lifestyle modification. This scale was developed based on Bandura's self-efficacy theory, included taking antihypertensive medication, dietary modifications, weight control, physical exercise, avoiding risk factors, stress management and follow-up visits. The scale had 26 items consisting of 6 items for the taking of antihypertensive medication, 4 items for dietary modification, 2 items for weight control, 6 items for physical exercise, 4 items for avoiding risk factors, 2 items for stress control, and 2 items for follow-up visits. A 4-point Likert scale was used with the response to each item ranging from 1 (defined less confidence) to 4 (referred to most confidence). The range of scores was 26 to 104 and the higher the score the higher level of perceived self-efficacy. The content validity was approved by five experts with SCVI of this scale .96. Also, the reliability using internal consistency applied to 20 subjects who had the same characteristics as the population of the inclusion criteria reported .89.

The Perceived Self-efficacy Questionnaire for hypertensive patients. The scale was developed by Onchim (2002). This instrument is a self-report questionnaire focused on self-efficacy of hypertensive patients toward management or problems by themselves in difficult situations. The self-report questionnaire is a rating scale consisting 13 items with a 5 point rating scale. The scale ranged from 5 (extremely confident to perform the activity) to 1 (not confident to perform the activity). The scores of questionnaires range from 13 to 65 which are divided into 3 categories, including low level (13-30), moderate level (30-47), and high level (48-65). The questionnaire was examined for both content validity and internal consistency reliability. The reliability was a reasonable result at .83 which was tested by 30 hypertensive patients who were similar to the sample of this study.

In summary, self-efficacy is an important psychosocial factor affecting adherence to therapeutic regimens directly among chronic illness patients, especially hypertension.

Also, it is the mediator in several predicted factors of adherence to regimens among patients with chronic condition. Measuring self-efficacy among older adults with hypertension should concern with the same items in adherence to hypertensive regimens and also compare to the same culture of Thai persons. Therefore, this study selected the HSS developed by Pinprapapan (2013) because of its acceptable validity and reliability.

Social support. Social support is a factor that is associated with adherence in older people with chronic diseases (Voils et al., 2005). Social support usually means support from family, friends, and the significant social network in which people involving in their life (Byrd, 2004; Cornwell & Waite, 2012; Voils et al., 2005). It may influence persons with chronic illness to enhance the ability in addressing and changing to a more appropriate lifestyle (DiMatteo, 2004). Social support is associated with better adherence to regimens and also is predictor of hospital readmissions, mortality, and quality of life (Maeda et al., 2013). Thus, social support can increase adherence to therapeutic regimens and reduce the common barriers of adherence among older adults with hypertension.

Social support generally consists of both types and sources. The type is consisted of information, emotional, and tangible support and the sources from family members, friends, health care provider, and co-workers (House, 1981; Langford, Bowsher, Maloney, & Lillis, 1997). It can be described as follows:

Emotional support commonly refers to affective assistance from family or close friends. This is basically social support addressing emotional problems by providing caring, empathy, love, concern, and trust. The benefit of this aspect can promote and empower persons to solve their problems from chronic illness and adherence to treatments. A previous systematic review demonstrated that patients who received emotional support from family members, friends or health care providers were more likely to adhere to their treatments because decrease in their negative attitudes to treatment and motivation was reinforced (DiMatteo, 2004).

Instrumental support provides tangible food and services that assist directly some individuals to meet their needs. This type is generally well known in terms of concrete in the form of financial assistance, time, and other assistances. Social support for hypertensive older adults can be made more appropriate for promoting adherence to

therapeutic regimens, particularly by providing a suitable environment for their performing with good health behavior, following their physician's appointments, and giving subsidized welfare treatment of health care services.

Informational support refers to provision of information, suggestions, and advice for people who have to confront their serious situations such as the severity of chronic diseases and treatment. Providing information support can help individuals to make to enable them to perform adherence to therapeutic regimens.

Appraisal support is the self evaluation of persons after being informed by useful information in decision making for performing their health behaviors. The information mostly comes from family members, friends, or community persons. For example, hypertensive older persons who have changed their health behavior by performing adherence to regimens after being given some feedback and also understand the benefits of increased adherence behavior. Similarly, House (1981) stated that the appraisal support tends to give information related to self assessment rather than problem-solving. So, this type of social support can reassure hypertensive persons in their ability or competency for enhancing adherence behavior to antihypertensive regimens.

When the older persons with hypertension perceive high social support and are also provided support from other concerned people, they are more likely to perform adherence to hypertensive therapeutic regimens. Therefore, social support is a significant factor for improving adherence to regimens among older adults with hypertension.

Among older adults with hypertension, social support from the family plays an important role which is well documented in some health empirical studies (Al-Kandari, 2011). Also, it is a major assistance of self-management for elderly with type 2 diabetes (Song et al., 2010). Several studies have established that social support from family members is associated strongly with adherence to therapeutic regimens among chronically ill patients (Suppapitiporn & Suppapitiporn, 2005; Xu, 2005). According to Suppapitiporn and Suppapitiporn (2005), who conducted the study to explore the relationship between family functioning and glycemic control of patients with type 2 diabetes, found that better family functioning including problem solving, communication, affective responsiveness, affective involvement and general function

was related to adherence to diabetic glycemic control. Social support from family members is also certainly an important factor affecting adherence to hypertensive regimens. Better social support from family of older adults with hypertension leads to higher self-reliance and enhance adherence to treatment because of taking full responsibility of providing care for patients from family members (Hashimi et al., 2007; Hussain et al., 2011).

Social support and medication adherence. Several studies have been found that social support is positively associated with medication adherence in both adult and elderly groups. All showed that social support from family members and friends, is associated with medication compliance (Osamor & Owumi, 2011). Patients who are assisted continuously from their family and friends are more likely to adhere to taking medication than those who have no social support (Poirier, Turbide, Bourdages, & Houle, 2006). Byrd (2004) found that perceived social support from family ($r = .301$, $p = .011$), friends ($r = .511$, $p < .001$), and significant others ($r = .337$, $p = .004$) were each significantly and positively correlated with medication adherence. Moreover, Naewbood (2005) examined the related factors with medication adherence in elderly hypertensive patients and found that social support was significantly related to medication adherence ($r = 0.235$, $p < .01$). Tepsuriyanont (2010) found that social support has a strong positive direct effect and is also the most influential factor affecting mediation adherence behavior in elderly with hypertension ($\gamma = .44$, $p < .001$).

Social support and lifestyle modification adherence. Social support is a key factor related to adherence in patients with chronic diseases such as hypertension, diabetes, and cardiovascular diseases and also the predictor of adherence to hypertensive treatment (Byrd, 2004). Social support in the elderly with hypertension is necessary for improving lifestyle modification. Byrd (2004) found that perceived social support from family was significantly and positively correlated with diet adherence ($r = .242$, $p = .017$) and also perceived social support from friends was significantly and positively correlated with exercise adherence ($r = .266$, $p = .008$). Furthermore, social support from family among patients with coronary heart disease (mean aged 64 years) was significantly related to eating behaviors ($r = .255$, $p < .01$) and also was a predictor of eating behavior ($\beta = .149$, $p < .05$) (Boonmeesrisap, 2007).

Several studies in other chronic diseases have examined the effect of social support on other psychosocial factors. Pinprapapan (2013) found that social support had an indirect positive effect on adherence to antihypertensive therapeutic regimens mediated by perceived self-efficacy. Also, the study of Khuwatsamrit (2006), who studied the adherence to self-care requirements among patients with coronary artery disease, revealed that social support had a positive direct effect on self-efficacy ($\gamma = 0.41$, $p < .001$) and also had a positive indirect effect on adherence to self care requirements ($\gamma = 0.12$, $p < .001$). It was similar to Tepsuriyanont (2010), who studied about the causal model of adherence to medication among the elderly with hypertension, found that social support had a strong positive direct effect on mediation adherence behavior ($\gamma = .44$, $p < .001$). Notably, it can be claimed that social support has a positive direct effect on adherence to regimens among older adults with hypertension.

Measuring social support. In previous studies, several scales of social support were used to measure social support in general hypertensive patients. It can be explained as follows:

The Personal Resource Questionnaire (PRQ85 Part 2). This inventory was developed by Vrand and Weinert (1987, as cited in Tepsuriyanont, 2010). This instrument consists of five dimensional subscales: intimacy, social integration, nurturance, worth, and assistance. The PRQ85 Part 2 is a self-report evaluating the personal's perceived level of social support as sufficiency. It consists of 25 items, using a Likert scale with five items for each subscale from strongly disagree = 1 to strongly agree = 5. The total score has a range of 25 to125. The higher the score the higher level of social support. The reliability was examined with both test-retest reliability and internal consistency of the scale. The test-retest reliability coefficient was r = .72, and the reliability of internal consistency using Cronbach's alpha coefficient was .85.

The Hypertensive Social Support Scale (HSSS). This social support inventory was developed by Pinprapapun (2013), based on House's concept of social support including four parts: emotional, informational, instrumentional, and appraisal support. She added items about perceived social support of hypertensive patients performing behavioral recommendations with adherence to hypertensive regimens. The HSSS

consists of 20 items with four types of social support including emotional (6 items), informational (4 items), instrumental (5 items), and appraisal support (5 items). The scale was used for four rating scale ranging from 1 (not true) to 4 (strongly true). The total score ranges from 20 to 80. The total social support score was classified into three levels: low level (1.00-2.00), moderate level (2.01-3.00), and high level (3.01-4.00). Five experts approved the content validity and the value of SCVI was .85. Internal consistency reliability was tested and the Chronbach's alpha coefficient was .84.

There are few instruments which directly measuring social support from family. The scale of measuring social support in general is mostly focused on assistance from family members. A high quality of psychometric properties is an essential criterion for selecting an instrument. The Hypertensive Social Support Scale (HSSS) developed by Pinprapapan (2013) has acceptable reliability and also compatible with Thai culture. As a result, this scale was used to measure social support from family for this study.

Provider-patient communication. Provider-patient communication is well established as a crucial factor in clinical therapy which addresses patient-centered encounters (Ha, Anat, & Longnecker, 2010). It is essential for health care systems in order to achieve optimal health outcomes, mainly including better patient's health and medical care, and patient satisfaction (Brinkman et al., 2007; Herndon & Pollick, 2002). The definition of provider-patient communication was defined by Xu (2005) as the perception of patients on physician's communication including general clarity while having conversations, explanations of the physician of both the disease and treatment, and physicians' careful listening and responsiveness to patient problems and disease management.

The important purposes of provider-patient communication are described in three parts, including creating a good interpersonal relationship, regarded as a major prerequisite for achieving optimal medical care, exchange of information between the doctor and patient both information-giving and information-seeking, and medical decision-making by means of shared decision-making including both the doctor or health care providers and patients (Ong, De Haes, Hoos, & Lammes, 1995). The components of provider-patient communication are divided into two main aspects; instrumental behaviors (giving information, identifying treatment and asking questions)

and affective behaviors (concerned with partnership, being friendly, and giving encouragement) (Ong et al., 1995). Also, the components of provider-patient communication determined by Kim and Park (2008) have been classified into two dimensions, including affective empathy (responding to emotional state) and cognitive empathy (responding to patients' needs). These aspects are crucial for communication styles of physicians influencing understanding of the disease and its treatment of patients and also improving patients' satisfaction and compliance to regimens.

Several studies have established the importance of provider-patient communication in chronically ill patient regarding improving the ultimate health outcomes. Desirable health outcomes, resulting from effective physician-patient communication, have been reported in several studies, including patients' satisfaction, health status, recall of information, and enhance patients' adherence to therapeutic regimens (Bennett et al., 2011; Franks et al., 2006; Matthews et al., 2009; Ong et al., 1995; Schoenthaler, Chaplin, et al., 2009; Zolnierek & DiMatteo, 2009).

Communication, through the means of discussion of specific treatment with chronically ill patients, may improve the ability of patient's perception of agreement regarding treatment and also directly enhance adherence to treatment (Phillips, Leventhal, & Leventhal, 2011). The multiple processes of communication could enhance adherence to treatment resulting from patients' understanding of their illness and the risks and benefits of treatment, having support, empathy and understanding from their provider, collaborative partnership, and involving patient-centered interviewing (Ha et al., 2010; Zolnierek & DiMatteo, 2009).

However, insufficient provider-patient communication during treatment may significantly affect adherence to therapeutic regimens and overall clinical care (Grover, Drossman, & Oxentenko, 2013). Furthermore, serious miscommunication regarding a patient's therapy has led to patients' misunderstanding in terms of their disease such as prognosis, aim of treatment, expectations, decision making in treatment and involvement in all treatment (Ha et al., 2010).

Although the desirable outcomes of good communication with patients during clinical encounters are well documented, mainly improving doctor-patient relationships

and health care outcomes, these strategies are difficult tasks and require skills and practice of communication (Hingle & Robinson, 2009). For achieving favorable health outcomes, the key roles of providers should encompass primarily three skills, including attentive listening skills, empathy, and open-ended questions used during treatment (Ha et al., 2010). Also, health care providers should help patients by working in a collaborative manner and more effective communication. These tasks are the most powerful predictors of adherence to therapeutic regimens and self-care behavior (Rubin, 2005).

Focusing on provider-patient communication concerning specific tasks among older adult patients during treatment encounters is a necessary strategy for enhancing adherence to therapy due to the limitation of physical health and cognitive function resulting from advanced age (Ishikawa, Roter, Yamazaki, & Takayama, 2005; Robinson, White, & Houchins, 2006). Therefore, improving adherence to therapeutic regimens among elderly should focus on promoting good communication during encountering treatment because of limitations of elderly rather than younger age particularly psychosocial factors, cognitive and physical function factors.

According to Bayer-Fetzer Conference (2001), it was concluded that the acceptable method of provider-patient communication in medical education consisted of seven crucial elements. These elements were described as follows:

1. Building a relationship between physician and patient as a partnership, and patients' active participation in decision making and also sharing the ideas, feeling and values of both patients and health care providers.
2. Allowing patients to discuss about their illness and prescribed treatments.
3. Accessing understanding and perception of patients' illness by gathering information which emphasizes active listening techniques for collecting patient's information.
4. Health care providers should try to understand patient's perception in both their illness and treatments and explore patient's background such as culture, economic status, spirituality, beliefs, and family. Also, they should recognize and respond to the ideas, feelings, and values of patients.

5. Giving the explanation about disease and treatments to patients through using simplicity of language which patients can understand and also encouraging patients to share information.

6. Encouraging the patients to participate in decision making, checking the willingness and ability to follow the treatment plans of patients and also providing the existing resources and supporting many tasks for achieving health outcomes. Reminder of the agreement on patient's problems and treatment plans is necessary for communication between health care providers and patients.

7. Health care providers should gather others issues regarding patients, summarize and affirm patients' agreement with the plans of action as well as discuss follow-up.

Provider-patient communication and medication adherence. Several studies about communication in chronically ill patients support the association with medication adherence. Schoenthaler, Chaplin, et al. (2009), who examined the effect of provider communication on medication adherence in poorly controlled hypertension of African Americans aged range 25-98 year, found that providers with more collaborative communication were associated with significantly better medication adherence ($r = -.15$, $p = .003$). Also, patients who rated their providers' communication to be more collaborative were better significantly with medication adherence than those with non-collaborative communication ($\beta = -0.11$, $p = 0.03$). One study, which investigated barriers to adherence to antihypertensive drugs in the elderly with hypertension, found that doctor-patient interaction, giving lower priority to discussion about hypertension disease to patients compared to collaboration, was significantly related to medication adherence (adjusted OR = 32, 95% CI = 0.12-0.84) (Turner et al., 2009). In addition, one study focused on factors associated with adherence to medication in chronically ill patients, found that communication between physicians and patients with regard to illness and treatments significantly and positively predicted patient medication adherence ($\beta = .49$, 95% CI = .026-.963, $p < .05$) (Phillips et al., 2011).

Provider- patient communication and adherence to lifestyle modification. The study of Heisler, Bouknight, Hayward, Smith, and Kerr (2002) found that provider communication was significantly associated with diet adherence ($p < .001$) and it also

was a predictor of self-management such as medication taking, diet control, and foot care in diabetes patients (β = 0.18, $p < .001$). Also, Xu (2005) found that provider-patient communication had a positively significant association with self-management (diet, exercise, taking medications, glucose/urine monitoring, foot care) (r = .179, $p < .05$). One study in Thailand by Pinprapapan (2013) found that provider-patient communication was significantly and positively related to adherence to therapeutic regimens (adherence to medication and lifestyle modification) (r = .23, $p < .01$).

Apart from these relationships, there were studies which focused on factors affecting, directly or indirectly, provider-patient communication. The study of Pinprapapan (2013) found that provider-patient communication was a predicting variable of adherence to hypertensive therapeutic regimens (β = .42, $p < .01$) and knowledge of hypertension (β = .60, $p < .01$) among hypertensive patients. It could be noted that provider-patient communication has directly affected adherence to hypertensive therapeutic regimens and knowledge of hypertension. Also, Roh (2005) demonstrated that patient-provider relationships involving two way communication about an illness had a positive direct effect on self-efficacy and positive indirect effect on adherence to regimens via self-efficacy among type 2 diabetes patients.

In brief, it is important to note that communication between providers and patients during treatments process is crucial to enhancement of adherence to therapeutic regimens among older adults with hypertension. Thus, provider-patient communication is a significant factor that influences adherence to therapeutic regimens among older adults with hypertension and was adopted into hypothesized model for this study.

Measuring the provider- patient communication. The previous studies conducted scales were used to measure provider-patient communication for general hypertensive patients as follows:

The Provider-patients Communication Scale (PCS). The scale was translated and modified by Pinprapapan (2013). It was primarily modified by Xu (2005) and was originally developed by Stewart et al. (1999, as cited in Xu, 2005). The PCS is used to evaluate the perception of patients on provider's communication including clear talking, manifestly explaining medical care, and alert to and responding to patients' concern.

The PCS has 9 items, categorized into 3 indicators including general clarity (2 items), explanation of hypertension and medical care (4 items) and careful listening to and responding to patients' problems and concerns (3 items). This scale is a Likert scale with 4-point from the lowest point as 1 (never) to the highest point as 4 (always). The sum of scores ranges from a minimum of 9 to a maximum of 36 and the higher score indicated better communication between health care providers and patients. The content validity was examined by five experts resulting from SCVI and its value was .85. The internal consistency reliability was applied to 20 hypertensive patients who met similar to inclusion criteria for this study. The reliability calculated from Chronbach's alpha coefficient was .77. Thus, the PCS has acceptable and reasonable psychometric properties.

The Provider Communication Scale (PCS). This scale, modified by Schoenthaler, Chaplin, et al. (2009), was first developed by Bultman and Svarstad (2000, as cited in Schoenthaler, Chaplin, et al., 2009) for evaluating the effect of physicians' initial and follow-up communication styles on the beliefs and behaviors of patients with depression. The provider communication scale was used for measuring perceived provider communication through assessing the patients' perception of the quality of their physicians' communication and the extent to which the physician encourages patient participation in the treatment process. This scale is administered with 13 items and was divided into two parts. The first part is a Likert type scale with eleven questions having responses to questions of not at all (score of 1) to very much (score of 4). The other part had two items with a dichotomous answer format (yes = 1 or no = 0) in the area of the information about given patients' medication and the timetable of a follow-up appointment. All 13 items were converted into a z-score and then summed as a continuous measure to create a composite score. The reliability, tested for the internal consistency using Chronbach's alpha, was .92 (Schoenthaler, Chaplin, et al., 2009).

Measuring the provider-patient communication should be concerned with good psychometric properties and closely related to the Thai context. The provider-patient communication scale (PCS) was modified and translated into the Thai language by Pinprapapan (2013), developed originally from Chinese culture by Xu (2005) and used to measure the provider-patient communication for this study.

In conclusion, provider-patient communication is a significant aspect of factors affecting adherence to therapeutic regimens among chronically ill patients such as hypertension and diabetes. Thus, it was chosen as a factor effecting adherence to therapeutic regimens among older adults with hypertension in this study.

Conceptual Framework

In this study, the conceptual framework of a causal model of adherence to therapeutic regimens among older adults with hypertension is based on the literature review involving empirical evidence factors associated with adherence to therapeutic regimens and also predicting factors of adherence among hypertensive patients and other chronically ill patients. Ten factors affecting adherence to therapeutic regimens among older adults with hypertension are included into the hypothesized causal model, including cognitive function, physical function, knowledge of hypertension, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, perceived self-efficacy to adherence, social support from family, and provider-patient communication. These factors are derived from the Five Dimension Model of Adherence of WHO (2003), including social and economic factors, health care team-related factors, condition-related factors, therapy-related factors, and patients-related factors.

Regarding these two out of five dimensions including patients-related factors and health care team- related factors, it can be widely claimed that these dimensions affect adherence to therapy in several chronic diseases such as hypertension, diabetes and cancer. The dimension of patients-related factors normally include knowledge, attitudes, health beliefs (perceived benefits, perceived severity, perceived susceptibility, and perceived barriers), forgetfulness, expectations of the patient, and physical function which are the set of factors mostly affected directly patients. These factors in above may have a direct and indirect effect on adherence to therapeutic regimens. In particular, when persons have a high level of knowledge, beliefs, cognitive function, physical function and self-efficacy, these factors can motivate them to perform adherence behavior and enhance confidence in their ability to manage their illness and treatment. It can be concluded that these factors directly affect adherence to therapeutic regimens. In addition, most of factors have an indirect effect on adherence to therapeutic regimens through a crucial factors especially perceived self-efficacy. It can be noted that

patients-related factors including cognitive function, physical function, knowledge and health beliefs have an indirect effect on adherence to therapy through self-efficacy. These factors also have a negative effect on adherence to therapeutic regimens. If individuals have inadequate knowledge about disease and treatment, forgetfulness, having impaired physical function, a lack of self-perceived need for treatment and its effect, and negative beliefs regarding the efficacy of the treatment, these consequences will lead poor adherence to therapeutic regimens and eventually result in adverse health outcome. Specifically, older adults with hypertension are more likely to have their process of biological degeneration in physical function and cognitive function that are different from younger adults. Thus, cognitive function and physical function are significant factors affecting adherence to therapeutic regimens among older adults with hypertension. Moreover, because of their limitations from declining physical function and cognitive function, social support from family is well documented as an important factor affecting adherence to therapeutic regimens among older adults with hypertension. It is helpful for assisting them to perform better adherence to therapeutic regimens through significant supports. Therefore, the patients-related factors are composed of cognitive function, physical function, perceived self-efficacy to adherence, knowledge of hypertension, perceived susceptibility, perceived benefits, perceived severity, perceived barriers, and social support from family. For the dimension of health care team- related factors, these factors may affect adherence to therapy through relationships between health care providers and patients, particularly communication regarding therapeutic regimens. Having a good patient-provider relationship may improve adherence to therapeutic regimens in chronically ill patients by increasing patient's trust, satisfaction, and confidence to perform adherence behavior (WHO, 2003). Especially, good communication between health care providers and patients is an important factor that may be useful for older adults with hypertension in improving clearly understanding in their disease and treatment and lead to better adherence to therapeutic regimens.

Four attributes of adherence analyzed by Cohen (2009), including alignment of patient behavior and health recommendations, mastery of a new behavior and health knowledge and their perceived ability to meet the outcome targets and ongoing collaborative relationships between the patient and health care providers on treatment

plan for achieving to the optimal blood pressure control will be included into the framework.

Therefore, all factors affecting adherence to therapeutic regimens among older adults with hypertension in this study can be modified and applied by nurses or health care providers for enhancing adherence to therapeutic regimens. These factors was included in the hypothesized causal model of adherence to therapeutic regimens among older adults with hypertension. The hypothesized model is illustrated in figure 2-1 described as follow:

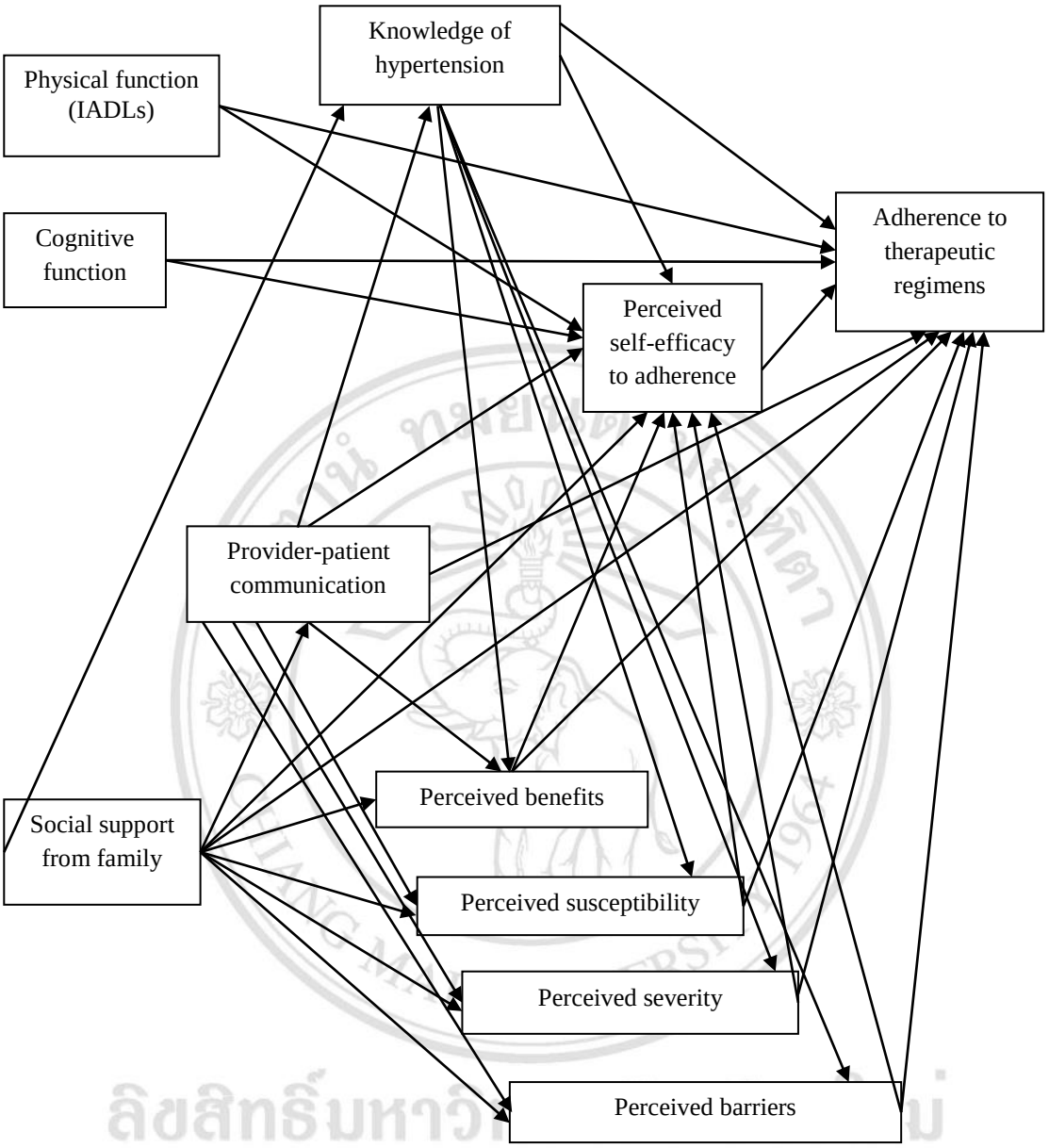

Figure 2-1. The hypothesized causal model of adherence to therapeutic regimens among older adults with hypertension