CHAPTER 1

Introduction

Background and Significance of the Research Problem

At the present time, the aged population is rapidly increasing worldwide. This situation leads to a high rate of premature morbidity and mortality from chronic disease related to advancing age. According to world population ageing from the World Health Organization, the proportions of population aged 60 years and over are escalating faster than other age groups (World Health Organization [WHO], 2002). The number of world ageing population increased from 9.2 percent in 1990 to 11.7 percent in 2013 and also will continuously increase around 21 percent by 2050 (the United Nations, Department of Economic and Social Affairs [UNDESA], 2013). In Thailand, numbers of elderly population have increased rapidly nearly 11.9% in 2010 (Dumrikanlert, Thanunchai, & Keawket, 2012) and it has increased drastically by 14.88% in 2013, (Institute for Population and Social Research, Mahidol University, 2013). This number is higher than that estimated by the National Statistical Office of Thailand (2008) that might increase by 13.4% in 2015. Thus, this impact of increasing older adults' population is expected to lead to a prevalence in both morbidity and mortality rate of several chronic diseases, especially hypertension which is the highest prevalence of chronic diseases among older people worldwide (Aronow et al., 2011; National Health Examination Survey Office [NHESO], 2010).

Hypertension is a serious problem of public health and is increasing drastically in the elderly population worldwide. It is well known that hypertension is significantly associated with advancing age and also strongly contributes to a risk of cardiovascular disease (Fukutomi & Kario, 2010). WHO (2010) has reported that the prevalence of hypertension has been rapidly rising, from an estimated number of 600 million in 1980 to increase to approximately 1 billion in 2008 because of the increasing size of the world elderly population. Notably, the data which were collected by the National

Health and Nutrition Examination Survey [NHANES] in the United States during 2005 to 2008, have been reported that the prevalence of hypertension has increased following advancing age and the highest prevalence was in persons aged over 65 years at 70.3% (95% CI = 67.5-73.2) (Keenan & Rosendorf, 2011). In addition, the current data from NHANES during 2011 to 2012 revealed that the prevalence of hypertension was highest at 65% in those who were more than 60 years which was nearly equal to the previous data (Nwankwo, Yoon, Burt, & Gu, 2013). In Thailand, hypertension is a vital disease which is one of the top five diseases leading to a major cause of morbidity and death and also has increased a tendency each year during 2006 to 2010 (Bureau of Policy and Strategy, Ministry of Public Health, 2011). The numbers of older adults with hypertension are also continuously increasing per year until the present time. According to the data from the 4th National Health Examination Survey (NHES) during 2008-2009, it was reported that the prevalence of hypertension was the highest in Thai people aged 60 years and over at range from 44.0 to 55.9% comparing with other age groups (NHESO, 2010). These findings were consistent with the annual report of hypertensive prevalence survey among persons aged 60 years and older in 2008 by the Bureau of Policy and Strategy, Ministry of Public Health (2009) which showed that the prevalence of essential hypertension in older persons was highest at 42.87%. From these data, the trends of the problems regarding essential hypertension in older persons are becoming one of the critical effects on the health system in Thailand.

Hypertension is the one of substantial chronic diseases mostly affecting elderly population compared with other age groups worldwide. Although many studies have established the proper management for controlling hypertension in older persons, it continuously has shown the suboptimal outcomes with uncontrolled blood pressure throughout the world (Anthony, Valinsky, Inbar, Gabriel, &Varda, 2012; Chobanian, 2009a; Lloyd-Jones, Evans, & Levy, 2005). In general, the problem of poor control of high blood pressure was mostly found in older adults with hypertension. For instance, the data from NHANES during 2011 to 2012 was shown that American older adults aged 60 and older could control their blood pressure of 50.5% (Nwankwo et al., 2013). In Asia, Ishine et al. (2008), from 1999 to 2004, conducted a study to examine the prevalence of hypertension among Japanese older people aged 70 and older which showed that the overall rate of favorable control blood pressure during treatment was

only 31.7%. Similar to the result of the longitudinal study in Korea by Kim, Cho, Choi, and Kim (2008) which was found that on prevalence only 38.5% of hypertensive elderly patients can control their blood pressure. In Thailand, the data from 4th NHES revealed that the prevalence of controlling blood pressure among older adults with hypertension was only 22-25% (NHESO, 2010) which was higher than that the 3rd survey. From these studies, it can be noted that controlling blood pressure to normal or less than 140/90 mmHg among older adults with hypertension is an unfavorable treatment outcome.

The majority of impacts of the constantly uncontrolled blood pressure among older adults with hypertension consists of physical, psychological, and economical impact. The physical impact which is the strongest effect on hypertensive persons results from the critical complications, including cerebrovascular disease or stroke, heart disease mainly heart failure and chronic kidney disease until which eventually develops to the end stage renal disease (Aslam, Haque, Agostini, Wang, & Foody, 2010; Kotchen, 2008; Messerli, Williams, & Ritz, 2007). In particular, the physical impact in older people who have uncontrolled blood pressure for longer period includes a high risk of cardiovascular, cerebrovascular and renal disease leading to disability and death (Appel et al., 2006, Kim, Howard, Kaufman, & Holmes, 2008). The psychological impact mostly results from psychological distress such as anxiety and depressive symptoms which may be because of a direct effect of elevated blood pressure, adverse effects of treatment, or the consequences of labeling hypertension diagnosis (Hamer, Kivimaki, Stamatakis, & Batty, 2012). Also, uncontrolled blood pressure in older adults may affect their family caregivers by causing fatigue and irritable emotion leading to undesirable and unsuccessful goals of care (Shieh, Tung, & Liang, 2012). The economical impact is also critical issue in the elderly with hypertension, particularly increased frequency of hospitalizations, and increased health care costs (Kalogianni, 2011). Likewise, one study found that costs of persons with hypertension who have poor medication adherence increased by approximately $3,574 in each person during 3 years (Dragomir et al., 2010). Notably, these impacts of undesirable outcomes of hypertension treatment are consistently associated with impact of these dimensions.

The desirable health outcome of hypertensive patients' management to prevent these complications, is to control blood pressure to less than 140/90 mmHg, based widely on the guideline of the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-7) (Chobanian, 2009b; Chobanian et al., 2003). This treatment guideline is recommended for hypertension management significantly preventing the cardiovascular complications across all patient aged groups including older people (Aslam et al., 2010; Chobanian, 2009). Optimizing blood pressure control has not depended only on taking antihypertensive medications, but also on modifying lifestyle behaviors, including weight reduction, dietary control, moderation of salt, alcohol intake, and increased physical activity (Appel et al., 2006; Chobanian et al., 2003; Nguyen, Odelola, Rangaswami, & Amanullah, 2013). It can be noted that, both nonpharmacological (lifestyle modification) and pharmacological (taking medication) interventions are of equal significance in the current standardized guidelines for management of hypertension (Chobanian et al., 2003; Uzun et al., 2009).

The benefits of taking antihypertensive medication lead to a satisfactory target outcome. Various clinical trials have shown the effectiveness of antihypertensive drugs which can cause lowering of blood pressure by 2-3/1-2 mmHg (Chobanian et al., 2003). As well, a recent RCT study examined the effects of antihypertensive drugs among non-diabetic hypertensive individuals with a mean age of 67 years, and found that the experimental group who received high aggressive treatment achieved a lowering of blood pressure by 3.8/1.5 mmHg compared to the control group. This finding also showed that the experimental group had a 37% lower incidence of diagnosed left ventricular hypertrophy (Verdecchia et al., 2009). For the nonpharmacologic treatment, many studies have found the favorable outcomes from adopting nonpharmacologic treatment in the hypertensive patients. For instance, Nguyen et al. (2013) which indicated that a substantial strategy for effectively lowering blood pressure must be combined with adopting the Dietary Approaches to Stop Hypertension (DASH) diet and sodium restriction. One study demonstrated that hypertensive patients recommended a greater adherence to the DASH diet had a significant association with larger reduction in systolic blood pressure (SBP) and diastolic blood pressure (DBP) ($p < .001$) (Epstein et al., 2012). In addition, one meta-analysis study has found that reduction in net body

weight of 5.1 kg reduced systolic and diastolic blood pressure by 4.4 and 3.6 mmHg respectively (Neter, Stam, Kok, Grobbee, & Geleijnse, 2003). Therefore, both adherence to medication and lifestyle modification among the older adults with hypertension should be necessarily undertaken effective enhancement to optimize blood pressure control and prevent hypertensive complications. These proper strategies would lead to desirable health outcomes.

Adherence to therapies launched by WHO has been used commonly for chronically ill patients in the global health system (Bissonnette, 2008). Traditionally, the term compliance as commonly used by health care providers is focused on passive participation that patients have to only depend on health care personnel. While, the term adherence which addresses patients-centered, shared responsibility between patients and providers, having active patients participation and having powerful patient decision-making with their treatment has been acknowledged rather than the term compliance (Horne et al., 2005; WHO, 2003). The definition of adherence defined by WHO is commonly used in various studies worldwide. It refers to the extent to which a person's behavior corresponds with agreed recommendations from a health care provider which emphasized taking medication, following healthy diet, and executive changing lifestyle (WHO, 2003).

Although, it is important to note that better adherence to therapy is the most significant factor for improving patients' health outcomes, several studies have shown the unsatisfactory results of poor adherence leading to adverse health outcomes. Commonly, WHO (2003) has demonstrated that hypertensive patients' adherence with medication therapy varies between 50% and 70%. In particular, some studies have been found a lower rate of adherence to therapy among older adults with hypertension (Benner et al., 2002; Elliott, Plauschinat, Skrepnek, & Gause, 2007). For instance, the results of a study of Lin et al. (2007) which examined adherence to antihypertensive medications among the Taiwanese elderly demonstrated that the medication adherence rate was only 57.6%. Likewise, one study has found that the rate for adherence to antihypertensive medications among the elderly Chinese Americans was 52% (Hsu, Mao, & Wey, 2010).

Regarding the literature review, there are various factors associated with adherence to therapeutic regimens both medication taking and lifestyle modification among older adults with hypertension. In addition, factors associated with therapy such as comorbidity, number of pills taken each day, regimen complex, number of side effects, follow-up interval and duration of therapy were reported from several studies (Bardel, Wallander, & Svardsudd, 2007; Krousel-Wood et al., 2010; Okoro & Ngong, 2012; Sung et al., 2009; Tepsuriyanont, 2010; Uzun et al., 2009). Factors associated with adherence to therapeutic regimens among older adults with hypertension, could be classified into five groups based on the five dimension adherence model of WHO (2003) including socio and economic factors, health care team and system-related factors, condition-related factors, therapy-related factors, and patients-related factors. It is possible to modify patients-related factors by nurse's role rather than other factors such as condition-related factors, therapy-related factors and health care system-related factors. However, factors which cannot be modified by nurses are still included in tailoring interventions for enhancing adherence to regimens among older adults with hypertension. In this study, ten variables affecting adherence to therapeutic regimens among older adults with hypertension will was selected from two out of five dimensions from WHO (2003). These dimensions include patients-related factors and health care team related factors. The patients-related factors are composed of cognitive function, physical function, perceived benefits, perceived susceptibility, perceived severity, perceived barriers, perceived self-efficacy to adherence, knowledge of hypertension and social support from family, whereas selected health care team related factor includes provider-patients communication.

In Thailand, previous studies have investigated factors affecting adherence to antihypertensive therapeutic regimens. However, there is limited practical implication for interventions enhancing adherence to therapy among older adults with hypertension. A recent study conducted by Pinprapapan (2013) who tested a causal model of adherence to therapeutic regimens including taking medication and lifestyle modification among hypertensive persons aged 35-59 years. It was found that social support, provider-patient communication and perceived self-efficacy had a direct positive effect on adherence to regimens, health beliefs and social support had an indirect positive effect on adherence via perceived self-efficacy, whereas knowledge of

hypertension had neither direct nor indirect effect on adherence to regimens. Since, this study was conducted in only adults group, it is not possible to generalize to older adults with hypertension who are different from adult persons, especially in aspects of cognitive function and physical function. According to the characteristics of older adults, in general, they are more likely to have biologic process underlying age-related declines in both physical and cognitive functioning which are remarkable individual differences from younger persons (Clouston et al., 2013). Thus, to enhance adherence to therapeutic regimens among older adults with hypertension both medication and lifestyle modification may be more difficult task than adult persons because of the complexity of adherence behaviors. Especially, promoting adherence to lifestyle modification is different from medication adherence because of its difficult behavior for older adults with hypertension. Specifically, performing adherence to exercise behaviors to control blood pressure may be complicated activities in older adults with hypertension, because it has to use specific skills and also should be exactly promoted and taken care by their family members who play an important role in helping them to perform adherence behaviors. Thus, to apply this model may be faulty due to inadequate knowledge of specific factors covering intervention for promoting adherence and may lead to improper hypertension management among older adults with hypertension.

Another causal model conducted in older adults with hypertension showed that cognitive function, health beliefs, and social support had a positive direct effect on medication adherence and also showed that age had an indirect effect on medication adherence through cognitive function (Tepsuriyanont, 2010). Regarding this study, it is important to note that to develop a fit model for factors affecting direct and indirect effect on adherence to medication among older adults with hypertension should necessarily focus on the aspect of cognitive function. However, this study have focused only on antihypertensive medication adherence and it was not consistent with JNC-7 which widely accepted as global medical guideline for therapeutic regimens in controlling blood pressure among hypertensive persons. The acceptable guideline recommended that adherence to therapeutic regimens among persons with hypertension has emphasized both medication taking and lifestyle modification regarding to the proper hypertension management for controlling blood pressure leading to the optimizing outcome. This model has found only three modifiable factors directly affect

adherence to medication which do not cover the other factors that may have well documented a direct effect on older persons, in particular physical function, perceived self-efficacy, knowledge of hypertension and communication between patients and health care providers. Moreover, this model has addressed non-modifiable factors which could not be manipulated by the nursing role, including age and family income. Thus, it is necessary to focus on factors affecting directly and indirectly both adherence to medication and lifestyle modification among older adults with hypertension for this study.

Therefore, it is important to fill these gaps in knowledge. The newly developed model from this study will determine modifiable factors directly and indirectly affecting adherence to therapeutic regimens among older adults with hypertension based on various evidences from literature review. This model will be helpful for health care providers, particularly the geriatric nurses for developing programs enhancing adherence to therapeutic regimens among older adults with hypertension or other chronic diseases. The factors adopted by the new model consist of cognitive function, physical function, knowledge of hypertension, health belief (perceived benefits, perceived susceptibility, perceived severity, and perceived barriers), perceived self-efficacy to adherence, social support from family, and provider-patient communication.

Cognitive function refers to the process by which information is acquired, stored, shared and used which mainly includes significant intellectual tasks such as thinking, remembering, perceiving, communicating, calculating, and problem solving (Bunten, 2001). It encompasses comprehension, working memory, long-term memory, and prospective memory (Park & Jones, 1997). Also, remote memory, orientation, immediate memory, attention, general knowledge, language, abstract thinking, judgement and calculation are the important components of cognitive function (Jitapunkul, Lailert, & Worakul, 1996). In general, cognitive function is mostly focused on older persons rather than younger adult persons, because advancing age leads to poor cognitive function or cognitive impairment (Barclay et al., 2007; Miller, 2004). WHO (2003) indicated that cognitive function impairment was one of several factors affecting poorer adherence in older people and was the major risk factor of medication nonadherence (Thiruchselvam et al., 2012). Also, cognitive function impairment was

significantly related to poorer compliance with antihypertensive treatment among elderly with hypertension (Vinyoles, De la Figuera, & Gonzalez-Segura, 2008). In Thailand, a study of Tepsuriyanont (2010) revealed that cognitive function had a positive direct effect on medication adherence behavior ($\beta = .32$, $p < .001$). It could be noted that cognitive function is a significant factor directly affecting adherence to therapeutic regimens among elderly with hypertension.

Physical function is the extent to which persons are able to perform the needed basic tasks or activities in daily life normally consisting of basic activities of daily living (BADL) and instrumental activities of daily living (IADL) (Leidy, 1999; Painter, 2005). BADLs refer to the basic tasks of everyday life, such as eating, bathing, dressing, toileting, and transferring (Wiener, Hanley, Clark, & Van Nostrand, 1990). The instrumental activities of daily living (IADL) include handling personal finances, cooking, shopping, traveling, doing housework, using the telephone, and taking medications (Graf, 2008; Tanner, 2004). Normally, persons suffering from poor physical function 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 treatment both medication and lifestyle modification. Some studies have revealed physical function affecting adherence to therapy among chronically ill patients. A study of Sowapak (2006) showed that Thai hypertensive elderly with IADLs deficit were more likely to be nonadherent to medication. Also, one study of Sanjaithum (2006) revealed that physical function was positively significant associated with the nutritional self-management. Moreover, IADLs had a direct positive effect on self-management behavior and also had an indirect effect on self-management via self-efficacy among Thai elderly with chronic kidney disease which mostly were diagnosed with hypertension (Sritarapipat, Pothiban, Panuthai, Lumlertgul, & Nanasilp, 2012).

Knowledge of hypertension refers to information regarding hypertension including the definition of hypertension, medication treatment, adherence to therapy, lifestyle modification, complications, and continuous follow-up visit (Erkoc, Isikli, Metintas, & Kalyoncu, 2012; Karakurt & Kasikci, 2012; Saleem, Hassali, Shafie, Awad, & Bashir, 2011). Hypertensive patients having good hypertension knowledge tend to have better medication compliance (Hadi & Rostami-Gooran, 2004). Whereas,

decreased knowledge of hypertension was a predictor of poor adherence to medication (Turner, Hollenbeak, Weiner, Have, & Robert, 2009). By the fact, 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). In Thailand, the study of Nangyaem (2007) has found that knowledge of specific hypertensive diet was mutually related to and as predictors of eating behavior among hypertensive patients. As well, the study of Sritarapipat et al. (2012) found that knowledge of chronic kidney disease among Thai elderly had a direct effect on self-management behaviors.

Health belief (perceived benefits, perceived susceptibility, perceived severity, and perceived barriers) is an important psychosocial factor commonly used to explain and predict health-related behaviors modification of persons (Janz, Champion, & Strecher, 2002). It refers to the perceptions of an individual in susceptibility to a disease, the seriousness of the disease, the benefits of taking specific actions to reduce the disease's threat and the barriers to take action for management of illness (Janz & Becker, 1984) 2009). The results of the study of Sowapak (2006) have found that hypertensive older people with high perceived barriers were more likely to nonadhere to the drug regimen. Also, one study has revealed that the perception of severity of complicated hypertension from poor treatment and threat to life was positively correlated with treatment adherence behaviors including medication-taking, appointment-keeping, food or salt consumption and alcohol consumption (Atulomah, Florence, & Oluwatosin, 2010). As well, the study of Tepsuriyanont (2010) has found that health beliefs among the elderly with hypertension had a significant positive direct effect on mediation adherence behavior. In addition, the study of Pinprapapan (2013) found that health beliefs had an indirect effect on adherence to therapeutic regimens through self-efficacy.

Perceived self-efficacy is belief of persons which enhances his or her self confidence of capability to perform a specific situation or task behavior for achieving a desired outcome (Bandura, 1977; Lenz & Shortridge-Baggett, 2002; McAlister, Perry, & Parcel, 2008). Hypertensive patients with good self-efficacy were significantly related to an increased prevalence of adherence to medication (Kressin et al., 2007; Warren-Findlow, Seymour, & Huber, 2012). Also, hypertensive patients with high self-

efficacy were significantly associated with increased prevalence of eating a low-salt diet, engaging in physical activity, not smoking, and practicing weight management techniques (Warren-Findlow et al., 2012). Self-efficacy was the strongest factor influencing adherence to therapeutic regimens among hypertensive patients and had a significant direct effect on patient adherence (Roh, 2005). Similarly, the study of Pinprapapan (2013) revealed that perceived self-efficacy had a direct positive effect on adherence to therapeutic regimens among hypertensive patients and also was a mediator of both social support and health belief.

Social support is usually determined by the support with emotional, instrumental, informal, and appraisal from family, friends, and the significant social network in which people involving in their life (Byrd, 2004; Voils, Steffens, Flint, & Bosworth, 2005). Several studies have found that social support is associated with better adherence to regimens and also is a predictor of hospital readmissions, mortality, and quality of life (DiMatto, 2004; Maeda, Shen, Schwarz, Farrell, & Mallon, 2013). Social support from family has been well documented in some health empirical studies and it was found to play a significant role for supporting elderly with hypertension (Al-Kandari, 2011). As well, social support from family was associated strongly with adherence to therapeutic regimens among chronically ill patients (Suppapitiporn & Suppapitiporn, 2005; Xu, 2005). The study of Tepsuriyanont (2010) showed that social support had a strong positive direct effect on mediation adherence behavior among elderly with hypertension. Further, social support from family was associated with self-management mediated by self-efficacy in diabetic patients (Xu, 2005). As well, the study of Pinprapapan (2013) also revealed that social support had an indirect positive effect on adherence to regimens mediated by perceived self-efficacy among hypertensive patients.

Provider-patient communication is the perception of patients of physician's communication, including general clarity during conversation, explanation by the physician of both the disease and treatment, and active listening during having dialog and responsiveness to patient problems concerning disease management (Xu, 2005). Many studies have established that giving better communication, in both content and quality from providers can enhance patients' adherence to therapeutic regimens

(Bennett, Fuertes, Keitel, & Phillips, 2011; Matthews, Peden, & Rowles, 2009; Schoenthaler, Chaplin, et al., 2009; Zolnierek & DiMatteo, 2009). A study of Roh (2005) revealed that the patient-provider relationship had a positive direct effect on self-efficacy and a positive indirect effect on adherence to regimens via self-efficacy among hypertensive patients. Also, the study of Pinprapapan (2013) found that provider-patient communication directly affected adherence to hypertensive therapeutic regimens and knowledge of hypertension among hypertensive patients.

From these empirical evidences, it can be concluded that access to the achievement of desirable control of high blood pressure should recognize adherence to both medication taking and lifestyle modification tailoring intervention for enhancement adherence to therapeutic regimens among older adults with hypertension. Moreover, in developing a model one should emphasize extraordinary factors affecting adherence to therapeutic regimens among older adults with hypertension, in particular addressing cognitive function and physical function. However, the modifiable factors directly and indirectly affecting adherence to therapeutic regimens both medication and lifestyle modification among older adults with hypertension have still not been established. Also, inadequate existing knowledge of factors clearly related to this issue causes health care providers tailoring incomprehensive interventions for enhancing adherence to therapeutic regimens. Therefore, it is important to examine factors directly and indirectly affecting adherence to therapeutic regimens among older adults with hypertension. The results from this study will be helpful on going to conduct an appropriate intervention program for promoting adherence to therapeutic regimens among older adults with hypertension.

Research Objectives

A causal model of adherence to therapeutic regimens among older adults with hypertension consists of two objectives including the general and the specific objective described as follows:

1. The general objective is to test a model of adherence to therapeutic regimens among older adults with hypertension.
2. The specific objectives are categorized into two aspects:

2.1 To examine the relationships between cognitive function, physical function (IADLs), knowledge of hypertension, health beliefs (perceived susceptibility, perceived severity, perceived benefits, and perceived barriers), self-efficacy to adherence, social support from family, and provider-patient communication and adherence to therapeutic regimens among older adults with hypertension.

2.2 To identify factors directly and indirectly affecting adherence to therapeutic regimens among older adults with hypertension.

Research Questions

The research questions consist of two aspects as follows:

1. What relationships are there between cognitive function, physical function (IADLs), knowledge of hypertension, health beliefs (perceived susceptibility, perceived severity, perceived benefits, and perceived barriers), self-efficacy to adherence, social support from family, and provider-patient communication and adherence to therapeutic regimens among older adults with hypertension?

2. What factors have direct and indirect effects on adherence to therapeutic regimens among older adults with hypertension?

Definition of Terms

Adherence to therapeutic regimens among older adults with hypertension is defined as the extent of agreement and performance of older adults with hypertension in the recommendation of health behaviors provided by health care personnel, including antihypertensive drugs taking and lifestyle modification consisting of antihypertensive taking, dietary modifications, weight control, physical activity, avoiding from hypertensive risk factors, stress management and keeping appointment. It was measured by the Hypertensive Adherence to Therapeutic Regimens Scale (HATRS) developed by Pinprapapan (2013). A higher score level means a higher level of adherence to therapeutic regimens.

Cognitive function is the capability of older adults with hypertension to perform intellectual tasks and mental processes encompassing the important parts of remote memory, orientation, immediate memory, attention, general knowledge, language,

abstract thinking, judgment and calculation. It was measured by the Chula Mental Test (CMT) developed by Jitapunkul et al. (1996). The interpreted scores are categorized into four levels, 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).

Physical function (IADLs) is the extent to which persons performing five instrument activities of daily living (IADLs), including walking outdoors, cooking, transportation, money exchange, and heavy house work. These aspects of physical function was measured by the Chula Activity of Daily Living Index (CAI) in Thai version developed by Jitapunkul, Kamolratanakul, and Ebrahim (1994). The total scores were interpreted by the range, the higher the total score, the greater physical function and the lower the total score, the lower physical function.

Knowledge of hypertension refers to information regarding hypertension, including the definition of hypertension, medication treatment, adherence to therapy, lifestyle modification, complications, and continuous follow-up visits. It was measured by the Hypertension Knowledge-Level Scale (HK-LS) developed by Erkoc et al. (2012). The cut-off point was classified into two levels, including adequate knowledge which had total score of 18 and above, and inadequate knowledge which had score less than 18.

Health beliefs (perceived susceptibility, perceived severity, perceived benefits, and perceived barriers) are defined as a set of perceptions of older adults with hypertension and divided into four subscales in terms of perceptions, including perceived susceptibility to complications of hypertension, perceived severity of hypertension and its impact, perceived benefits of antihypertensive drugs taking and lifestyle modification, and perceived barriers to perform antihypertensive drugs taking and lifestyle modification. These variables were measured by the Health Beliefs for Hypertensive Patient Scale (HBHS) developed by Pinprapapan (2013). The higher scores of perceived susceptibility, perceived severity, and perceived benefits refer to the higher appropriate health belief, whereas the lower scores of perceived barriers refer to the higher level of health belief.

Perceived susceptibility refers to the belief of older adults with hypertension about the risk of complications of uncontrolled blood pressure.

Perceived severity refers to the belief of older adults with hypertension with the seriousness or severity of the complications of uncontrolled blood pressure.

Perceived benefits refer to the belief of older adults with hypertension with the benefits of adherence to perform antihypertensive drugs taking and lifestyle modification.

Perceived barriers refer to the belief of older adults with hypertension about their barriers to perform adherence to antihypertensive drugs taking and lifestyle modification.

Perceived self-efficacy to adherence refers to the extent that the elderly with hypertension confidences that he or she can be successful in performing health behaviors recommended by the health care provider for being able to control their blood pressure. These behaviors consist of antihypertensive taking, dietary modifications, weight controlling, physical activity, avoiding from hypertensive risk factors, stress management, and keeping appointment. It was measured by the Hypertensive Self-efficacy Scale (HSS) developed by Pinprapapan (2013). The higher the total score, the greater perceived self-efficacy to adherence and the lower the total score, the lower perceived self-efficacy to adherence were interpreted.

Social support from family refers to the level of four assistances from family including emotional, instrumental, information and appraisal support which are perceived by older adults with hypertension for keeping adherence behavior to therapeutic regimens. It was measured by the Hypertensive Social Support Scale (HSSS) developed by Pinprapapan (2013) which based on House (1981). The higher scores indicate better social support.

Provider-patient communication is the extent to which the elderly with hypertension's perception in communication behavior of health care providers which are categorized into three dimensions, including (1) general giving clarified talking, (2) giving manifest explanation about antihypertensive medication and lifestyle

modifications and (3) carefully listening to and responding to patient problems and concerns about hypertension management. It was measured by the Thai version of Provider-Patient Communication Scale (PCS) of Pinprapapan (2013). The higher scores indicate better communication between health care providers and patients.

Older adults with hypertension refer to older persons aged 60 years and over who have been diagnosed with hypertension and taking antihypertensive drug of at least one type.