Factors Influencing Diabetes Self-Management Behaviors among Patients with T2DM in Rural Thailand

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This dissertation is dedicated to my mother and to the generation of teachers who have beautifully carried the lamp of science to nursing.

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LIST OF ABBREVIATIONS

ADA	American Diabetes Association
A1C	Hemoglobin A1C
BIDR	Balanced Inventory of Desirable Responding
BMI	Body Mass Index
CAD	Cardiovascular Disease
CDC	Centers of Disease Control and Prevention
CIRS	Chronic Illness Resources Survey
DCCT	Diabetes Control and Complications Trial
DM	Diabetes Mellitus
DKT	Diabetes Knowledge Test
DSE	Diabetes Self-Efficacy
EDIC	Epidemiology of Diabetes Intervention and Complications
ER	Environmental Risk
FFB	Kristal Fat and Fiber Behaviors Questionnaire
ISEL	Interpersonal Support Evaluation Checklist
OB	Optimistic Bias
PASE	Physical Activity for Elderly
PDR	Personal Disease Risk
PPC	Perceived Personal Control
MAR	Missing At Random
MCAR	Missing Completely At Random
MNAR	Missing Not At Random
MOS	Medical Outcomes Study
NGSP	National Glycohemoglobin Standardization Program
RK	Risk Knowledge
RPS-DM	Risk Perception Survey for Diabetes Mellitus
SD	Standard Deviation
SDIS	Stockholm Diabetes Intervention Study
SDSCA	Summary of Diabetes Self-Care Activities
T1DM	Type 1 Diabetes Mellitus
T2DM	Type 2 Diabetes Mellitus
TDR	Thailand Diabetes Registry
UKPDS	United Kingdom Prospective Diabetes Study

SUMMARY

There are limited studies on diabetes self-management behaviors in Thai adults with Type 2 diabetes (T2DM). In effort to extend this knowledge of Thai population, the purposes of this exploratory study are: 1) to examine influences of the predictors (Buddhist values, social support, self-efficacy, general diabetes knowledge, risk perception of developing complications, and A1C) on their self-management behaviors, and 2) to determine influences of the predictors including Buddhist values, social support, self-efficacy, general diabetes knowledge, risk perception of developing complications, and self-management behaviors contribute to optimal glycemic control (A1C) in the middle-aged to elderly with T2DM living in rural Thai communities.

A total of 197 adults aged 30-79 with T2DM completed the following self-report surveys: Summary of Diabetes Self-Care Activities (SDSCA), brief Chronic Illness Resources Survey (CIRS), Risk Perception Survey for Diabetes (RPS-DM), Buddhist Value Survey, Diabetes Self-Efficacy (DSE), Diabetes Knowledge Questionnaires (Thai), and personal factors. Subjects had capillary blood taken for A1C measurement.

Self-management behaviors were moderate, with self-reported high to low engagement in medications, foot care, dietary, exercise, and blood glucose monitoring. Risk knowledge related to developing diabetes complications was high. Scores on optimistic bias, personal control, worry of developing DM complications were higher than scores on personal disease risk. Social support, self-efficacy, diabetes knowledge, and Buddhist values were moderate to high. Optimal glycemic control rate was low. Pearson’s product moment correlation analyses revealed that self-management behaviors were significantly positively associated with perceived social support,

diabetes self-efficacy, general diabetes knowledge, and Buddhist values, but negatively significantly related to risk perception. There was no relationship between glycemic control and self-management behaviors, perceived social support, diabetes self-efficacy, general diabetes knowledge, Buddhist values, and risk perception. Simultaneous regression analyses demonstrated that Buddhist values, diabetes self-efficacy, and risk perception were the strongest explanatory variables for self-management behaviors in this population, accounting for approximately 21% of the variance in self-management behavior. Regression analyses showed that duration of diabetes and age significantly contributed to the variance of glycemic control, explaining 6% of the variance in A1C.

Diabetes self-management strategies increase lifestyle adjustments to maintain best possible diabetes management to achieve optimal glycemic control in T2DM. Findings from this study support the relationship between self-management behaviors and Buddhist values, self-efficacy, and risk perception. Self-management programs designed to improve diabetes self-management skills should consider including strategies of Buddhist teachings and practices, self-efficacy, and understanding of risk perception for developing complications.

I. INTRODUCTION

A. Background

Diabetes mellitus (DM) and its complications in adults remain a global health problem. Currently, an estimated 366 million people worldwide have diabetes; over 90% of those have type 2 diabetes (T2DM) (International Diabetes Federation [IDF], 2011). The global diabetes burden is increasing. Approximately 280 million adults have impaired glucose tolerance, also called "pre-diabetes" (IDF, 2011). By year 2030, diabetes is expected to be the leading cause of death worldwide (Mathers & Loncar, 2006), with a global prevalence of 552 million (IDF, 2011). In the most recent report from the Centers for Disease Control and Prevention (CDC), over 25.8 million people (8.3%) in the U.S. population were affected by diabetes (Centers for Disease Control and Prevention, 2011). Diabetes is sharply increasing in the U.S. population and is associated with considerable increase in treatment costs and health expenditures (Alexander, Sehgal, Moloney, & Stafford, 2008).

In Thailand, approximately 8% (2.4 million people) of Thai adults are affected by diabetes (Aekplakorn et al., 2003), and 12.4% have pre-diabetes (Aekplakorn et al., 2007). Approximately one-half of those with diabetes are undiagnosed (Aekplakorn et al., 2007). Diabetes among Thai adults is estimated to increase to 9.8% (4.9 million) by year 2030 (IDF, 2010). The majority of those who have T2DM are aged 35 years or older, and 58% (1.4 million) reside in rural areas (Aekplakorn et al., 2003).

This increased diabetes burden imposes a larger economic burden on individuals and the national health care system (IDF, 2010). Diabetes patients with complications have higher health care expenditures (Chaikledkaew, Pongcharoensuk,

Ongphiphadhanakul, & Chaiyakunapruk, 2005). The treatment costs of diabetes and its complications are an additional 16% for T2DM with hypertension, and increases up to 232% for T2DM with gangrene, compared to T2DM without complication (Riewpaiboon, Pornlertwadee, & Pongsawat, 2007).

As reported respectively in the Thailand Diabetes Registry (TDR) study (*N* = 8,416) (Rawdaree et al., 2006) and in the Diabcare-Asia (Thailand) survey (*N* = 1,078) (Nitiyanant et al., 2007), severe complications are prevalent in both urban and rural areas. When urban and rural areas are compared, the prevalence of nephropathy (44% vs. 17%); retinopathy (31% vs. 13.6%), cardiovascular problems (8% vs. 0.7%), and stroke (4.4% vs. 1.9%) is higher in urban areas. The specific prevalence of peripheral neuropathy is not reported but is estimated to be 34% in rural areas. Amputation is less common, but it is an important problem both in urban (1.6%) and rural areas (1.3%) (Thai Multicenter Research Group on Diabetes Mellitus, 1994). This disproportion in the prevalence of complications between rural and urban areas may be a result of differences in sample characteristics, sample size, and services of settings.

Chronic hyperglycemia is a major problem, leading to progression of diabetes complications. A1C reflects average glycemic control over several months (Sacks et al., 2002). In general, glycemic goal recommendations for adult are 7% or lower, if this can be achieved without episodes of severe hypoglycemia or other severe adverse effects of treatment (American Diabetes Association [ADA], 2011). In Thai populations, glycemic control (A1C < 7%) rates are poor in both urban (38%) (Rawdaree et al., 2006) and rural (29%) areas (Worawongprapa, 2008).

Diabetes self-management is composed of strategies designed to develop healthy lifestyle leading to optimal diabetes control. The purpose of self-management strategies is to help patients make management choices that allow them to achieve success in reaching self-care goals (Lorig et al., 1999). Self-management includes individual tasks that must be performed to live with chronic health conditions such as diabetes. Self-management tasks in diabetes include insulin and medication adjustments; blood glucose monitoring; alterations in the timing, frequency, and content of meals; changes in exercise patterns; and foot care.

In other populations, a number of barriers have been identified that interfere with performing diabetes self-management tasks. These include depression (Dalewitz, Khan, & Hershey, 2000), fear of needles and pain related to self-blood testing, lack of self-control over diet; lack of personal control over the ability to maintain self-care behaviors (Chlebowy, Hood, & LaJoie, 2010; Vijan et al., 2005), and financial problems (Dalewitz et al., 2000; Schoenberg & Drungle, 2001). The ability to manage symptoms, the ability to communicate with health care providers, emotions and social roles (family, personal and work) also may be major barriers that interfere with diabetes self-management. Additionally, the ability to complete diabetes self-management tasks may be influenced by factors including age, gender, duration of diabetes, treatments, (Ruggiero et al., 1997), and education (Sarkar, Fisher, & Schillinger, 2006). Whether these barriers are the same for Thai populations is not known.

Management of nutrition, medications, exercise, and symptoms are necessary strategies needed to achieve and maintain optimal blood glucose control. Self-management strategies are behaviors that help individuals maintain optimal blood

glucose levels and postpone the devastating acute and chronic complications of diabetes (Heisler, Smith, Hayward, Krein, & Kerr, 2003). Patients need to understand how emotions such as fear, anger and depression affect their ability to participate in self-management activities. Patients with diabetes need to work with health care providers (nurses, nurse-educators and physicians) to learn about self-management strategies (Lorig et al., 1999; Norris, Lau, Smith, Schmid, & Engelgau, 2002). Communication with health professionals, problem-solving and decision-making are necessary components of optimal diabetes self-management strategies. These strategies can assist patients with diabetes to develop skills necessary to reach the goal of glycemic control as the target of diabetes self-management strategies.

B. **Statement of the Problem**

Little is known about self-management behaviors among Thai adults with T2DM. As noted in the previous section, diabetes is a public health burden in Thailand. Optimal diabetes self-management may lessen the burden. Self-management strategies include diet regulation, medicine use, exercise, blood glucose monitoring, foot care, weight loss, blood pressure and renal function monitoring. Not all patients adhere to self-management strategies. There are many reasons that people with diabetes decide to not follow their physician's recommendations. However, glycemic control is a focal point of diabetes management because diabetes complications progress with chronic hyperglycemia. In the following paragraphs, a discussion will be presented about glycemic control and risk of diabetes complications.

1. Glycemic Control and the Development of Complications

Control of blood glucose to near normal levels is the optimal goal of diabetes management, in order to prevent developing major diabetes complications. Intensive therapy is recommended to achieve optimal blood glucose control in both type 1 diabetes (T1DM) and T2DM. Several research groups have examined the effects of intensive therapy on decreasing risk of acute and chronic complications of long-term diabetes in both types of diabetes. These are described below.

a. Intensive Treatment of Type 1 Diabetes

Intensive therapy in T1DM consists of insulin injections performed three or more times daily or an insulin pump, along with self-monitoring of blood glucose performed at least four times a day and of food intake management and proper exercise. Insulin doses are adjusted to achieve optimal glycemic control.

In the Diabetes Control and Complications Trial (DCCT), the effects of intensive blood glucose control were examined in subjects with T1DM (*N* = 1,441) (Diabetes Control and Complications Trial Research Group, 1993). The subjects were followed for approximately 6.5 years. Subjects who had T1DM without retinopathy and those with mild retinopathy were randomly assigned to receive conventional or intensive therapies. Compared to conventional therapy, intensive therapy dramatically reduced the risk of developing retinopathy by 76% in the primary prevention cohort (i.e., those without evidence of retinopathy at baseline). For the secondary-intervention cohort (i.e., those with retinopathy at baseline), intensive therapy considerably reduced the progression of retinopathy by 54%, and decreased the development of proliferative and severe nonproliferative retinopathy by 47%. In the two cohorts, intensive therapy reduced the

occurrence of nephropathy (microalbuminuria [39%] and albuminuria [54%]) and neuropathy (60%).

In the Stockholm Diabetes Intervention study (SDIS), people with T1DM (*N* = 102) receiving *intensified insulin therapy* (*n* = 48) had lower A1C levels and a lower rate of retinopathy (14% vs. 35%), nephropathy (25% vs. 47%), and neuropathy (14% vs. 28%), compared to the group receiving *standard insulin therapy* (*n* = 54) after approximately 7.5 years (Reichard, Nilsson, & Rosenqvist, 1993). These results suggest that intensive therapy is an effective way to achieve glycemic control to decrease the risk of microvascular complications in people with T1DM.

The Epidemiology of Diabetes Interventions and Complications (EDIC) was a study designed to follow the participants in the DCCT longitudinally (Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications (DCCT/EDIC) Study Research Group, 2005). After 17 years of follow-up, intensive therapy reduced the long-term risk of cardiovascular disease by 42%. Additionally, the intensive therapy group had a lower prevalence of coronary artery calcification (an index of atherosclerosis) compared to the conventionally treated group (21.7% vs. 29.8%; OR = 1.59, 95% CI = 1.06-2.39, $p < 0.024$) (Cleary et al., 2006).

b. **Intensive Treatment of Type 2 Diabetes**

Whereas the DCCT and the SDIS showed significant effect of intensive therapy in reducing risks of microvascular complications in T1DM (Diabetes Control and Complications Trial Research Group, 1993; Reichard et al., 1993), the United Kingdom Prospective Diabetes Study (UKPDS, the largest and longest study) demonstrated similar reductions in patients with T2DM (American Diabetes Association,

2002; United Kingdom Perspective Diabetes Study, 1998). In the UKPDS, intensified groups were treatment with insulin (*n* = 1,156) and sulfonylureas (*n* = 1,573), while the conventional group was treated with diet regulation (*n* = 1138). Subjects were randomly assigned to receive treatment and followed for approximately 10 years. Intensive therapy substantially decreased the risk of developing microvascular diabetes complications by 25%, compared to the conventionally treated group. There was a 16% reduction in risk for developing *macrovascular* complications; however, the result was not statistically significant (*p* = 0.052) (UKPDS). Additionally, further analysis of the UKPDS data demonstrated that reductions in A1C were associated with decreased risk of complications in adults with T2DM (e.g., for every 1% decrease in A1C, risk of complications was reduced by 35%) (Stratton et al., 2000).

In the Kumamoto Study, the effect of intensive therapy with multiple insulin injections was examined in 110 lean Japanese subjects with T2DM (Shichiri, Kishikawa, Ohkubo, & Wake, 2000). The subjects who had T2DM without retinopathy and nephropathy (*n* = 55) and those with mild retinopathy and nephropathy (*n* = 55) at baseline were randomly assigned to receive intensive or conventional therapy. The subjects were followed for approximately 8 years. In the primary prevention cohort (i.e., those without retinopathy and nephropathy), development of nephropathy (11.5% vs. 43.5%, *p* = 0.029) and retinopathy (15.4% vs. 47.8%, *p* = 0.022) was significantly lower in the intensively treated group than those in the conventionally treated group. For the secondary-intervention cohort (i.e., those with mild retinopathy and nephropathy at baseline), the incidence of patients who progressed in stages of nephropathy (16.0% vs. 40.0%, *p* = 0.043) and retinopathy (24.0% vs. 56.0%, *p* = 0.023) was significantly

lower in groups treated intensively than in groups treated conventionally. Intensive therapy significantly improved peripheral nerve functions (sensory and motor) and somatic and automatic nerve functions after 8 years with normal glycemic ranges ($p < 0.05$), while nerve functions slightly deteriorated in the conventionally treated group.

People with diabetes are at risk of developing diabetes complications that can be either macrovascular (cardiovascular, peripheral vascular and stroke) or microvascular (neuropathy, nephropathy, and retinopathy). As suggested by the results of the DCCT, SDIS, UKPDS and Kumamoto studies, optimal glycemic control is considered to be an A1C < 7%, which can significantly decrease the risk of developing diabetes complications. Aggressive medication therapy with self-management strategies are recommended to achieve success in obtaining optimal glucose control (ADA, 2011). In general, middle-aged or elderly adults may find that the burden of physical demands of diabetes, emotional issues related with diabetes management, and several identified barriers can seriously impede performing self-management strategies. Psychological factors, culture and beliefs play important roles in development of health behaviors (Skaff, Mullan, Fisher, & Chesla, 2003). In Thailand, little is known about the influence of cultural beliefs of Buddhist values, social support, self-efficacy, perceived risk for developing complications, and diabetes knowledge on accomplishment of self-management behaviors among middle-aged to elderly people with T2DM living in rural areas. There is no research linking these factors and examining their impact.

C. **Purpose of the Study**

Life stress is a cause of fatigue and tiredness in daily activities, living with diabetes has added responsibilities of maintaining the best possible blood glucose

levels. There are limited studies on diabetes self-management behaviors in Thai adults with T2DM. Patients with poor diabetes self-management behaviors may have chronic hyperglycemia that increases their risk of developing complications. These patients need to adhere to diabetes self-management practices to control their elevated blood glucose levels. There are, however, psychosocial factors that may influence their ability to perform these behaviors.

In effort to extend this knowledge of Thai population, the purposes of this exploratory study are: 1) to examine influences of the predictors (Buddhist values, social support, self-efficacy, general diabetes knowledge, risk perception of developing complications, and A1C) on their self-management behaviors (**Figure 1**), and 2) to determine influences of the predictors including Buddhist values, social support, self-efficacy, general diabetes knowledge, risk perception of developing complications, and self-management behaviors contribute to optimal glycemic control (A1C) in the middle-aged to elderly with T2DM living in rural Thai communities.

1. **Theoretical Framework and Self-Management**

The primary conceptual framework for the proposed study “Factors Influencing Diabetes and Self-Management Behaviors among Patients with T2DM in Rural Thailand” presented in Figure 1 are developed from the literature and guided by the theoretical concept of “self-management” (Creer, 2000).

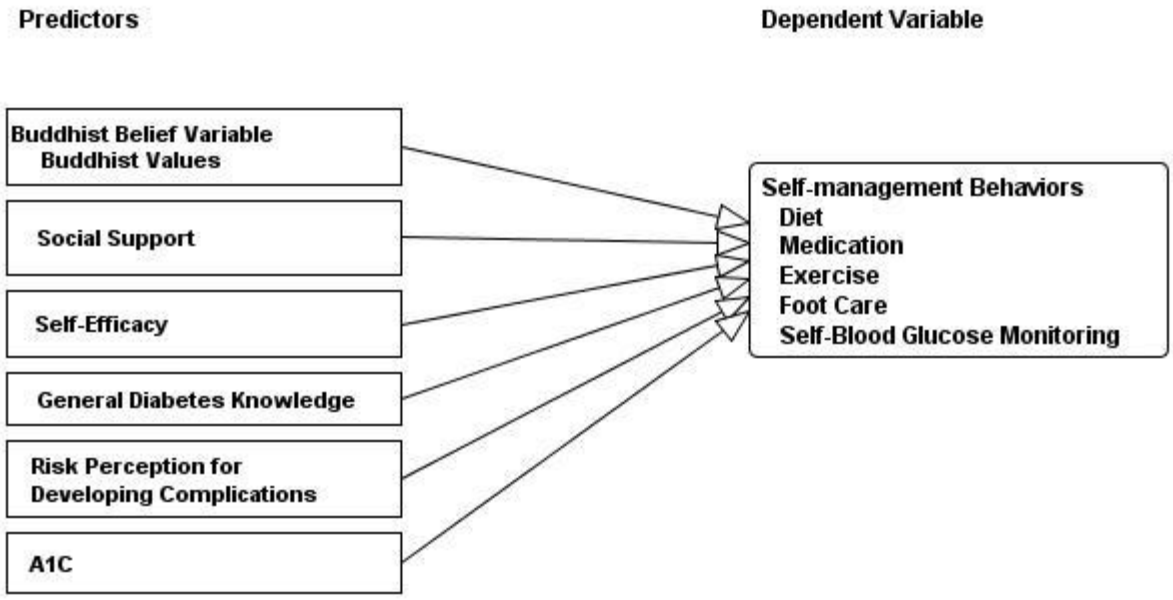

Figure 1. Primary Conceptual Framework of Factors Influencing Diabetes Self-Management Behaviors among Patients with T2DM in Rural Thailand

In general, “self-management” is characterized by a number of multidimensional behaviors. Basic diabetes self-management behaviors include medication use, dietary practices, exercise, blood glucose monitoring and foot care. Diabetes self-management behaviors are among the most important measures for achieving optimal glycemic control, which is associated with a decrease in the development of diabetes complications. These self-management behaviors are developed through the processes of goal selection, information selection, information processing and evaluation, decision making, action, and self-reaction. A number of predictors for diabetes self-management behavior have been identified, including

personal factors, diabetes knowledge, age, gender, education level, duration of diabetes, attitudes, self-efficacy, social support, and problem-solving skills.

Frequencies of self-management behaviors increase with age, retirement, working status, insurance coverage, and insulin use in people with T1DM and T2DM (Ruggiero et al., 1997). Female gender, higher education level, longer duration of disease and married marital status are associated with higher levels of self-management behaviors (Ruggiero et al., 1997; Xu, Toobert, Savage, Pan, & Whitmer, 2008). These variables, however, vary across levels of diabetes knowledge (Brown, 1987; Chantrakul, Salibutra, & Ramasoota, 2007; He & Wharrad, 2007), self-efficacy (Skaff et al., 2003), cultural beliefs (Sowattanangoon, Kochabhakdi, & Petrie, 2008), and A1C levels (Skaff et al., 2003).

In Thailand, there is a high prevalence of T2DM among adults with diabetes (Aekplakorn et al., 2007); therefore, the proposed study will be limited to adults with T2DM. Age, gender, education, and duration of diabetes will be included in the primary conceptual framework (Figure 1) as predictors of self-management behaviors. These demographic variables will be adjusted for potential confounders that may cause variability in self-management behaviors.

a. Buddhist Beliefs

Culture and social context are related to both social life and health behaviors (Glasgow, Hampson, Strycker, & Ruggiero, 1997; Glasgow & Toobert, 1988). Over 90% of Thais are Buddhist, but little attention has been paid to the role of Buddhist beliefs on self-management behaviors among Thai patients with diabetes. As a cultural norm, Buddhist beliefs and practices are ways of thinking and behaving with a

mindfulness that are important in accepting diabetes and coping and living with the disease (Sowattanangoon et al., 2008). Buddhist beliefs and practices such as chanting, meditation, and mindfulness are believed by Buddhists to relieve stress and be good for humankind. Buddhist values have been shown to be significantly correlated with self-management behaviors (better diet self-care and more frequent doctor visits) and glycemic control among Thais with T2DM (Sowattanangoon et al., 2008). In Figure 1, Buddhist beliefs and practices are theorized to be associated with diabetes self-management behaviors.

b. Social Support

The relationship between individuals and their environments, such as family, friends, social networks, culture, and social context, is a multilevel system of support for coping with a chronic illness such as diabetes (Glasgow et al., 1997; Glasgow & Toobert, 1988). These resources for support can enhance adjusting to the new lifestyle that T2DM demands (Gilden, Hendryx, Clar, Casia, & Singh, 1992; Trento et al., 2001) and help maintain behavioral changes such as in increasing physical activity and in reducing fat consumption (Barrera Jr, Strycker, Mackinnon, & Toobert, 2008). Jones and colleagues (Jones, Remley, & Engberg, 1996) found that people with T2DM increased self-blood glucose testing (17.3%) and maintained blood-testing behaviors (9.7%) when free strips and self blood testing classes were provided. Those resources were important supports for performing self-management behaviors, and the concept of socio-ecological resources of support are consistent with the Thai family and social context. Thus, resources and social support are included in Figure 1 as factors that may predict diabetes self-management behaviors.

c. Self-Efficacy

Improving self-efficacy is helpful in improving self-management for people with chronic conditions. In many intervention studies, self-efficacy was associated with health-improving behaviors in patients with diabetes (Glasgow et al., 1989; Hurley & Shea, 1992; McCaul, Glasgow, & Schafer, 1987; Padgett, 1991; Sarkar et al., 2006; Skaff et al., 2003). In a study by Glasgow et al. (1989), adults with T2DM were highly confident in medicine use (89%), self-monitoring blood glucose (SMBG) (80%), and diet management (78%). Confidence in performing exercise was lower (59%) compared to other self-management behaviors. In a population with limited health literacy, T2DM patients with higher self-efficacy were more likely to perform optimal self-management behaviors (diet, exercise, self-blood glucose testing, and feet care) (Sarkar et al., 2006). Self-efficacy has been shown to be a strong predictor of adherence across all self-management activities in patients with T1DM (McCaul et al., 1987). Higher self-efficacy has been reported to enhance behaviors of self-managed health conditions (Hurley & Shea, 1992). Thus, self-efficacy is selected as an independent predictor of self-management behaviors in Thais with T2DM (Figure 1).

d. General Diabetes Knowledge

Appropriate knowledge of basic diabetes physiology, diet, medication, blood glucose monitoring, and general diabetes care has been viewed as an essential aspect of diabetes management (Dunn et al., 1984; Fitzgerald et al., 1998). In a Thai population with T2DM, people who had more diabetes knowledge were likely to have improved glycemic control (Chantrakul et al., 2007). Diabetes education may improve diabetes knowledge and diabetes self-management behaviors; in turn, better

self-management behaviors have been shown to significantly decrease glycemic levels (Brown, Garcia, Kouzekanani, & Hanis, 2002; Keeratiyutawong, Hanucharurnkul, Boonchauy, Phumleng, & Muangkae, 2006; Wattana, Srisuphan, Pothiban, & Upchurch, 2007). While Chan and Molassiotis (1999) demonstrated that diabetes knowledge was not related to diabetes compliance, diabetes education can help people develop self-management behaviors. Little is known about the relationship between diabetes knowledge and self-management behaviors among Thais with T2DM. Thus, in this study, the relationship between diabetes knowledge and self-management behaviors will be explored in a Thai sample of patients with T2DM.

e. Risk Perception of Developing Complications

Risk perception for developing complications is believed to raise awareness of diabetes complications and encourage people to perform preventive behaviors. Perceptions of risk may affect a patient's emotions such as fear, which could have an impact on health care behaviors (Shiu, 2004). Perceived risk and the belief that diabetes is a severe life-threatening disease might lead an individual to develop positive attitudes toward health preventive behaviors (Lek & Bishop, 1995; O'Connor, Crabtree, & Yanoshik, 1997). People with diabetes who deem the condition as serious and feel susceptible to the risks may be more likely to change their behaviors to reduce the risks of developing complications. The judgment of diabetes as a personal health risk might have an impact on self-management behaviors. Thus, risk perception for developing complications will be explored for its association with self-management behaviors among Thais with T2DM.

f. Glycemic Control (A1C) and Self-Management

In follow-up studies of a self-management program, improving self-management behaviors significantly improved glycemic control (Brown et al., 2002; Keeratiyutawong et al., 2006; Wattana et al., 2007). The A1C is an estimated average of blood glucose levels over the previous three months--the average erythrocyte lifespan. Self-management behaviors are self-report estimates over the previous week up to one month. Thus, A1C is a good indicator for monitoring the effectiveness of self-management behaviors (ADA, 2011). Increased self-management behaviors have been consistently associated with decreased A1C levels (Speer et al., 2008).

In Figure 1, the selected variables of Buddhist beliefs, social support, self-efficacy, diabetes knowledge, risk perception for diabetes complications and A1C are expected to have impact on self-management behaviors (diet, medication, exercise, foot care, and self-blood glucose monitoring). In addition, self-management behaviors are combined with the other six predictor variables (Buddhist beliefs, social support, self-efficacy, diabetes knowledge, risk perception for diabetes complications, and A1C); these predictors are expected to impact A1C levels. Although there are interrelationships among variables of social support, self-efficacy, general diabetes knowledge, and others, this exploratory study focuses on the predictor variables that are associated with self-management behaviors and A1C among Thais with T2DM.

The specific questions are:

1. Which of the six predictor variables of Buddhist beliefs (Buddhist values), social support, self-efficacy, general diabetes knowledge, risk perception for developing complications, and A1C are the most influential in predicting adherence of self-

management behaviors (diet, medication, exercise, foot care, and self-blood glucose monitoring)? Are there any factor variables that do not contribute significantly to the prediction model?

2. Do self-management behaviors combined with Buddhist beliefs (Buddhist values), social support, self-efficacy, general diabetes knowledge, risk perception for developing complications significantly contribute to the prediction of A1C in adults with T2DM in rural areas?

The specific aims of the study are to:

Controlling for age, gender, education, and duration of diabetes,

1. Examine which of the six predictor variables (Buddhist values, social support, self-efficacy, general diabetes knowledge, risk perception for developing complications, and A1C) are the most influential in predicting self-management behaviors (diet, medication, exercise, foot care and self-blood glucose monitoring) among Thai adults with T2DM.

2. Determine whether self-management behaviors combined with Buddhist values, social support, self-efficacy, general diabetes knowledge, and risk perception for developing complications significantly contribute to the prediction of A1C in adults with T2DM in rural areas.

D. **Significance of the Study**

Diabetes self-management is a cornerstone of overall diabetes management in decreasing risk of diabetes complications. Diabetes self-management is a burden that can be affected by personal and interpersonal factors. In Thailand, little is known about diabetes self-management behaviors and factors influencing diabetes self-management

behaviors. Although there are findings related to self-care behaviors from international countries, they are not applicable to the Thai population because of differences in culture and beliefs (Christopher, Charoensuk, Gilbert, Neary, & Pearce, 2009; Sowattanangoon, Kochabhakdi, & Petrie, 2009). In Thailand, few research studies have focused on self-management program interventions. In addition, knowledge of the factors influencing self-management behaviors is limited. This research will provide basic information that might help health care providers to better understand how well patients are able to perform self-management behaviors. Appropriate recommendations will be provided that might help better patients' self-management behaviors for their diabetes.

Findings of this study will be used to describe types and frequency of self-management behaviors and explain the multiple plausible factors that can predict self-management behaviors among Thais with T2DM in rural communities. The goal of this study is to explore the relationship between self-management behaviors and factors that might enhance self-management regarding diet, physical activity, medication, blood glucose monitoring, and feet care. The aim of this study is to provide health providers better understanding Thai patients' self-management behaviors. This basic information will help in developing suitable interventions or education programs to improve self-management behaviors.

II. THEORETICAL FRAMEWORK AND RELATED LITERATURE

A. Diabetes Self-Management

Self-management behaviors are essential components for optimal glycemic control. Self-management strategies require individual responsibility in managing this chronic disease. The concept of self-regulation is defined as “those processes, internal and/or transactional, that enable an individual to guide his/her goal-directed activities over time and across changing circumstances (contexts)” (Karoly, 1993, p. 25). Self-management entails modulation of thought, affect, behavior, or attention through use of specific mechanisms and skills. Self-management’s process of goal-guided activities is similar to self-regulation, but, in self-management, goal selection is determined by other people or health providers (Karoly & Kanfer, 1982). Creer and Holroyd (1997) described self-management as the processes of goal selection, information collection, information processing and evaluation, decision making, action, and self-reaction. The procedure of self-management can change some aspects of one's behaviors. Skills in those processes are required to accomplish diabetes self-management, as described by Goodall and Halford’s definition (1991), in which self-management is “a set of skilled behaviors engaged in to manage one’s own illness” (p. 1). Thus, preparing patients with the skills needed for self-management processes is one of the most effective strategies to improve self-management behaviors.

Knowledge and information are necessary to build skills in self-management of disease (Parcel, Bartlett, & Bruhn, 1986), but they are not sufficient to change behavior (Coates & Boore, 1996, 1998). Behavior change is thought to be affected by self-confidence in one's ability to perform particular behaviors (Newman, Steed, & Mulligan,

2004). Training in the skills of problem solving and selecting goals is helpful to motivate people to be confident and ready to change. Individuals with diabetes have to take extensive responsibility in diabetes self-management, including medicine use, lifestyle change, and coping with diabetes in daily life. Individual skill is required to manage symptoms, treatments, physical and psychological consequences, and lifestyle adjustments (Barlow, Wright, Sheasby, Turner, & Hainsworth, 2002). Thus, training in basic self-management skills is needed for patients to better participate in the intensive treatment and diabetes care (Norris, Engelgau, & Venkat, 2001; Norris et al., 2002).

Sufficient knowledge of illness conditions and treatments leads to successful self-management behaviors. Self-management education helps people to be ready to change their health behavior (Gary, Genkinger, Guallar, Peyrot, & Brancati, 2003; Jones, 1990). In a study by Speer et al. (2008), engagement in a healthy eating plan, following eating plans, eating five or more servings of fruits and vegetables daily, spacing carbohydrates and inspecting of feet were all increased by one day per week after a 4-month training program in diabetes self-management. Levels of A1C were decreased correspondingly with the increase in physical activity and consistency of self-management behaviors (Speer et al., 2008). Wattana, Srisuphan, Pothiban, and Upchurch (2007) reported that a self-management program was significantly effective in decreasing glycemic levels and in improving self-efficacy and quality of life in Thai adults with T2DM.

Success of self-management behaviors requires a dynamic and continuous process of self-regulation. Adherence to self-management behaviors for people with diabetes is purported to prevent diabetes complications (Jones, 1990) and decrease

glycemic levels (Heisler, Smith et al., 2003; Speer et al., 2008; Whittemore, Melkus, & Grey, 2005). However, some activities of self-manage diabetes can be time-consuming, inconvenient, or difficult. Consequently, some patients with diabetes then choose to perform only parts of their diabetes regimens. For instance, people with diabetes may actively adhere to their medicine use, dietary guidelines, and blood glucose monitoring, yet they choose not to adhere to their exercise regulations (Chan & Molassiotis, 1999; Howteerakul, Suwannapong, Rittichu, & Rawdaree, 2007; Ruggiero et al., 1997).

The self-care behavior among Thais and Taiwanese with T2DM that is highly followed is taking prescription medications (89%-92%) (Howteerakul et al., 2007; Wattanakul & Quinn, 2010; Xu et al., 2008), followed by moderate engagement in following diet regulations (54%-72%) and exercise suggestions (19%-32%). There is low adherence to self-monitoring of blood glucose (4.5%) among the Taiwanese (Xu et al., 2008). In Thai adults with T2DM (*N* = 124), blood glucose monitoring and exercise were low in rural communities (Wattanakul & Quinn, 2010), while there was no report for self-monitoring blood glucose in other studies (Howteerakul et al., 2007; Keeratiyutawong et al., 2006).

A number of factors have an impact on people's self-management behaviors. Diabetes is a complex disease to manage through self-management efforts. Individuals with diabetes may have barriers to self-management efforts (Chlebowy et al., 2010) and lower adherence to self-management (Chlebowy et al., 2010; Gerber, Cho, Arozullah, & Lee, 2010; Ruggiero et al., 1997; Schoenberg & Drungle, 2001; Shenolikar, Balkrishnan, Camacho, Whitmire, & Anderson, 2006). In regard to variation among individuals, positive and negative responses to diabetes care can lead to different

attitudes and views of diabetes care (O'Connor et al., 1997). These differences are likely based on beliefs about the cause and seriousness of the disease and the effectiveness of treatments (Hampson, Glasgow, & Toobert, 1990). The spiritual and social context has an influence on coping with and adjusting to the disease (Samuel-Hodge et al., 2000). Although people with diabetes worried about suffering diabetes complications, their diabetes self-management behaviors had barriers from daily life stress, tiredness, and difficulties caused by diet deprivation (Samuel-Hodge et al., 2000; Whittemore et al., 2005). Those with lower income had financial challenges and lacked knowledge about diabetes, which in turn led to negative attitudes toward living with diabetes (Schoenberg & Drungle, 2001; von Goeler, Rosal, Ockene, Scavron, & De Torrijos, 2003). Thus, in development of self-management programs, several factors that impact self-management behaviors must be used as supports for increasing self-management efforts.

B. **Conceptual Framework of the Study**

The primary conceptual framework (Figure 1) show the potential factors of general diabetes knowledge, cultural beliefs, social support, self-efficacy, and risk perception for diabetes complications are linked as direct influences on developing self-management behaviors in T2DM and A1C levels. Personal factors such as age, gender, education and diabetes duration may differ in relation to self-management behaviors and A1C. The following discussion will be based on review of the evidence to support the selection of these particular variables in the framework.

C. Review of Related Literature Supporting the Framework

1. General Diabetes Knowledge

Knowledge, in terms of patient education, is a “learning experience with a combination of methods of teaching, counseling, and health behavior modification techniques which influence on improving patient’s knowledge and health behavior changes” (Dunn, 1990, p. 282). Improving knowledge and health behavior modification lead to optimal diabetes control (He & Wharrad, 2007; Heisler, Smith et al., 2003; Kemper, Savage, Niederbaumer, & Anthony, 2005). Diabetes knowledge is an essential component of diabetes self-management education.

Many studies, including those in Thailand, reflect problems associated with uncontrolled blood glucose (Aekplakorn et al., 2007). Patients' poor diabetes knowledge is one determinant that has an impact on glycemic control (Chantrakul et al., 2007). A self-management training program was helpful in improving diabetes knowledge and self-efficacy (Lorig et al., 1999; Norris et al., 2001) and in increasing self-efficacy, which led to improved health outcomes (Bandura, 1977, 1986; Williams, Freedman, & Deci, 1998). Individuals with diabetes who were involved in medical decision making together with their physicians had better self-care and lower A1C levels (Heisler, Piette, Spencer, Kieffer, & Vijan, 2005; Heisler et al., 2003). Several studies have suggested that patients with chronic disease who were engaged and active participants in their health care had better health outcomes (Lorig et al., 1999; Von Korff, Gruman, Schaefer, Curry, & Wagner, 1997; Von Korff et al., 1998). Patients’ knowledge and skills are required for communicating with their physicians and participating in making medical decisions (Heisler, Cole, Weir, Kerr, & Hayward, 2007; Heisler, Vijan et al., 2003;

Rothman et al., 2004). Little is known about the knowledge, skills and motivation that patients need to effectively participate in decision making along with their health care providers. However, diabetes knowledge is expected to help people be able to develop the skills needed to accomplish self-management behaviors.

Research studies on how diabetes knowledge related to diabetes and self-management behaviors and health outcome are conflicting. In one such study, individuals with less diabetes knowledge had higher A1C levels and higher incidence of severe hypoglycemia (Powell, Hill, & Clancy, 2007; Schiel, Ulbrich, & Muller, 1998). In another study, there was no significant relationship between knowledge and A1C levels (Coates & Boore, 1996). Many studies have indicated that diabetes self-management programs can improve diabetes knowledge and self-management behaviors, resulting in improved glycemic control (Brown et al., 2002; Keeratiyutawong et al., 2006; Wattana et al., 2007).

In contrast, in a diabetes knowledge survey by Chan and Molassiotis (1999), diabetes knowledge had no relationship to regimen compliance. Only 19% of participants in that study were deemed "knowledgeable" (score >80%), and 25% to 89% had correct answers. The small sample (N = 52) was over 58% low educated and 16% uneducated. Thus, the principles of diabetes management may be hard to understand when patients are little or no education. Lack of diabetes knowledge might lead to inadequate anticipation of ways to prevent avoidable negative consequences of diabetes. This raises concerns that individuals with diabetes need to be trained in skills and provided with information that supports diabetes self-management.

Whether perceived knowledge is related to health behavior modification remains a question. Diabetes knowledge was lower in a T2DM sample of individuals who had low education (West & Goldberg, 2002). Likewise, a higher level of diabetes knowledge can be predicted by higher education (Murata et al., 2003; Rafique, Azam, & White, 2006; West & Goldberg, 2002), literacy (Powell et al., 2007), age (McClean, McElnay, & Andrews, 2001; Rafique et al., 2006), insulin use (McClean et al., 2001; West & Goldberg, 2002), and duration of diabetes (West & Goldberg, 2002). West and Goldberg (2002) estimated that every 10-year increase in age would correspond to a 3% decrease in knowledge. Elderly people with diabetes with low education and low income were less receptive to education on diabetes self-care, which increased barriers to diabetes self-care (Murata et al., 2003; Schoenberg & Drungle, 2001; von Goeler et al., 2003; West & Goldberg, 2002). Brown and his colleagues (2000) reported that gender and type of treatment had no significant effects on diabetes knowledge. Interestingly, depression has been reported to have no significant impact on diabetes knowledge (Egede & Ellis, 2008). These personal factors have varied impact on the ability to learn and understand about diabetes and its treatment.

Those influences have been studied in Asians with diabetes. In one such study, diabetes knowledge had no association to gender, marital status, duration of diabetes, and diabetes complications (He & Wharrad, 2007). There was higher diabetes knowledge in individuals who were younger, college-educated, employed, or had a history of first-degree relative with diabetes. Treatment of diabetes can also be associated with acquisition of diabetes knowledge. Individuals who treated their diabetes with both diet and insulin use (26.22 ± 2.11) had significant lower diabetes

knowledge than those using a diet regimen alone (21.37 ± 3.83) (F (2,97) = 7.62, p < .001) (He & Wharrad, 2007). However, knowledge alone cannot ensure optimal glycemic control. In He and Wharrad's study, there was no difference in diabetes knowledge among Chinese with T2DM who had optimal and suboptimal control.

Much evidence indicates that there is insufficient knowledge about diabetes self-care. The scores of diabetes knowledge varied from 14% to 87% in different populations (Murata et al., 2003; Schoenberg & Drungle, 2001; West & Goldberg, 2002). West and Goldberg (2002) reported that, overall, both insulin users and non-insulin users missed 50% of the answers on the Diabetes Knowledge Test (DKT). This implies that people with DM lack enough knowledge about diabetes to self-manage. Literacy, ability to learn, and complicated questions on the instrument may have had an impact (Powell et al., 2007; Rothman et al., 2004), or differences in treatment or culture (Brown et al., 2002; Brown et al., 2000).

In our pilot study, there was a high number of incorrect responses to the DKT. Subjects had difficulty answering questions about their disease and its treatment: 76% of the subjects had incorrect answers to questions about unsweetened fruit juice and insulin reaction, 63% had incorrect responses to questions about urine ketones, and 60% provided incorrect answers about A1C (unpublished data). Their knowledge about "free food" (20 calories or fewer per serving) was low, as reflected by few correct responses in both groups: those with complications (28%) and without complications (29%) (no significant difference, χ^2 = .01, p = *.93*) (unpublished data).

In addition, misunderstanding and lack of knowledge about the demands of diabetes management are recognized as barriers to maintaining self-management

behaviors (Siripitayakunkit et al., 2008). Thai adults with T2DM performed self-management behaviors based on their beliefs even if those beliefs were based on misunderstandings about diabetes management (Keeratiyutawong et al., 2006). For example, although patients with diabetes believe that eating sweet foods and not taking medications are serious causes of high blood glucose levels, they continue to participate in these unhealthy practices. Medication and diet regulation were only carefully adhered to when blood glucose levels were high. This misunderstanding can put them at high risk of developing complications.

Because diabetes knowledge is needed for complex self-management, health providers should help individuals with diabetes understand their diabetes and provide information on improved daily lifestyles. Arguably, high scores on diabetes knowledge might not result in application of such knowledge to daily life. This may result in a gap between what the patient is taught and what the patient is doing. Little attention is paid to research on how diabetes knowledge affects patients' self-care behavior. To understand how to improve self-management behaviors, knowledge related to diabetes self-management behaviors are selected as a variable in this study because the literature suggests that it can affect self-management behaviors and that diabetes knowledge needs to be studied more in Thailand.

2. **Thai Cultural Beliefs**

Buddhism is the national religion of Thailand (Keyes, 1971). Approximately 95% of its population of nearly 63 million is Buddhist, mostly of the Theravada tradition (National Statistical Office, 2000). Buddhism influences Thai culture. Buddhism has a great deal of influence on the mind, character, ways of life,

health, and particularly mental health (Disayavanish & Disayavanish, 2007). The principal Buddhist teachings are the Four Noble Truths: (a) life is full of suffering, (b) suffering is originated from our own passion and craving, (c) cessation of suffering is attainable by dispassion and not craving, and (d) the way to end suffering is called the middle way described by the Noble Eightfold Path. The middle way is the way between the two extremes of excessive self-indulgence and excessive self-mortification (Buddhadasa, 1956). The middle way is a practical guideline to the development of the mind through mindfulness meditation and conscious self-acceptance (Buddhadasa, 1956; Christopher et al., 2009; Sowattanangoon et al., 2008). Thai culture, particularly Buddhism, strongly influences ways of life, and the Law of Karma helps people accept challenges and change their attitudes and behaviors toward unpleasant situations (Mikulas, 1983). The Thai mindfulness meditation is uniquely Thai (Christopher et al., 2009). Such types of mindfulness meditation have been integrated into cognitive behavioral therapies and anxiety reduction therapy (Disayavanish & Disayavanish, 2007; Rungreangkulkij & Wongtakee, 2008; Salmon, Lush, Jablonski, & Sephton, 2009).

a. **Buddhist Values in Patients with Chronic Disease**

Buddhism is the Thai philosophy of life and has a profound role in shaping the identity and attitudes of the Thai people, particularly those who live outside the urban areas. Thai people believe in Buddhist teachings and view suffering and illness as a result of bad karma (Burnard & Naiyapatana, 2004; Tongprateep, 2000). Lay people with diabetes believe that diabetes is caused by bad karma and diabetes is natural biology (Naemiratch & Manderson, 2007). Their diabetes belief is ambivalent

between biological viewpoints and religious beliefs (Sowattanangoon et al., 2008, 2009). Buddhist values are culturally specific regarding health beliefs and coping with chronic illness (Lundberg & Trichorb, 2001; Soonthornchaiya & Dancy, 2006; Sowattanangoon et al., 2009). In a sample of elderly Thai immigrants in the United States and Thai diabetics living in Thailand, practicing Buddhist teachings, acceptance, and mindfulness meditation were frequently used as coping strategies to accept their illness and its management (Soonthornchaiya & Dancy, 2006). Buddhist teachings have a calming effect on the mind, particularly practicing Buddhist ways in the temple. Two investigators attempted to improve self-management behaviors through acceptance, relaxation therapy, and mindfulness skills to cope with diabetes. These coping strategies have been reported to be associated with improved glycemic control (Gregg, Callaghan, Hayes, & Glenn-Lawson, 2007; Rosenzweig et al., 2007). One intervention study reported that mindfulness meditation had a hypoglycemic effect and slightly lowered blood pressure in a Thai sample of T2DM (Chaiopanont, 2008).

Diabetes self-management behaviors are related to a specific cultural issue. A preliminary study has determined that cultural beliefs are associated with self-management behaviors and glycemic control. Thai adults with T2DM who reported higher Buddhist values had higher engagement in medication and dietary self-care and health care use, and lower A1C levels (Sowattanangoon et al., 2008). Higher scores of Buddhist values were significantly positively correlated with better adherence to medication ($r = 0.25, p = .001$), regular diet ($r = 0.21, p = .007$), and frequency of doctor visits in the previous 12 months ($r = 0.34, p = .0001$) (Sowattanangoon et al., 2008). This research provides evidence that practicing Buddhism had a significant correlation

to A1C levels (r = 0.17, p < 0.026). The stronger belief in Buddhism was significantly related to A1C reduction (F (1, 161) = 6.0, p < 0.015, β = -0.20, R^2 = 0.03) even after controlling for age, gender, education level, and diet regulation. Buddhist values were higher in the older (r = 0.19, p < 0.01) and less educated (r = -0.38, p < 0.001), but not reported by gender. These findings imply that cultural beliefs can have an impact on self-management behaviors for Thais with T2DM.

3. **Socio-Ecological Resource for Social Support**

Behavior modification and self-management are difficult tasks in diabetes care (Norris et al., 2002; Weijman et al., 2005). It is a burden to integrate diabetes care tasks into daily lifestyle. Social support can mediate lifestyle adjustments to improve health outcomes. Social support is broadly defined by Barrera, Sandler and Ramsay (1981) as “the significant others help the individual mobilize his psychological resources and master his emotional burdens; they share his/her tasks; and they provide him/her with extra supplies of money, materials, tools, skills, and guidance to improve his handling of his situation” (p. 438). The perception of the availability of social support includes appraisal, belonging, tangibility and self-esteem (Wilson et al., 1986). Appraisal is the perception of who is available to talk to about problems. Belonging is the perception of who is available to do things. Tangibility is about resources and materials. Self-esteem is the sense of being praised by others. Hanucharurnkul (1988) defined social support and resources for Thai cancer patients receiving radiation therapy as perception of support from family, friends and health care providers.

Social support benefits adults with diabetes in disease management and lifestyle adjustment. Social support enhances the intention to perform self-management. The

role of social support is as a help to lifestyle modification that mediates the improvement of health outcomes and quality of life among people with chronic diabetes. In general, social support is characterized by giving assistance and protection (Langford, Hinson, Bowsher, Maloney, & Lillis, 1997). Patients' perceptions of encouragement from relatives, family, friends, and health care providers can help them comply with diabetes treatment and management (Garay-Sevilla et al., 1995). This involves the degree to which a person's basic needs of affection, esteem, belonging, identity, and security are supported through interaction with others. Social support implies the availability of resources and psychological functions which the receiver processes as supportive behaviors. Therefore, social support is a sort of communication or exchange of resources and increases the well-being of the receiver.

Social support and social networks are identified as having a major impact in behavior adjustment (Glasgow, Strycker, Toobert, & Eakin, 2000). These had positive relationship to higher adherence to diabetes regimen (Glasgow & Toobert, 1988). Many types of social support can improve self-management behaviors. For example, group support intervention is one helpful strategy to improve knowledge of diabetes (Brown & Hanis, 1995; Gilden et al., 1992; Trento et al., 2001), weight loss in obese persons with T2DM (Wing, Marcus, Epstein, & Jawad, 1991), and blood glucose levels and A1C levels (Brown & Hanis, 1995). The family's function as a resource and support may enhance lifestyle adjustment (Gilden et al., 1992; Trento et al., 2001). The network of supporting resources, friends, family, and neighborhood support from social-ecological resources can mediate behavior changes such as increasing physical activity and reducing fat consumption in a two-year period (Barrera Jr et al., 2008). Thus, friends,

family, and neighborhood resources provide some support for maintaining exercise and healthy eating behaviors.

Thai cultural beliefs and social and family structure are among the factors that form social support. Family members take care of each other. The young generation of a family traditionally assumes responsibility for elderly parents. Adult children are expected to support their elderly parents and to take care of their parents when the latter get sick. Elderly parents fear living separately from their children and prefer living with grateful sons or daughters (Knodel, Saengtienchai, & Sittitrai, 1995). Economic development and social changes have affected elderly living arrangements, with Thai families changing from the traditional intergenerational arrangement to a small family arrangement. However, those non-co-resident children often send material and financial support. Support from family provides protection and assistance for daily activities, medication, and responsibility for Thais who have chronic illness (Subgranon & Lund, 2000).

Some studies showed that social support mediated an improvement of self-care and lifestyle adaptation in patients with chronic illness (Brody, Kogan, Murry, Chen, & Brown, 2008; Khuwatsamrit et al., 2006; Siripitayakunkit et al., 2008). Support from family members, health care providers, and friends enhanced adherence to self-care behaviors in Thai people with cardiovascular disease (CAD) (Khuwatsamrit et al., 2006). Support included informational, emotional, and tangible resources to develop self-care behaviors. Support had a direct and an indirect effect on adherence to self-care behaviors. Additionally, self-efficacy played a role as a mediator between social support and adherence to self-care behaviors. All social support had a positively significant

influence on being confident in self-care practices (Khuwatsamrit et al., 2006). All of those supports are aids to behavior adjustment resulting in improved health outcomes.

Diabetes information support was related to improved diabetes knowledge and self-management behaviors in T2DM with poor blood glucose control (Keeratiyutawong et al., 2006). The intervention was a four-month supportive-educational program on diabetes self-care using lectures, demonstrations, videos, and handbooks. The subjects' blood glucose levels improved to fair (21% of participants) and good (33% of participants) control. In our pilot study, social support and resources were significantly correlated to self-care behaviors *(r* = .33, *p* < .001*)* (Wattanakul & Quinn, 2010). This information indicates that adults with T2DM need informational support about diabetes and its management.

Another prospective, self-help group program had a great impact on improvement of self-management behaviors in people with T2DM (Chaveepojnkamjorn, Pichainarong, Schelp, & Mahaweerawat, 2009). The subjects were given sessions covering diabetes knowledge, dietary control skills, physical activity skills, group structure, group leadership skills, self-monitoring, and motivation in self-management behaviors, as well as sharing experiences among group members. Sharing experiences among friends who have diabetes was particularly helpful in motivating change of self-management behaviors.

Support from health care providers is an important motivational factor for self-management behaviors. Information and practical support will encourage adults with diabetes to self-manage their diabetes (Norris et al., 2001). Health care providers can motivate patients to self-manage diabetes through provision of empathetic, practical,

and individualized support (Oftedal, Karlsen, & Bru, 2010): for instance, support about diet and meal planning, such as what food to buy and how to prepare their food. The informational support should be applicable to the living situation and specific to an individual's problem to be more effective at helping people adjust their behaviors.

Overall, various types of support and resources can help make adaptation of self-management behaviors easier for people with diabetes. Personal efforts aided by social support may enhance levels of adherence to self-management activities. Though daily living tasks can be barriers for diabetes care, helpful resources from family and friends and the neighborhood social context can motivate patients to follow their diabetes regimen and actively manage their diabetes.

4. **Risk Perception of Developing Diabetes Complications**

Weinstein (1984) defined the dimensions of risk perception as susceptibility, comparative risk adjustment, pessimistic bias, optimistic bias, perceived controllability, and environmental risk. Slovic (1987) used psychophysical scaling and multivariate analysis techniques to simulate cognitive maps of diverse hazard perceptions that were classified in dimensions of perceived risks, levels of risks, and perceived benefits. People evaluate risks from different angles of benefits and hazards. There is a gap between perceived and desired risks because some people are satisfied to tolerate higher risks to gain greater benefits. Weinstein et al. (2007) suggested that perceived risk and worry about the risk predicts health behavior better than a purely cognitive probability judgment. Integrating the concepts of both Weinstein (1984) and Slovic (1987), the specific measure of the Risk Perception Survey-Diabetes Mellitus (RPS-DM) were developed to assess the risk knowledge, personal control, personal

disease risk, optimistic bias, and environmental risk of nine recognized potential hazards (Walker et al., 2007).

Differences in perceived risk are influenced by many factors. Perception of risk and worry were greater if there was a family history of a specific disease (DiLorenzo et al., 2006; Erblich, Bovbjerg, Norman, Valdimarsdottir, & Montgomery, 2000). In contrast, high levels of general trust and general confidence of a patient may reduce perceived risk of hazards (Siegrist, Gutscher, & Earle, 2005). Males and females perceived risk of developing specific diseases differently; for instance, males were worried about getting heart disease while females were worried about getting breast cancer (C. Wang et al., 2009). In comparing the perceived risk for other diseases, diabetes was rated as less severe than cancer (C. Wang et al., 2009). However, the experience of severe hypoglycemia led to fear and worry about hypoglycemia and diabetes complications, and that feeling became a barrier in following diabetes regimens (Shiu, 2004).

Not much literature examines the relationship between risk perception for developing diabetes complications and diabetes self-management behaviors. However, the mechanism of response to perceived risk is thought to be positive behavior adjustment (Weinstein et al., 2007). Perception of risk for developing diabetes complications is believed to raise patients' awareness of diabetes care. Individuals with T2DM had more chance of developing complications than persons without diabetes (Dunning & Martin, 1998; IDF, 2010). Patients with diabetes were actually concerned and aware of their risk of developing diabetes-related diseases, as indicated by rating eye problems as a high risk (Dunning & Martin, 1998). However, their risk estimation was shown to be an overestimation of the actual risk (Meltzer & Egleston, 2000). Such

overestimated risk and worries can be beneficial if they raise patients' concerns enough to develop preventive behaviors (Weinstein et al., 2007). The high degree of risk perception can contribute to behavior modification to avoid the risk of developing diabetes complications. However, unrealistic optimistic bias for developing diabetes complications might be a major barrier to behavior change, particularly in patients who have uncontrolled blood glucose and low education (Hevey, French, Marteau, & Sutton, 2009; Weinstein, 1984). Less educated individuals had higher ratings of optimistic bias (Walker et al., 2007). If their optimistic bias is high, this can lead to less worry about getting diabetes complications.

Risk knowledge for developing complication is necessary to recognize whether the health status of individuals is at risk. Risk knowledge of developing complications had an important relationship to risk perception for developing complications. Risk knowledge was moderate to high, while risk perception was average in patients with diabetes complications (Calvin, 2009; Walker et al., 2007; Wattanakul & Quinn, 2010). Although those who were younger and had higher income had higher risk knowledge, the less educated patients had higher optimistic bias for personal risk of developing major diabetes complications. Calvin reported that perception of risk for developing diabetes complications in an African American, high-risk population was low (Calvin, 2009). Their risk perception, however, was directly related to their perception of a negative consequence of having diabetes (Calvin, 2009). Thus, lack of a perception of risk for developing complications may not raise patients' concerns enough to develop preventive behaviors. In our pilot study in a sample of Thais with T2DM, perceived personal control, personal disease risk, environmental risk, optimistic bias, and worry

were “slight,” with only worry positively correlated to self-care behaviors *(r* = .20, *p* < .02*)* (Wattanakul & Quinn, 2010). While optimistic bias of risk-specific disease threats showed a strong relationship with perceived illness threats and related behaviors (Lek & Bishop, 1995), the low perception of risk for developing complications may lead to risky health behaviors. Since optimistic bias was a disadvantage due to lack of motivation to adhere to self-management, less optimistic bias but more worry is most advantageous for modifying health behaviors. Understanding risks is expected to improve realistic risk perception and diabetes self-management. Thus, understanding the risks for developing complications can raise patients' awareness about adhering to self-care behaviors.

5. **Self-Efficacy and Diabetes Self-Management**

Bandura (1986) described "self-efficacy" as “people’s judgment of their capabilities to organize and execute courses of action required to attain designated types of performances” (p. 395). Confidence in one's ability to manage daily self-management behaviors is required to achieve expected health outcomes (Bandura, 1977). Perceived self-efficacy is crucial to encourage, empower, and judge beliefs in personal capability for diabetes self-management activities (Bandura, 1977, 1997). The successful mastery and performance of self-management skills is a result of development of self-efficacy beliefs in diabetes patients by becoming partners of physicians and health care providers (Thomas L. Creer, 2000). Studies showed that self-efficacy positively influences health behaviors in patients with diabetes (Glasgow et al., 1989; Hurley & Shea, 1992; McCaul et al., 1987; Padgett, 1991; Sarkar et al., 2006; Skaff et al., 2003).

Self-efficacy was identified as a strong predictor of adherence across all self-management activities in patients with diabetes (King et al., 2010; McCaul et al., 1987). High self-efficacy in self-care activities was identified as having a positive relationship to self-management behaviors. Confidence in problem solving and social skills was significantly associated with self-care adherence in adolescents, but not in adults with T1DM (McCaul et al., 1987). The extensive study by Glasgow et al. (1989) showed that adults with T2DM were highly confident in medicine use (89%), self-monitoring blood glucose (SMBG) (80%), and diet (78%), but confidence in performing exercise was lower (59%). People with higher self-efficacy were better able to perform their self-management behaviors (Hurley & Shea, 1992). In a study by Sarkar et al. (2006) in T2DM patients with low health literacy, for every 10% increase in self-efficacy score, patients were more likely to report optimal diet (0.14 day more per week, 95% CI = 0.06-0.23), exercise (0.09 day more per week, 95% CI = 0.015-0.18), self-monitoring blood glucose (odds ratio 1.16, 95% CI = 1.03-1.31) and feet care (odds ratio 1.22, 95% CI = 1.10-1.41), but not medication adherence (odds ratio 1.10, 95% CI = 0.94-1.20). This association was similar for all races/ethnicity and health literacy levels (Sarkar et al., 2006). As confidence of their practices increased, people with diabetes had better self-management behaviors in a variety of people with different race/ethnicity, education and socioeconomic status (Sarkar et al., 2006).

Level of self-efficacy might be affected by demographic characteristics: gender, education, and income. The differences can be a result of culturally specific differences. For example, a study in Yugoslavia showed that a higher level of self-efficacy was related to male gender, younger age, higher education, higher self-rating adherence in

self-management behaviors, and lower depression (Padgett, 1991). In contrast, a sample of low-income Hispanics with T1DM reported low to average self-efficacy ratings regarding the ability to manage all aspects of diabetes self-management behaviors (Bernal, Woolley, Schensul, & Dickinson, 2000).

There are many strategies to improve self-efficacy in diabetes patients. In uneducated populations, there are studies on the effects of interventions that have reported both improvement (Schillinger, Handley, Wang, & Hammer, 2009; Wallace et al., 2009) and no improvement on self-efficacy (Gerber et al., 2005; Seligman et al., 2005). Multimedia lessons for diabetes education through a computer kiosk improved perceived susceptibility to diabetes complications (Gerber et al., 2005), but self-efficacy was still unchanged at 1-year follow-up. Seligman et al. (2005) studied whether notifying physicians of their patients' limited literacy affected patient self-efficacy. Self-efficacy was similar in both control and intervention groups (Seligman et al., 2005). In contrast, Wallace et al. (2009) assessed the impact of providing patients with a literacy-appropriate diabetes education guide accompanied by brief counseling session at baseline and by telephone at 2 and 4 weeks follow-up. Self-efficacy was improved, and this improvement was similar across literacy levels for English-speaking patients, but not for Spanish-speaking patients (Wallace et al., 2009). In a three-arm practical clinical, randomized, controlled trial including an automated telephone self-management program and a group medical visit program compared to usual care, both intervention arms improved self-efficacy more than usual care. The automated telephone self-management program support yielded higher engagement among patients with lower

literacy and limited English than those who were English speaking with higher education (Schillinger et al., 2009).

Some studies showed that diabetes self-management education programs increased level of self-efficacy in managing diabetes (Farrell, Wicks, & Martin, 2004; Gerber et al., 2005; Shi, Pothiban, Wonghongkul, Panya, & Ostwald, 2008). Bernal et al. (2000) reported in an adult sample with T2DM that receiving diabetes classes and home visits was associated with an increase in sense of self-efficacy, particularly related to diet and insulin self-efficacy. One study in Thailand showed that family support facilitated cardiovascular disease patients' self-management activities and confidence in self-management practices (Khuwatsamrit et al., 2006). People who have strong self-efficacy often perform self-management better; thus, this issue should be examined in people with diabetes.

D. **Summary**

Diabetes self-management is important for optimal glycemic control and delays diabetes complications. Developing self-management skills is necessary to help people with diabetes achieve the goals of diabetes management. In the proposed study, we have selected factors, including people’s diabetes knowledge, Buddhist beliefs, social support, risk perception for developing complications, and self-efficacy, that have been observed to have a noticeable impact on self-management behaviors in various populations. Little is known about the impact of these factors on self-care behaviors among Thai population. Little evidence is available about how people with diabetes manage their diabetes and what factors can influence self-management behaviors in this population. The proposed study is designed to fill this gap.

III. METHODS

A. Overview of Study

This study was designed as a descriptive study for self-management behaviors among a sample of Thai adults with T2DM. The variables of personal factors (age, gender, education, diabetes duration), Buddhist values, social support, self-efficacy, general diabetes knowledge and risk perception for developing complications were described and examined in relation to self-management behaviors. The investigator recruited 197 participants who have had T2DM for at least 1 year and have ongoing diabetes treatments. This sample size was estimated based on Effect size index (f^2) = 0.122, Power = 0.80, level of significance = 0.05. The principal investigator interviewed all participants with a 111-item questionnaire including questions about personal factors, Buddhist values, social support, self-efficacy, general diabetes knowledge, risk perception for developing complications and self-management behaviors. The interview lasted in average of 30 – 60 minutes. Weight and height were collected for descriptive information. Capillary blood samples were collected for analysis of hemoglobin A1C by using A1CNow+® (Bayer HealthCare, Tarrytown, NY).

B. Study Design

This exploratory descriptive study used a cross-sectional design to explore the relationships among self-management behaviors and Buddhist values, social support, self-efficacy, general diabetes knowledge, and risk perception for developing complications in Thai patients with T2DM.

C. Sample and Setting

The eligible samples were adult patients with T2DM who live in Thailand. This was drawn from those with low socioeconomic status and living in rural areas. The T2DM sample was recruited from outpatient diabetes clinic in a community hospital of Chachoengsao province, Thailand: Phanom Sarakham Hospital (90-bed size).

1. Inclusion and Exclusion Criteria

The principal investigator asked subjects to participate in the research if they had T2DM for at least 1 year. We used a convenience sampling method. The inclusion criteria for this study were male and female, aged 30 years or older, diagnosed with T2DM and receiving treatment for diabetes for at least 1 year, beliefs in Buddhism, ability to read or understand the Thai language, with or without major complications, and willingness to participate. Subjects who have life-threatening illnesses or are developmentally disabled or mentally ill were excluded.

2. Sample Size

Sample size was calculated by the G*power program (Faul, Erdfelder, Buchner, & Lang, 2009) to determine the minimum number of participants needed for multiple regression analysis. The method resulting in a minimum sample size was used to prevent type I errors in statistical analysis (Huck, 2008).

The sample size was calculated from the model of linear multiple regressions (fixed model, R^2 deviation from zero) based on agreement of the power analysis (0.80) and anticipated medium effect size (Cohen, 1988). The effect size index ($f^2 = 0.122$) is assumed from the largest correlation coefficient between social support and self-management behaviors ($r = 0.33$, $p < 0.001$) in our recent pilot study of 124 Thai adults

with T2DM by using G*power software. In sample size estimation, we calculated based on six key predictors in Figure 1. At the level of significance of 0.05, a number of total predictors selected were 10 including 6 main predictors and 4 covariate variables; the number of subjects required at enrollment is estimated as (*n*) at least 124 adults with T2DM. In the diabetes clinic, with diabetes registry over 2,000 cases, we recruited 197 participants. This sample size could be appropriate to determine power and sensitivity for multiple regression analysis.

Thus, in this study, the sample size of enrollment (practical and statistical considerations) was a total of 197 participants. This sample size achieved power of 0.80. This sample size was appropriate for statistical inference for the target population.

D. Study Variables and Measurement Methods

Table I outlines the variables of personal factors, Buddhist values, social support, self-efficacy, general diabetes knowledge, risk perception for developing complications, A1C and self-management behaviors and the instruments that were used to measure each variable. The investigator translated the English instruments into Thai language. Three bilingual nurses examined the translation.

1. Self-Management Behaviors

Creer and Holroyd (1997) determined that the process of self-management includes goal selection, information collection, information processing and evaluation, decision making, action, and self-reaction. Self-management is defined as “a set of skilled behaviors engaged in to manage one’s own illness” (Goodall & Halford, 1991, p. 1). In the proposed study, self-management behaviors were operationally defined as multidimensional behaviors that people with T2DM perform to manage their

conditions and illness across the diabetes regimens, including diet regulation, physical activity, medication adherence, blood glucose testing, and foot care (Toobert, Hampson, & Glasgow, 2000). Glasgow, McCaul, and Schafer (1987) and McCaul, Glasgow, and Schafer (1987) used different diabetes aspects to measure types and frequency of self-management behaviors and determine adherence to diabetes regimens. The revised Summary of Diabetes Self-Care Activity (SDSCA) (Toobert et al., 2000) was used to determine levels of self-management behaviors (Table I).

The SDSCA is a multidimensional measure of diabetes self-management behaviors with adequate internal consistency and test-retest reliability. In review for reliability, validity and normative data of the original SDSCA from seven different studies, the SDSCA questions were revised (Toobert et al., 2000). Three changes were made in the revised version of the SDSCA on the medication and specific diet subscales. The specific diet subscale was removed in response to low internal consistency reliability of subscales. The question about specific diet was modified to focus on carbohydrates rather than sweets. The medication use item was removed because it lacked variability among respondents (Toobert et al., 2000). Two items about cigarette smoking were added to the survey because smoking increases risk of cardiovascular disease among diabetes patients. The revised SDSCA contains 17 items and assesses aspects of healthy eating activities (5 items), physical activity (2 items), medication adherence (3 items), blood glucose testing (2 items), and foot care (5 items). There are 2 additional questions about smoking status. These questions ask about general self-management behaviors, not assessing compliance to specific standards of diabetes self-care.

TABLE I
STUDY VARIABLES AND INSTRUMENTS

Concept	Variables	Measurement	Scoring Item	Method	Reliability		Validity
					Internal consistency	Test-Retest	
Independent Variables							
Personal Factors	Personal Factors	Age, Gender, Education, Duration of Diabetes, Family History of Diabetes, Income BMI	-	-	-	-	-
Social Cognitive Theory	**Self-Efficacy**	Diabetes Self-Efficacy [Stanford Patient Education Center, 1996]	8 items, each rated on a 10-point Likert scale; items summed for total score ranging from 8 to 80	Self-report	α = 0.828	-	-
Socio-Ecological Resources	**Social Support**	Brief CIRS [Glasgow et al., 2005]	22 items, each rated on a 5-point Likert scale; items summed for total score ranging from 22 to 110	Self-report	α = 0.82	6 months, r = 0.11-0.48 Median = 0.25 $p < 0.05$	$r > 0.40$ at $p < 0.05$
Diabetes Knowledge	**General Diabetes Knowledge**	General Diabetes Knowledge (Thai) [Wongwiwatthananukit, 2004]	21 items, each marked correct or incorrect; 21 correct items summed for total score	Self-report	α = 0.81	-	Content validity, Difficulty index= .18-.87
Cultural Beliefs	**Buddhist Values**	Buddhist Values (Thai) [Sowattanangoon, 2008]	7 items, each rated on a 5-point Likert scale; items summed for total score ranging from 7 to 35	Self-report	α = 0.87	-	Content and face validity

TABLE I (continued)
STUDY VARIABLES AND INSTRUMENTS

Concept	**Variables**	**Measurement**	**Scoring Item**	Method	**Reliability**		**Validity**
					Internal consistency	Test-Retest	
Independent Variables							
Risk Perception	**Risk Perception for Developing Complications**	RPS-DM [Walker et al., 2007]	26 items, each rated on a 4-point Likert scale; items composited for total score ranging from 26 to 109; 5 items for Risk Knowledge, each rated correct or incorrect; items summed for score ranging from 0 to 5	Self-report	0.64-0.86	0.33-0.76	Content and face validity by an expert panel
Dependent Variables							
Self-Management	**Self-Management Behaviors**	SDSCA [Toobert et al., 2000]	17 items, each rated on a 7-point Likert scale; items summed for total score ranging from 0 to 119	Self-report	R = 0.23 to 0.80 (Inter-items correlations)	Mean r = 0.40 (- 0.05-0.78) [3-4 months]	r = 0.23 ($p < 0.05$)
Physiological Variable	A1C Level	Blood Test [A1CNow+ Kit]	$\leq$ 7% = adequate glucose control	Blood Test	r = 0.99*	-	99.7%

* Calibration of the A1CNow+ with a set of blood samples that have values assigned by a National Glycohemoglobin Standardization Program (NGSP)

The SDSCA is a Likert-type scale in which participants recall how often they performed diabetes self-management behaviors from the past 7 days; answers range from 0 to 7 days. Alpha coefficient values are influenced by number of item and relationship among items. Rather than using alpha coefficient, in this review, inter-item correlations were applied because the various SDSCA scales contained different and small numbers of items in some scales. The inter-item correlations ranged from 0.07 (specific diet) to 0.80 (exercise); however, the average inter-item correlation (0.47) is acceptable for internal consistency. The specific diet subscales were consistently unreliable, as inter-item correlations ranged between 0.07-0.23. Correlations were generally low and mean correlations of < 0.3 (r = 0.23) supports that the diet and exercise SDSCA subscales did not overlap. The test-retest correlations were 0.40 over three to four months; range was r = -0.05 for medication to r = 0.78 for glucose testing. This low stability may result from behavioral change over time. In a review of 5 studies using the SDSCA, four of five of the reviewed studies were interventions aimed at making behavioral changes. Self-care behaviors vary over time in response to changing personal and environmental factors.

The validity of the original SDSCA and sensitivity to change for diet and exercise scales are supported as criterion measures. Correlations with other measures of diet and exercise supported the validity of the SDSCA subscales. The SDSCA exercise subscale is correlated to exercise self-monitoring (r = 0.58, p < 0.001) and attendance at exercise class (r = 0.22, p < 0.05). The general diet is negatively correlated with the Block Fat Screener (Block, Woods, Potosky, & Clifford, 1990) (r = -0.23 to -0.53, p < 0.05). The sensitivity to change of SDSCA general diet subscale widely ranged in

responsive index (0.03 to 0.43) and showed significant pre-to-post change among interventions ($p < 0.05$). The specific diet was all significant correlation with the 3- or 4-day food records, food-frequency questionnaires ($r = -0.33$, $p < 0.001$), Food Habits Questionnaires ($r = -0.52$ to -0.27, $p< 0.001$), Block Fat Screener ($r = -0.51$ to -0.25, $p < 0.001$), and Glasgow and Toobert's study ($r = 0.29$, $p < 0.001$) (Toobert et al., 2000). The index of responsiveness to change varied widely across studies (- 0.09 to 0.43), and pre-to-post change for comparisons in six of nine interventions was significantly improved on the dietary SDSCA scales ($p < 0.05$). These supported the criterion validity and sensitivity to change of exercise and dietary subscales.

This instrument has been translated and tested in a sample of 124 rural Thais with T2DM, and the average inter-item correlations of the SDSCA scale were 0.393. This suggests acceptable reliability. The average inter-item correlations for subscales of general diet, specific diet, exercise, foot-care, medication, and blood glucose checking were 0.224, 0.039, 0.420, 0.189, 0.673, and 0.815, respectively (unpublished data). The inter-item correlations were consistent with previous studies. Therefore, the SDSCA can be applicable to Thai populations.

2. **Personal Factors**

a. **Age**

Age is operationally defined as a self-report of the number of years of age.

b. **Gender**

Gender is operationally defined as a self-report of participant's sex.

c. **Education**

Education level is operationally defined as a self-report of the highest level of formal education that participants finished from schools or institutes.

d. **Diabetes Duration**

Duration of having diabetes is operationally defined as number of years of having been diagnosed for diabetes by a physician.

3. **Cultural Belief Variable**

a. **Buddhist Values**

Buddhist Values is conceptually defined as having beliefs of Buddhist teachings and practices: a way of thinking and behaving with mindfulness. This has been shown to be important for Thais living with diabetes (Sowattanangoon et al., 2008). Buddhists who are actively practicing Buddhist meditation tend to be aware of diabetes as a cause of physical and psychological suffering. These patients accepted being diagnosed with diabetes, cultivated their sense of well-being, and adhered to their treatments as a way to eliminate suffering. While Buddhists who are less likely to practice meditation nevertheless engage in other kinds of Buddhist practices such as making good merit, chanting, listen to Dharma, these patients also believe that following Buddhist principles promotes psychological well-being and leads to a good life. This idea is helpful to diabetes management because Buddhists with diabetes accepted their diagnosis with diabetes and attempted to adhere to healthy living to eliminate suffering from diabetes. In the proposed study, Buddhist values were operationally defined as beliefs and attitudes in Buddhist teaching, chanting, meditation and mindfulness to relieve stress and anxiety.

Buddhist values will be measured by a Buddhist values questionnaire which contains 7 items about beliefs in Buddhist teaching and practices; including, 1) Diabetes (illness) is part of normal life cycle (birth, aging, illness, death), 2) Do good, receive good; do evil receive evil, 3) Chanting makes me feeling good (sabaay jai), 4) Buddhism (Dharma) helps reduce unhealthful imaginations, 5) Buddhist practices help control craving, 6) Meditation relieves stress, and 7) To be moderate in living and eating is good. This instrument was developed by Thai diabetes researchers and tested for simplicity and validity by six Thai Buddhists. The internal consistency was adequate: Alpha coefficient = 0.87 (Sowattanangoon et al., 2008) (Table I). The reliability was tested in the target sample of this study: alpha coefficient = .812 (Appendix C, p. 120).

4. **Socio-Ecological Resources**

a. **Social Support**

Social support is conceptually characterized as giving of assistance and protection of four types: emotional, instrumental, informational, and appraisal. This involves the degree to which a person's basic needs for affection, esteem, belonging, identity, and security are supported through interaction with others (Langford et al., 1997). The family, friends, social networks, culture, and social context have predominant relationships with people's social life (Glasgow et al., 1997; Glasgow & Toobert, 1988). In the proposed study, social support (Figure 1) is exploring the individual's perception of social support for helpful lifestyle behaviors and chronic illness management from multiple sources, including personal, family and friends, neighborhood, community, media and health policies (Glasgow, Toobert, Barrera Jr, & Strycker, 2005).

Social support was measured by the brief Chronic Illness Resources Survey (CIRS). The brief CIRS assesses multiple support dimensions for self-management in chronic illness in specific tasks such as diet, exercise, and medication use. The CIRS items are based on informational, emotional, instrumental and tangible support resources (House, Landis, & Umberson, 1988). The CIRS was developed based on a multilevel model of psychosocial environmental support with respect to socio-ecological perspective, ranging from proximal (e.g., family and friends, physicians and health care professionals) to greater distal support (e.g., neighborhood or community, work and organization, media and policy) (Glasgow & Eakin, 1998; Glasgow et al., 1999). Seven distinct levels of social support are noted: personal, health care team, family and friends, community organizations, neighborhood and community, media and policy, and work. Each of the 22 items on the CIRS is rated on a 5-point Likert format, from 1 (not at all) to 5 (a great deal) for the eight support resources. The internal consistency is 0.82 (subscales alpha ranged from 0.45 to 0.86), and test-retest reliability is $r = 0.70$ at a 6-month period ($p < 0.05$). Correlations between subscales ranged from 0.11 to 0.48 (median = 0.25) (Table I) (Glasgow et al., 2005).

During CIRS development, construct validity was tested for divergent and convergent validity (Glasgow et al., 2000; Glasgow et al., 2005). The CIRS subscales were significantly associated with the Self-Efficacy for Exercise and Eating Behaviors scales (personal subscale, $r = 0.43$), the Social Support for Eating Habits and Exercise Survey (personal subscale, $r = 0.42$; family and friends, $r = 0.42$), the Medical Satisfaction Questionnaire (physician and health care team subscale, $r = 0.75$), Campbell Community Survey (neighborhood and community subscale, $r = 0.36$), and

Take Heart company and co-worker support survey (worksite subscale, $r = 0.60$). The CIRS subscales were moderately significantly correlated with similar constructs of social support tools ($p < 0.01$). This evidence shows that the CIRS achieves convergent validity and construct validity as a social support instrument (Glasgow et al., 2000).

Criterion-related validity (predictive validity) was tested by correlations of the CIRS scale with other support instruments for self-management behaviors and quality of life, including the Kristal Fat and Fiber Behaviors Questionnaire (FFB) (Kristal, Shattuck, & Henry, 1990), the Physical Activity Scale for Elderly (PASE) (Washburn, Smith, Jette, & Janney, 1993), the Illness Intrusiveness scale, the Medical Outcomes Study (MOS) SF-12 Mental Health and Physical Functioning scale, and the MOS Illness management scale. In addition, the Social Support for Eating Habits and Exercise Survey, the Interpersonal Support Evaluation Checklist (ISEL) and the Social Network Index were used to evaluate the criterion validity of the CIRS. The CIRS personal subscale was positively correlated with eating habits as measured by the FFB (personal actions, $r = 0.27$, $p < 0.01$). The CIRS personal subscale ($r = 0.29$), neighborhood and community ($r = 0.32$) subscales, and CIRS total score ($r = 0.38$) were positively significantly correlated with the 4-month mental health, as measured by the MOS SF-12 Mental Health ($p < 0.01$), but only neighborhood and community resources subscales ($r = 0.28$) predicted physical functioning ($p < 0.01$). For prospective predictive validity, the CIRS summed score and physician and health care team subscale were predictors for the 4-month illness management as measured by MOS ($r = 0.25$, $p < 0.01$) (Glasgow et al., 2000).

Response bias due to socially desirable responding was tested using the Balanced Inventory of Desirable Responding (BIDR), which measured two constructs of self-deceptive positivity and impression management. None of the CIRS scale scores was significantly correlated with the two scales of the BIDR. This suggested no socially desirable responding bias for both the original and the brief CIRS (Glasgow et al., 2000; 2005). The CIRS in Thai translation had adequate reliability, with an alpha of 0.802 (unpublished data) (Table II).

TABLE II
RELIABILITY OF THE CHRONIC ILLNESS RESOURCE SURVEY SUBSCALES (THAI VERSION) (*N* = 124)

Social Support	Number of Items	*N*	Alpha Coefficients
Personal Support	3	124	0.602
Family and Friends	3	124	0.627
Physician/Health Care Team	3	124	0.494
Neighborhood/Community	4	124	0.602
Organizations	3	124	0.736
Workplace (*N* = 34)	3	34	0.838
Media and Policy	3	124	0.263
CIRS without Media/Policy and Workplace	16	124	0.756
CIRS without Workplace	19	124	0.777
Total	22	124	0.802

5. **Social Cognitive Variable**

a. **Self-Efficacy**

Self-efficacy is conceptually defined as an individual's confidence in her or his capability to manage specific tasks or behaviors required to achieve expected health outcomes (Bandura, 1977). In the proposed study, self-efficacy is specific to daily self-management behaviors of five dimensions. Thus, self-efficacy is operationally defined as judgment of an individual's capability to manage daily diabetes self-care behaviors, including diet, physical activity, medication, blood glucose monitoring, and general diabetes care. Self-efficacy was measured by the valid and reliable Self-Efficacy for Diabetes Scale, which has an alpha coefficient of 0.828 (Stanford Patient Education Research Center, 1996). The Self-Efficacy for Diabetes Scale is an 8-item questionnaire which measures an individual's capability to manage daily diabetes self-care behaviors, including diet regulation, physical activity, medication adherence, blood glucose monitoring, and general diabetes care. The instrument was translated into the Thai language and tested for psychometric properties in Thai immigrants in Chicago. The internal consistency showed adequate reliability ($\alpha = 0.847$) (unpublished data) (Table III).

TABLE III
RELIABILITY OF DIABETES SELF-EFFICACY (STANFORD UNIVERSITY) IN THAI TRANSLATION (*N* = 23)

Item	***N***	**Alpha Coefficient if item deleted**
1. How confident do you feel that you can eat your meals every 4 to 5 hours every day, including breakfast every day?	23	.628
2. How confident do you feel that you can follow your diet when you have to prepare or share food with other people who do not have diabetes?	23	.585
3. How confident do you feel that you can choose the appropriate foods to eat when you are hungry (for example, snacks)?	23	.566
4. How confident do you feel that you can exercise 15 to 30 minutes, 4 to 5 times a week?	23	.391
5. How confident do you feel that you can do something to prevent your blood sugar level from dropping when you exercise?	23	.663
6. How confident do you feel that you know what to do when your blood sugar level goes higher or lower than it should be?	23	.511
7. How confident do you feel that you can judge when the changes in your illness mean you should visit the doctor?	23	.759
8. How confident do you feel that you can control your diabetes so that it does not interfere with the things you want to do?	23	.595
Total of 8 items: *Cronbach's alpha*	23	*.847*

6. **General Diabetes Knowledge**

Diabetes knowledge was measured by a valid and reliable questionnaire of general diabetes knowledge (Wongwiwatthananukit, Krittiyanunt, & Wannapinyo, 2004) (Table I). The content validity of the 40 original items was ascertained by an expert review panel, including eight physicians and pharmacists who were experts in diabetes. A cognitive interview was performed with 15 patients with diabetes for understandability and readability. The cross-sectional survey (*N* = 753) was conducted to test psychometric properties in 22 hospitals in Thailand (2 large hospitals in Bangkok and 20 hospitals from northern, southern, eastern, western and central Thailand). After item analysis, some items were deleted based on the criteria of alpha coefficient (< 0.70), corrected item-total correlation (< 0.30), and increasing alpha if item deleted. The final instrument is a 21-item questionnaire with response type of “yes,” “no” and “do not know." The questions ask about general knowledge related to diabetes (5 items), risk of diabetes complications (5 items), self-care on a daily basis and on sick days (6 items), and medication use (5 items). It is the only measure of general diabetes knowledge that has reported psychometric properties. The measure of general knowledge of diabetes had content validity and internal consistency (α = 0.8154). A difficulty index of items was acceptable, ranging from 0.18 to 0.87 (Wongwiwatthananukit et al., 2004).

In mid-2010, to test the proposed study instrument in a different population, another pilot study was conducted in a Thai temple on the North Side of Chicago, Illinois. Twenty-six healthy Thai Americans were recruited to complete the new instrument of Thai version of the diabetes knowledge questionnaire. Participants’ ages ranged from 22 to 54 years old (38.59 ± 10.03), and 64.7% were female. Internal

consistency reliability (Cronbach's alpha), corrected item-total correlations, Cronbach's alpha if item deleted, difficulty index and number of each choice chosen are shown in Table IV. Overall, the alpha coefficient was 0.849, estimated for 21 items, which reflects high internal consistency of measure. The item-total correlations were positive and slightly low to moderate, ranging from 0.153 to 0.720. Overall, none of the alphas for the category "if item deleted" exceeded the coefficient alpha of 0.849 except items 2 and 12. There were six items for which coefficients of the item-total correlation were less than 0.3, but their alphas for the category "if item deleted" and difficulty index were acceptable. The difficulty index had an acceptable range of 0.31 to 0.88. Thus, all items were still consistent. The scores on knowledge were not high with mean of 12.35 (SD = 4.96) and ranged from 0 to 21 (unpublished data).

The results from the second pilot study (n = 26) of the general knowledge measure in the Thai version showed that it is generalizable to a Thai sample who live on the North Side of Chicago, Illinois. The knowledge test was still reliable in this healthy sample. Thus, the measure is valid and reliable for use in further studies among indigenous Thai samples.

TABLE IV
DESCRIPTIVE STATISTICS FOR 21 ITEMS OF
DIABETES KNOWLEDGE QUESTIONNAIRES (*N* = 26)

Item	Corrected Item-Total Correlation	Alpha If Item Deleted	Mean ±*SD*	Number of chosen choices (%)		
				Incorrect	Correct	Don'*t* know
1. Diabetes mellitus is likely to be **cured** by treatment.*	.274	.849	.62 ± .49	16 (61.5)	5 (19.2)	5 (19.2)
2. Insulin is produced by **kidney**.*	.185	.853	.46 ± .51	12 (46.2)	9 (34.6)	5 (19.2)
3. Normally, blood sugar levels should be 90-130 mg/dl.	.293	.848	.38 ± .49	3 (11.5)	10 (35.8)	13 (50.0)
4. Stress causes blood sugar levels to increase.	.435	.843	.73 ± .45	4 (15.4)	19 (73.1)	3 (11.5)
5. Genetic problems are one of the causes of diabetes mellitus.	.379	.845	.76 ± .42	3 (11.5)	19 (73.1)	3 (11.5)
6. If you are beginning to have a low blood sugar reaction, you may feel sweating, shaking, and faint.	.288	.848	.88 ± .33	1 (3.8)	23 (88.5)	2 (7.7)
7. You are at greater risk of heart disease than people that do not have diabetes.	.572	.837	.73 ± .45	3 (11.5)	19 (73.1)	4 (15.4)
8. Poor blood sugar control can cause numbness in the hands and feet.	.314	.847	.65 ± .49	5 (19.2)	17 (65.4)	4 (15.4)
9. Poor blood sugar control can result in kidney failure.	.496	.840	.65 ± .49	4 (15.4)	17 (65.4)	5 (19.2)
10. Good blood sugar control usually reduces or delays occurrence of diabetes complications.	.455	.843	.84 ± .36	2 (7.7)	22 (84.6)	2 (7.7)
11. Drinking alcohol can affect blood sugar levels.	.543	.839	.77 ± .43	3 (11.5)	20 (76.9)	3 (11.5)
12. You should **continue to exercise** if you have chest pain or severe illness.*	.153	.854	.35 ± .48	9 (34.6)	9 (34.6)	8 (30.8)

* Negative questions

TABLE IV (continued)
DESCRIPTIVE STATISTICS FOR 21 ITEMS OF
DIABETES KNOWLEDGE QUESTIONNAIRES (*N* = 26)

Item	Corrected Item-Total Correlation	Alpha If Item Deleted	Mean ±*SD*	Number of chosen choices (%)		
				Incorrect	Correct	Don't know
13. You should check your feet every day.	.291	.849	.54 ± .51	4 (15.4)	14 (53.8)	8 (30.8)
14. In patients with diabetes, infections can cause high sugar levels.	.628	.834	.50 ± .50	2 (7.7)	13 (50.0)	11 (42.3)
15. If you are sick, you should drink more liquids and eat meals.	.720	.830	.50 ± .50	4 (15.4)	13 (50.0)	9 (34.6)
16. In a sick period, you do not need to take medications since your blood sugar levels are usually low.*	.584	.836	.34 ± .48	9 (34.6)	4 (15.4)	13 (50.0)
17. You should **do not take your medications or insulin twice** if you realize that you forgot your medication or insulin.	.228	.851	.42 ± .50	4 (15.4)	11 (42.3)	11 (42.3)
18. When you begin having signs of low blood sugar, you should take sweetened food or drink.	.411	.844	.57 ± .50	3 (11.5)	15 (57.7)	8 (30.8)
19. When you take diabetes drugs before meal and do not eat your meal, your blood sugar usually decreases.	.538	.838	.31 ± .47	3 (11.5)	8 (30.8)	15 (57.7)
20. Alcohol is likely to cause that diabetes drugs do not work.	.477	.841	.65 ± .48	4 (15.4)	17 (65.4)	5 (19.2)
21. While you are receiving diabetes drugs and you continue eating sweet desserts, this may result in poor blood sugar control.	.703	.831	.65 ± .48	3 (11.5)	17 (65.4)	6 (23.1)

* Negative questions

Cronbach's alpha = .849.

7. Risk Perception for Developing Complication

Perceived risk of diabetes complications is defined as the perception of risks for developing diabetes complications and other comparative risks in a person's life, such as other diseases and other environmental risks. The risk perception for developing diabetes complications was measured by the Risk Perception Survey for Diabetes Mellitus (RPS-DM). The RPS-DM includes five subscales: risk knowledge, perceived control, optimistic bias, worry, personal disease risk, and environmental risks (Walker et al., 2007). The RPS-DM is a 31-item survey questionnaire with a 4-point Likert scale, ranging from 1 (strongly disagree) to 4 (strongly agree). The risk knowledge subscale (5-item) is not included in the composite score because level of knowledge is not assumed to add to risk perception. Content and face validity were assessed by an expert panel of risk perception and diabetes researchers, and deemed acceptable. The psychometric properties were tested with 250 (85% response) multiethnic samples speaking English (79.2%) or Spanish (20.8%) who received diabetes care from the health care system, but had no eye examination in more than one year. Half of the sample was randomly assigned to receive telephone call for survey of Risk Perception Survey for Diabetes. Sample characteristics were: 62% women, mean age of 56.5 years (*SD* = 12.2). Duration of diabetes ranged 1-31 years, with a mean of 8.7 years. The internal consistency of risk knowledge was 0.64. The internal consistency reliability for the RPS-DM was 0.85; subscales ranged from 0.64 to 0.86. Test-retest reliability of subscales ranged from 0.33 to 0.76 (median of 16 days; range 7-21 days, *n* = 55). The correlation matrix among subscales was less than 0.3, and most were less than 0.2, except for correlation between personal disease risk and

environmental risk (r = 0.48). These subscales can be assumed to be approximately independent from each other (Walker et al., 2007). The RPS-DM in Thai version had internal consistency of 0.803 (unpublished data). In Table V, the alpha coefficients are over 0.60 for all subscales. This suggests the translation is applicable in a Thai population.

TABLE V
RELIABILITY OF THE RISK PERCEPTION SURVEY FOR DIABETES SUBSCALES (THAI VERSION) (N = 124)

Risk Perception for Diabetes Mellitus	Number of Items	*N*	Alpha Coefficients
Perceived Personal Control (PPC)	4	124	0.816
Optimistic Bias (OB)	2	124	0.776
Worry (W)	2	124	0.656
Personal Disease Risk (PDR)	9	124	0.855
Environmental Risk (ER)	9	124	0.805
Risk Knowledge (RK)	5	124	0.640
Total (excluding Risk Knowledge)	31	124	0.807

8. **Physiological Variable**

a. **Glycemic Hemoglobin A1C**

Assessment of A1C was measured by a small amount of capillary blood for testing with the A1CNow+ kit. The specificity and sensitivity of A1CNow+ have been reported as 99% accurate (Bode, Irvin, Pierce, Allen, & Clark, 2007), but the most accurate A1C range is limited to between 7% and 8.5% (Carter et al., 1996). The correlation (r = 0.97) between results from A1CNow+ and from the National Glycohemoglobin Standardization program (NGSP) is most likely close to 1.0 (Bayer HealthCare, 2008; Bode et al., 2007). This measure is not for diagnosis purposes, but it is accessible, accurate, and easier to use in point-of-care settings to evaluate the progress of patients.

9. **Covariate and Descriptive Variables**

These variables are considered as potential confounders and measured as covariates.

Household income is operationally defined as all those in the household's total monthly income that participants self-report.

Family history of diabetes is operationally defined as having a history of diabetes of their parents and first- and second-levels of relatives as self-reported.

Smoking is defined as smoking reported in the self-management activities as "yes" or "no."

Health status is defined as having an illness or disease related to diabetes complications, including hypertension, hyperlipidemia, retinopathy or vision problems, nephropathy or renal failure, diabetes foot complications, or coronary artery disease.

Body Mass Index (BMI) is an indirect anthropometric measurement determined by height and weight (WHO Expert Consultation, 2004). BMI is calculated as weight in kilograms divided by height in meters squared (kg/m^2). This is a proxy for the percent of body fat. The height and weight was measured by using gauges at the clinic.

In addition, age, gender, education level, and duration of diabetes were used as covariates in the analysis, all per self-report.

E. **Procedures**

1. **Recruitment**

The selected study site was a diabetes clinic in the community hospital in Chachoengsao, Thailand. In the prior pilot study, the principal investigator met with key clinic personnel to discuss the purpose of the study and the inclusion and exclusion criteria and review the research protocol. Subjects were recruited as follows: (1) clinic personnel referred the potential participants that meet eligibility criteria to contact the principal investigator, (2) the principal investigator passed out recruitment flyers in the waiting area at the diabetes clinic, and discuss the study if potential participants were interested in responding to the survey, and (3) the principal investigator contacted potential subjects who meet the study criteria. The principal investigator read the informed consent to subjects.

2. **Data Collection**

Before data collection, procedures for data collection and protection of subjects' human rights was approved by the UIC Institutional Review Board and permission obtained from participating hospitals. Participants who met the criteria read or had read to them the informed consent. The principal investigator spent time so that

the potential subjects can ask and clarify any information. After the informed consent was obtained, at a one-time meeting, the survey questions were verbally administered by the principal investigator and blood was collected for A1C analysis. All participants were encouraged to read the items along with assistance from the principal investigator to assure understanding. All 111 questions were administered in one questionnaire. The sequence of questions was as follows: general diabetes knowledge, the Summary Diabetes Self-Care Activities (SDSCA), the Diabetes Self-Efficacy, Buddhist values, the Chronic Illness Resource Survey (CIRS), the Risk Perception Survey for Diabetes (RPS-DM), and demographic information. The interview took about 35 to 45 minutes in a private place within the diabetes clinics. The capillary blood was drawn by a nurse in the clinics for analysis of hemoglobin A1C. In addition, weight and height were measured by clinic staff. All processes took approximately 45 minutes. The serum A1C analysis was done on site by the principal investigator using an A1CNow+ kit. All participants were provided an educational diabetes manual after completing all the instruments.

F. **Statistical Analysis**

1. **Data Management**

The demographic and health information were organized and coded before analysis. The principal investigator checked for completion after interviews. To validate data entry, all data were coded to excel two times and the data entering were matched by using 4TOPS Compare Spreadsheets program (Synchronizer); differences were re-checked with the original data until no differences were found. The full data entry was cross-checked for out-of-range values and logical inconsistencies (errors or

unusual cases). Missing patterns were identified: missing at random (MAR), missing completely at random (MCAR) and missing not at random (MNAR) (Schafer & Graham, 2002). If few cases (<5%) were missing data in a random pattern from the whole sample, deletion of cases were applied. However, random missing values were scattered both in variables and cases; if lots of data were missing, estimating missing values on the multiple imputations (MI) would be applicable (Dempster, Laird, & Rubin, 1977). In this study, neither MAR nor MAR were detected.

Outliers were diagnosed for leverage, discrepancy, and influence. For leverage, univariate outliers were assessed by large standard deviation, stem-leaf, and box plots. Multivariate outliers were determined by Mahalanobis distance (discrepancy). Influence is a product of leverage and discrepancy; an influence score larger than 1.00 is considered as indicating an outlier. The outlier can be assessed through SPSS regression using residuals/outliers by Mahalanobis distance, Cook's and leverage values. The causes of outliers were discovered, and a decision was made whether the case was a proper part of the sample or to modify scores or delete cases.

Descriptive statistics were calculated for central tendency and variability for interval variables, and frequency distribution for nominal (gender, having history of diabetes in family) and ordinal variables (education, income). Descriptive statistics were applied for relationships between self-management behaviors and A1C (interval scale). Bivariate correlations were used to analyze for the relationships among dependent variables (self-management behaviors and A1C), and independent variables (personal factors, Buddhist values, social support, self-efficacy, general diabetes knowledge, and risk perception for developing complications). Simultaneous multiple regression were

used to explore relationships among the independent and dependent variables in both models (Cohen, Cohen, & West, 2003; Keith, 2006). Covariates that were to be controlled include: age, gender, education and duration of diabetes.

The specific aims were to:

Aim 1: The primary specific aim is to determine which of the six predictor variables (Buddhist values, social support, self-efficacy, general diabetes knowledge, risk perception for developing complications, and A1C) are the most influential in predicting self-management behaviors (diet, medication, exercise, foot care and self-blood glucose monitoring) among Thai adults with T2DM while controlling for demographic characteristics.

To achieve this aim, simultaneous multiple regression analysis was performed to explore the relationship between self-management behaviors (dependent variable) and independent variables (Buddhist values, social support, self-efficacy, general diabetes knowledge, risk perception for developing complications and A1C). The entry of all factors was forced to enter the equation at the same time to achieve the explanation in combination of the effect of multiple independent variables (Keith, 2006). The standardized regression coefficients (beta or β) were used to conclude what factor is the best predictor of dependent variable and what factors do not contribute significantly to the prediction model (Keith, 2006). Multiple regression is applicable to continuous variables that are combined predictors and makes it possible to use information from numerous predictors to predict a single criterion score (Shultz & Whitney, 2005). To ensure the assumptions of multiple regression, each independent variable was diagnosed for normality, partial residual plots (linearity), and homoscedasticity

(standardized residual scatter plots, random scattering, or statistical tests). The multiple variance inflation factor was applied to examine multicollinearity (tolerance and VIF) among the variables included in the model (Cohen et al., 2003).

Aim 2: Examine whether self-management behaviors combined with Buddhist values, social support, self-efficacy, general diabetes knowledge, risk perception for developing complications significantly contribute to the prediction of A1C in adults with T2DM in rural areas, while controlling for demographic characteristics (age, gender, education and duration of diabetes).

To achieve this aim, simultaneous multiple regression analysis was performed to explore the relationship between A1C and independent variables (Buddhist values, social support, self-efficacy, general diabetes knowledge, risk perception for developing complications and self-management behaviors). Variables were diagnosed for normality, partial residual plots (linearity), and homoscedasticity to ensure the assumptions of linear regression. Bivariate correlation was used to analyze for the relationships among dependent variable. The multiple regression was applied if there was significant correlation between A1C and independent variables (Cohen et al., 2003).

IV. RESULTS

This chapter will present findings from the study: subject characteristics, demographic characteristics, diabetes-related health characteristics, and data analyses for the two aims. All statistical analyses were examined at a significance level of .05.

A. Subject Characteristics

The sample included 197 Thai adults with type 2 diabetes. The subjects were recruited from one diabetes clinic from Panomsarakham Hospital, Thailand. The investigator interviewed 198 eligible subjects. One subject had an error result (code “OR 2”) during blood test for A1C. This error reflects that the sample blood may have too much hemoglobin (greater than 60% hematocrit) or excess blood. The subject was willing to have another fingerstick blood drawn; the error was still present. This subject was excluded from the study due to inability to obtain an accurate A1C measurement.

B. Demographic Characteristics

The 197 subjects included a broad range of the adult life span. About 73% were older than 50 years of age. Almost 30% (59) were employed, and greater than 75% were little educated. Fewer males (31%) were recruited than females (69%). There were no significant differences in A1C between males (8.4 ± 1.8) and females (8.7 ± 1.9) (t = -.868, p = .386); or between the uneducated and educated subjects (8.19 ± 2.25 vs. 8.62 ±1.87) (p = .394). There were no significant difference in age between males (58 ± 12, ranged 30-79 years) and females (57 ± 10, ranged 31-77 years) (t = .813, p = .417). Table VI displays the demographic information for the study sample.

TABLE VI
DEMOGRAPHIC CHARACTERISTICS

Variable	Total subjects (*n* = 197)
Age (years)	
Mean (*SD*)	57.21 (10.47)
Range	30-79
Gender: *N* (%)	
Female	136 (69)
Male	61 (31)
Education: *N* (%)	
No Education	16 (8.1)
Educated	181 (81.9)
Some school (1-7 years)	148 (75.1)
Some high school (8-12 years)	26 (13.2)
Some college (13 -16 years)	7 (3.6)
Marital status: *N* (%)	
Single	5 (2.5)
Couple	151 (76.6)
Divorce/ Widow	41 (20.8)
Number of family member (person)	
Mean (*SD*)	3.86 (1.99)
Range	1-11
Household Income (%)	
Below 4,999 Baht (<$ 167)	39 (19.8)
5,000-9,999 Baht ($ 167-333)	52 (26.4)
10,000-14,999 Baht ($ 334-500)	51 (25.4)
15,000-19,999 Baht ($ 501-666)	18 (9.1)
20,000-24,999 Baht ($ 667-833)	19 (9.6)
Over 25,000 Baht (> $ 834)	18 (9.1)
Waist circumstance (cms)	
Mean (*SD*)	90.65 (10.58)
Range	63-119
Weight (kgs)	
Mean (*SD*)	66.59 (12.78)
Range	36.60-104.70

C. **Diabetes-Related Health Characteristics**

Table VII presents subjects' diabetes-related health conditions.

TABLE VII
DIABETES-RELATED HEALTH CONDITION CHARACTERISTICS

Variable	Total subjects (*n* = 197)	A1C (%) Mean (*SD*)
Duration of diabetes (years)		
Mean (*SD*)	6.85 (5.73)	
Range	1-30	
Length of Diabetes Therapy		
Mean (*SD*)	6.89 (5.73)	
Range	1-30	
Diabetes Therapy: *N* (%)		
Diet regulation	4 (2.0)	7.0 (1.4)
Oral medications	156 (79.2)	8.4 (1.8)
Insulin	17 (8.6)	9.4 (2.1)
Both oral medications and insulin	20 (10.2)	9.8 (2.2)
Comorbidity: *N* (%)		
No	28 (14.2)	8.6 (1.9)
Yes	169 (85.8)	8.6 (1.9)
Hyperlipidemia	147 (74.6)	
Hypertension	124 (62.9)	
Heart disease	19 (9.6)	
Renal disease	10 (5.1)	
Other (thyroid, old TB, etc.)	24 (12.2)	
Family History of Diabetes: *N* (%)	77 (39.1)	
Current Smoker: *N* (%)		
No	178 (90.4)	
Yes	19 (9.6)	
BMI		
Underweight (below 18.5)	5 (2.5)	9.1 (3.2)
Normal weight (18.5-24.9)	78 (39.6)	8.2 (1.9)
Overweight (24.5-29.9)	76 (38.6)	8.6 (1.8)
Obesity (30.0 and above)	38 (19.3)	9.2 (1.9)

D. **Research Question 1**

In this section, findings are presented in relation to Research Question 1 "Which of the six independent variables (Buddhist values, social support, self-efficacy, general diabetes knowledge, risk perception for developing complications, and A1C) are the most influential in predicting engagement of self-management behaviors? Are there any factor variables that do not contribute significantly to the prediction model?"

Table VIII displays the descriptive data for the outcome and each of the independent variables.

TABLE VIII
DESCRIPTIVE (MEAN and *SD*) OF OUTCOME AND INDEPENDENT VARIABLES

Variable	Possible scores	Total subjects (*n* = 197)
Self-management: Mean (*SD*)	0 – 112	77.09 (12.29)
Range		37 – 107
A1C: Mean (*SD*)	4.0 – 13.0	8.59 (1.91)
Range		4.9 – 13.0
Buddhist values: Mean (*SD*)	7 – 35	29.12 (3.13)
Range		20 – 35
Social support: Mean (*SD*)	19 – 95	59.43 (12.06)
Range		28 – 90
Diabetes self-efficacy: Mean (*SD*)	8 – 80	58.62 (13.76)
Range		8 – 80
General diabetes knowledge: Mean (*SD*)	0 – 21	16.77 (2.61)
Range		7 – 21
Risk perception: Mean (*SD*)	26 – 109	68.56 (12.08)
Range		33 – 97

In Table IX, each self-management behavior's mean number of days of performance during the prior week showed considerable consistency with prior studies that have reported higher numbers for diet than exercise. Mean number of days a week for self-management behaviors were high to low as follows: medication taking, foot care, general diet, specific diet, exercise, and blood glucose testing.

TABLE IX
DESCRIPTIVE (MEAN and *SD*) OF OUTCOME AND INDEPENDENT VARIABLE SUBSCALES

VARIABLES	M	*SD*	Range
Self-care activities: Mean number of days a week			
General diet	5.13	1.90	0 – 7
Specific diet	5.09	1.28	0 – 7
Exercise	4.16	2.09	0 – 7
Blood glucose testing	0.65	0.53	0 – 7
Medication	6.19	1.77	0 – 7
Check feet/Foot care	5.70	1.24	0 – 7
Risk perception: (Possible score: 1 – 4)			
Perceived personal control	2.79	0.33	2 – 4
Optimistic bias	2.91	0.69	1 – 4
Worry	2.70	0.68	1 – 4
Personal disease risk (Possible score: 1 – 5)	2.60	0.79	1 – 4.3
Environmental risk	2.72	0.60	1.2 – 4
Risk knowledge: (Possible score: 0 – 5)	4.21	1.12	0 – 5
Social Support: (Possible score: 1 – 5)			
Health care	3.93	0.99	1 – 5
Media/Policy	3.92	0.83	1 – 5
Personal	3.54	0.91	1 – 5
Work or volunteer (*N* = 59)	3.14	1.24	1 – 5
Neighborhood	2.85	0.86	1 – 5
Family/Friends	2.83	1.09	1 – 5
Organization	1.79	0.99	1 – 5

Risk knowledge for developing complications was high. Risk perception subscales showed moderate concern for their risk of developing diabetes complications compared to other diseases as demonstrated by their scores on perceived optimistic bias, personal control, worry about developing diabetes complications, and environmental risk (see Table IX). Worry about diabetes and developing diabetes complications were rated as moderate: 63% reported being concerned about getting diabetes health problems, and 71% reported worrying about getting diabetes complications.

Social support from multi-level resources was moderate. Their perceived support was high to low in this order: health care provider, media and policy, personal, work, neighborhood, family/friends, and organization (see Table IX). For subjects who were employed (30%), the work subscale did not include summed scores in the further analyses.

Buddhist values in regards to diabetes care in this population were rated as high. Most participants were older than 50 years old (73%) and little educated (75%). Those older (r = .217, p < .001) had relatively higher Buddhist values than those younger. The lower-educated (r = -.184, p < .001) were relatively higher Buddhist values than those higher-educated. However, gender was not significantly related to Buddhist values. Overall, diabetes self-efficacy was rated as high. Similar to self-management behaviors, their self-efficacy on diet was greater than exercise. Table X displays mean and standard deviation of the self-efficacy survey.

TABLE X
MEAN AND STANDARD DEVIATIONS OF SELF-EFFICACY SURVEY

ITEM	M	SD	Range
How confident do you feel that you can eat your meals every 4 to 5 hours every day, including breakfast every day?	8.01	2.30	1 – 10
How confident do you feel that you can follow your diet when you have to prepare or share food with other people who do not have diabetes?	7.30	2.53	1 – 10
How confident do you feel that you can choose the appropriate foods to eat when you are hungry (for example, snacks)?	7.09	2.542	1 – 10
How confident do you feel that you can exercise 15 to 30 minutes, 4 to 5 times a week?	6.92	3.042	1 – 10
How confident do you feel that you can do something to prevent your blood sugar level from dropping when you exercise?	6.42	2.832	1 – 10
How confident do you feel that you know what to do when your blood sugar level goes higher or lower than it should be?	7.27	2.72	1 – 10
How confident do you feel that you can judge when the changes in your illness mean you should visit the doctor?	8.19	2.35	1 – 10
How confident do you feel that you can control your diabetes so that it does not interfere with the things you want to do?	7.41	2.53	1 - 10

1. **Supplement Information**

TABLE XI
DESCRIPTIVE (MEAN & SD) OF PERCEIVED PERSONAL DISEASE RISK

PERCEIVED PERSONAL DISEASE RISK	M	SD	RANGE
Heart attack	2.54	1.18	1 – 4
Foot amputation	1.83	1.09	1 – 4
Cancer	1.82	2.54	1 – 4
Vision problems	2.54	1.11	1 – 4
High blood pressure	2.84	1.18	1 – 4
Numb feet	2.65	1.12	1 – 4
Stroke	2.67	1.13	1 – 4
Blindness	2.53	1.21	1 – 4
Kidney failure	2.70	1.22	1 – 4

TABLE XII
CORRELATIONS OF BUDDHIST VALUE ITEM AND SELF-MANAGEMENT

BUDDHIST VALUES ITEMS	SELF-MANAGEMENT BEHAVIORS
Diabetes (illness) is part of normal life cycle (birth, aging, illness, death)	.169*
Do good, receive good; do evil receive evil	.264**
Chanting makes me feeling good (sabaay jai)	.312**
Buddhism (Dharma) helps reduce unhealthful imaginations	.286**
Buddhist practices help control craving	.261**
Meditation relieves stress	.213**
To be moderate in living and eating is good	.193**

*$p < .05$. **$p < .01$.

TABLE XIII

CORRELATIONS OF BUDDHIST VALUES AND SELF-MANAGEMENT

SELF-MANAGEMENT BEHAVIORS	BUDDHIST VALUES
General diet	.171*
Specific diet	.180*
Exercise	.125
Foot care	.275**
Medications	.047
Blood glucose testing	.089

*$p < .05$. **$p < .01$.

TABLE XIV

COMPARISONS OF DIABETES KNOWLEDGE AND SELF-MANAGEMENT BETWEEN OPTIMAL AND SUBOPTIMAL CONTROL GROUPS

VARIABLES	A1C < 7% (n=40)		A1C > 7% (n = 157)		p-value
	M	*SD*	M	*SD*	
Diabetes knowledge: (Possible score: 0-21)	16.75	2.31	16.78	2.68	.930
Self-care activities: (Summed score: 37-107)	75.83	11.69	77.41	12.46	.327

Table XV shows a bivariate correlation matrix among the associated variables that were analyzed for significant relationships with self-management behaviors. The correlation analyses indicated that A1C was not significantly associated with self-management behaviors. Greater Buddhist values ($r = .334$, $p < .001$), social support ($r = .295$, $p < .001$), diabetes self-efficacy ($r = .329$, $p < .001$), and general diabetes knowledge ($r = .253$, $p < .001$) were all significantly associated with self-management behaviors. A high perception of risks for developing complications was significantly negatively associated with self-management behaviors ($r = -.208$, $p < .002$).

TABLE XV

BIVARIATE CORRELATIONS BETWEEN SELF-MANAGEMENT AND INDEPENDENT VARIABLES

Outcome Variable	A1C	Buddhist values	Social support	Diabetes self-efficacy	General diabetes knowledge	Risk perception
Self-management	.063	.334*	.295*	.329*	.253*	-.208*
INDEPENDENT VARIABLES						
A1C		-.021	.015	-.062	-.018	-.004
Buddhist values			.265*	.193*	.230*	.011
Social support				.415*	.418*	-.040
Diabetes self-efficacy					.324*	-.181*
General diabetes knowledge						-.006

*Significance level of .05, $p < .01$.

The correlation analyses included the covariates: age, gender, education, and duration of diabetes. These variables could hypothetically have an impact on levels of self-management behaviors. There were no significant associations between the covariates and self-management behaviors (see Table XVI).

TABLE XVI
CORRELATIONS AMONG A1C, SELF-MANAGEMENT, AND COVARIATES

COVARIATES	AGE	DURATION	GENDER	EDUCATION	A1C
Self-Management	-.011	.089	-.034	.037	.063
Age		.341*	.058	- .225*	- .138*
Duration of diabetes			-.077	- .158*	.139*
Gender				.105	- .062
Education					.061

*significant at < .05. **significant at < .01.

Regression assumptions were examined by normal probability plots; scatter plots of residuals versus predicted residuals. No evidence of violations was found. Although some raw data values (17 cases; 8.6%) were extremely high and low in the associated independent and dependent variable, differences between outliers and non-outliers were significant for only Buddhist values ($t = 2.955$, $p < .004$). There were no multivariate outliers. A total of 197 cases were included in analyses. Pearson's product moment correlation analyses displayed significantly slight to moderate correlations between the independent variables. Collinearity statistics indicated no multicollinearity including tolerance and variance inflation factors (VIF). There was normal distribution of residuals in both final models.

The simultaneous regression analysis performed between the dependent variable (self-management behaviors) and the six major independent variables (Buddhist values, social support, self-efficacy, general diabetes knowledge, risk perception for developing complications, and A1C) revealed that the full model significantly predicted the self-management behaviors in Thai adults with type 2 diabetes: F (6, 190) = 9.973, $p < 0.001$ (see Table XVII). Table XVII presents the unstandardized regression coefficients, standard error, standardized regression coefficients, t statistics, significance level and 95% confidence interval for each variable. The R^2 for the regression model was 0.240; adjusted R^2 was 0.215. Neither diabetes knowledge (t = 1.286, p = .200) nor A1C (t = 1.238, p = .217) contributed significantly to the variance in self-management behaviors.

TABLE XVII
REGRESSION ANALYSIS SUMMARY FOR
PREDICTORS OF SELF-MANAGEMENT

Variable	B	SE B	Beta	T	P	95% CI
Social support	.109	.076	.107	1.426	.155	-.042-.256
Diabetes self-efficacy	.161	.065	.180	2.483	.014	.033-.288
Buddhist values	.995	.261	.254	3.819	.000	.481-1.509
Risk perception	-.176	.066	-.173	-2.686	.008	-.306-.047
A1C	.507	.410	.079	1.238	.217	-.301-1.316
Diabetes knowledge	.434	.337	.092	1.286	.200	-.231-1.099

$F(6, 190) = 9.973.\ p < .001.$
$R^2 = .240$, adjusted $R^2 = .215$

Simultaneous regression analysis resulted in a model that also significantly predicted the self-management behaviors in Thai adults with type 2 diabetes, F (4, 192) = 14.086, $p < 0.001$. The R^2 for the regression model was 0.227; adjusted R^2 was 0.211. Four independent variables (social support, Buddhist values, risk perception and diabetes self-efficacy) in the model appeared significantly related to self-management behaviors (see Table XVIII). Although social support was significantly associated with self-management behaviors, the regression models appeared to have no significant influence on self-management behaviors. Social support was excluded from final regression analyses.

TABLE XVIII
REGRESSION ANALYSIS SUMMARY FOR
POSSIBLE PREDICTORS OF SELF-MANAGEMENT

Variable	B	SE B	Beta	T	P	95% CI
Social support	.142	.073	.140	1.959	.052	.000-.286
Diabetes self-efficacy	.169	.064	.189	2.659	.008	.044-.295
Buddhist values	1.069	.259	.263	3.969	.000	.518-1.541
Risk perception	-.174	.066	-.171	-2.648	.009	-.304-.044

$F(4, 192) = 14.086$. $p < .001$.
$R^2 = .227$, adjusted $R^2 = .211$

In Table XIX (the simultaneous regression analysis), the best fitting model revealed that Buddhist values, diabetes self-efficacy, and risk perception for developing complications strongly contributed to predicting the self-management behaviors in Thai adults with T2DM: F (3, 193) = 17.248, $p < 0.001$; $R^2 = 0.211$, adjusted $R^2 = 0.199$. The residuals were normally distributed. Focusing on βs, the standard deviation increase in Buddhist values led to a .289 standard deviation increase in engagement in self-management behaviors, controlling for perception of diabetes self-efficacy and risk perception. Each additional standard deviation in diabetes self-efficacy resulted in a .243 standard deviation increase in performing self-management behaviors, controlling for Buddhist values and risk perception. Each standard deviation increase in *risk perception* resulted in a .167 standard deviation decrease in performing self-management behaviors, controlling for Buddhist values and diabetes self-efficacy.

TABLE XIX

REGRESSION ANALYSIS SUMMARY FOR EXPLANATORY VARIABLES OF SELF-MANAGEMENT AMONG THAI ADULTS WITH TYPE 2 DIABETES

Variable	B	SE B	Beta	T	P	95% CI
Diabetes self-efficacy	.217	.059	.243	3.664	.000	.100-.334
Buddhist values	1.134	.256	.289	4.434	.000	.630-1.638
Risk perception	-.170	.066	-.167	-2.572	.011	-.301-.040

$F(3, 193) = 17.248$. $p < .001$.
$R^2 = .211$, adjusted $R^2 = .199$

E. **Research Question 2**

This section provides findings for Research Question 2 “Do self-management behaviors combined with Buddhist values, social support, self-efficacy, general diabetes knowledge, risk perception for developing complications significantly contribute to the prediction of A1C in adults with T2DM in rural areas?”

Generally, A1C was high (mean 8.59, *SD* = 1.91): 20.3% were optimal control (i.e., A1C less than 7%), and 79.7% were suboptimal control (i.e., A1C greater than 7%). There were no significant relationships between A1C and self-management, Buddhist values, social support, self-efficacy, general diabetes knowledge, and risk perception for developing complications among adults with T2DM in rural communities (see Table XV). A1C was significantly associated only to age and duration of diabetes (see Table XX).

In Table XXI, the regression model retained covariates including age and duration of diabetes due to the fact that no single main predictor was significantly related to A1C. The model was significant: F (2, 194) = 6.297, $p < .002$. The R^2 was .061; adjusted R^2 was .051. The residuals looked normally distributed. Age’s coefficient was too small for it to be considered a meaningful influence on A1C (β = .040, $p < .004$). Duration of diabetes had a small but meaningful influence on A1C (β = .073, $p < .004$). Focusing on Bs, the number of year increase in age led to a .040 unit (%) decrease in A1C, controlling for duration of diabetes. Each additional year living with diabetes resulted in a .073 unit (%) increase in A1C, controlling for age.

TABLE XX
BIVARIATE CORRELATIONS BETWEEN A1C AND COVARIATES

Covariates	Duration	Gender	Education	A1C
Age	.341*	.058	- .225*	- .138*
Duration of diabetes		-.077	- .158*	.139*
Gender			.105	- .062
Education				.061

*Significance level of .05 at one-tailed.

TABLE XXI
REGRESSION ANALYSIS SUMMARY FOR EXPLANATORY VARIABLES OF A1C AMONG THAI ADULTS WITH TYPE 2 DIABETES

Variable	B	SE B	Beta	T	P	95% CI
Age	- .040	.014	- .220	- 2.930	.004	-.067 – -.013
Duration of diabetes	.073	.025	.221	2.947	.004	.024 – .122

$F(2, 194) = 6.297$. $p < .002$.
$R^2 = .061$, adjusted $R^2 = .051$

F. SUMMARY

This chapter presented findings related to the two research questions. Findings suggested that Buddhist beliefs, social cognitive (risk perception) and psychosocial (self-efficacy) factors are associated with engagement in self-management behaviors among Thai adults with T2DM, but were not significantly associated with health outcomes. Lower A1C was marginally associated with increase in age and shorter duration of diabetes. Regression analysis suggests that the perceived Buddhist values, diabetes self-efficacy, and risk perception combined had the greatest influence on self-management behaviors; however, those associated independent variables were not associated with glycemic control.

V. DISCUSSION

This chapter includes discussion of the two study aims, limitations, and implications of the study.

A. Aim I

The primary aim of this study was to explore factors in predicting self-management behaviors among middle-aged to elderly Thai adults with T2DM.

1. Overview of Results

Self-management behaviors were positively related to Buddhist values (r = .334, p < .01), social support (r = .295, p < .01), diabetes self-efficacy (r = .329, p < .01), and general diabetes knowledge (r = .253, p < .01), but were negatively related to risk perception (r = -.208, p < .01). However, Buddhist values (β = .289), diabetes self-efficacy (β = .243), and risk perception (β = -.167) were the best predictors of compliance in self-management behaviors in this population. Buddhist values were correlated with diet (.17) and foot care (.27) (p < .05). Findings confirmed the hypothesis that diabetes self-management behaviors among Thai middle-aged to elderly with T2DM might have been improved through intertwining influences of Buddhist values, self-efficacy, and risk perception of developing diabetes complications. Those with high Buddhist values were more likely to adhere dietary and foot care self-care activities. In this study there was no significant relationship between self-management behaviors and the duration of diabetes, age, gender, and education.

Buddhist values' effects on diabetes care in this population were relatively higher in the older people and the lower-educated than those younger and higher-educated. As stated in Chapter II, Thai people believe and view their illnesses as a result of bad

karma (Burnard & Naiyapatana, 2004). It is of note that all items of Buddhist values showed positive significantly correlation with self-management behaviors. This could be hypothesized to be so because beliefs in Buddhism may influence modification of self-care activities of Thai people with diabetes through accepting the reality and changes in the current situation to reduce the consequences of misbehaviors in the past. Thai Buddhists are accepting of their situation, observe their own behavior (including behaviors of the mind), and accept greater responsibility for current and future behaviors (Mikulas, 1983, p. 95). These strategies allow patients with diabetes to learn about the cause of suffering from diabetes and its complications and gradually change their behaviors.

It is unclear about the mechanisms of how Buddhist values affect behavior changes among Thai people. A possible explanation is acceptance of diabetes as part of the birth and death life cycle. Death is certain in the life cycle. Diabetes is a consequence of past and current behaviors. Thai Buddhist patients may be unaware of their eating in the past until they are diagnosed with diabetes. According to the Law of Karma, it is their responsibility to manage their health problem, seek medical treatment, and change their eating behaviors. The Buddhist teaching of the “Middle Way” may lead them to moderation of their eating behaviors. They may be aware of food choices because a popular Thai proverb is “eat to survive, don’t live to eat.” Thai Buddhist patients believe in the “Law of Karma”, past actions influence the present, present action influences the future (do good, receive good), which implies that their diabetes control relies on their behaviors. Buddhist teaching and practices have an influence on acceptance of the cause of diabetes and on patients’ lifestyle modifications to live with

diabetes. Therefore, Thai Buddhist patients adhere to their dietary self-care activities with hope of optimal glycemic control effects. Buddhist training in meditation may lead to stability of mood and emotions, and it has been reported that meditation and mindfulness training may be effective components in decreasing both frequency and severity of binge eating episodes (Kristeller et al, 1999).

The relationship between Buddhist values and foot care might be explained regarding Thai life style. Traditionally, older Thai generations in rural communities have agricultural work, and many walk barefoot. There is a traditional belief that one has to wash her or his feet before getting to bed. Additionally, Thai DM patients seem to acknowledge that diabetes causes diabetes foot complications and can lead to amputation. This might make it easy to accept and follow foot care recommendations. However, these relationships need to be further investigated with qualitative study.

Findings from this study indicate that Buddhism and behavior modifications complement each other. Buddhist Thais with T2DM considered diabetes and its complications as life-threatening; they might adopt healthy lifestyle to alleviate suffering from diabetes complications. Buddhist values might be a factor that could be used to improve self-management behaviors through acceptance of coping with diabetes.

Overall, diabetes self-efficacy was rated as high. Participants in this study felt greater confidence in dietary than exercise self-care behaviors. Similarly, compliance was greater in dietary than in exercise self-care activities. This suggested that higher diabetes self-efficacy would result in more compliance to diabetes regimens. Diabetes self-efficacy is one factor among many that may improve compliance of self-management behavior among Thai adults with T2DM. A variety of external barriers may

limit patients' ability to follow self-management recommendations, such as lack of availability of place to exercise. Moreover, many experiences and barriers may decline self-management performance such as comorbid conditions, depression, problem of communication with physicians, or economic barriers.

The negative relationship between comparative risk perception and self-management behaviors is understandable. In this population, greater than 80% had A1C over the recommended goal of greater than 7%; over 73% developed comorbidities, including hyperlipidemia, hypertension, heart disease, and renal disease. Chronic hyperglycemia causes this population to be at high risk for progression to severe complications, particularly end stage renal disease. Their knowledge about the risk of developing diabetes complications was high. However, overall perception of risk for developing complications was moderate. The scores of the RPS-DM showed that perceived personal disease risk was rated as the lowest risk perception (Table IX). The perceived personal risks of cancer and amputation were rated as lower than those of hypertension, renal failure, and stroke (Table XI). Despite the fact that most participants had suboptimal control and developed at least one comorbidity related to diabetes, their risk perception subscale scores of the RPS-DM indicated a greater perceived optimistic bias and perceived personal control than perceived personal disease risk and worry of getting diabetes complications. Additionally, they rated that environmental risk was higher than personal disease risk. The optimism subscale, as the highest perceived risk, demonstrated that they did not view themselves as more likely to have serious problems and diabetes complications than their peers. These are evidence that their risk perception was unrealistic. The population's lower level of education (> 83%) and the

fact that these risks are often "invisible" may have contributed to a lack of perception that they may have highly biased perceptions about their own risk. As stated earlier, the scores on worry about getting diabetes complications was lower than optimism. Worry about getting diabetes complications was determined as moderate (Table IX). As stated in Chapter II, optimistic bias may be a disadvantage due to lack of motivation to adhere to self-management behaviors. Therefore, low worry and high optimism may lead to risky health behaviors. In this study, there was no correlation between risk perception and age, gender, education and duration of diabetes.

Perceived social support in this population had no impact on improvement of self-management behaviors; however, support from social networks was an important resource for the purpose of enhancing active and continuous performance of diabetes self-management behaviors (Brody et al., 2008; Fisher et al., 2005; Fisher et al., 2002; Garay-Sevilla et al., 1995). The overall score of perceived social support of the CIRS (without work subscale) in this population fills in a moderate range. Individuals perceived higher supports from resources in their social network might have more performing self-management behaviors. The correlation between self-management behaviors and the CIRS subscales was determined. Unlike other CIRS subscales, health care provider support was not related to their self-care activities (r = .075, p = .148), regardless of the high perceived support from health care team. This suggests that the health care team explaining the results of blood tests and listening to patients' health concerns might be not helping a person’s behavior to change. Social support had no relation to age, gender, and education.

Lack of a relationship between A1C and self-reported self-management behaviors measured by the SDSCA is in line with earlier studies. Findings in this study confirmed previous research reporting that the compliance was greatest with medication regimens, followed by lower compliance with lifestyle changes such as exercise and diet regulation (Ruggiero et al., 1997), which require more lifestyle adjustments. It has been shown in several studies that A1C does not affect one's self-management behaviors in either T2DM or T1DM populations (Chlebowy et al., 2010; Glasgow, McCaul, & Schafer, 1987; Mitchell, Bowker, Majumdar, Toth, & Johnson, 2004; Rothman et al., 2008). However, in a larger T2DM sample study (n = 810), better metabolic control was independently associated with greater medication adherence (measured adherence by pill count), increasing age, and lower intensity of drug therapy (fewer drugs); for each 10% increment in drug adherence, A1C decreased by 0.16 ($p < 0.0001$) (Schectman, Nadkarni, & Voss, 2002). Form a clinical viewpoint, A1C is influenced by many factors, including genetics, physiological reasons, medications, or diabetes recommendations. Lack of relationship between A1C and self-management behaviors in this study may be related to research methodology approach: measurement, design and statistical choices, and sample characteristics. Recall as a self-management behavior measure is prone to poor reliability due to poor subject recall or respondent bias or social desirability; however, reliability could be maximized with face-to-face interview and the investigator in this study was the only interviewer. The SDSCA questions asked about on how many of the last seven days the subject had performed dietary, exercise, medication, and blood glucose monitoring. The instrument did not take into account

intensity of dietary and exercise activities or pill count. This may have led to overestimated or underestimated amounts of the actual levels of self-care activities.

Glycemic control rate was poor, as only approximately 20% were in optimal control. Diabetes self-management behaviors were moderate, comparable scores in both the optimal control and suboptimal control groups. It is not surprising that those participants who were receiving more intensive therapy (complex treatment regimens) had poorer glycemic control (Table VII). This finding was consistent with a large study of the US population (Schectman et al., 2002). This relationship is expected because, based on the literature and customary clinical practice, oral medications and insulin are commonly added as a consequence of poor control. It might be hypothesized that there is variability of insulin resistance among individuals with T2DM. In addition, adherence to complex diabetes regimens and performance of any single self-care activity is hardly expected to be strongly related to glycemic control. In the existing literature, adherence and glycemic control had no straightforward relationship. Adherence to diabetes regimens does not automatically lead to lower A1C.

Lack of a relationship between general diabetes knowledge and self-management behaviors was inconclusive. In this population, participants who had high diabetes knowledge seem to be more likely to be compliant to self-management behaviors. Findings in this study differ from prior studies in Chinese samples (Chan & Molassiotis, 1999; Xu et al., 2008), and a US sample (T1DM) (McCaul et al., 1987). Participants in this study were knowledgeable about general diabetes care; however, they might have poor self-care activities. Approximately 88% had high scores of general diabetes knowledge; but there were no differences between suboptimal and optimal

control groups (Table XIV). Diabetes knowledge in a number of subjects was high; self-management behaviors were comparable between suboptimal and optimal glycemic control groups. In this study, greater diabetes knowledge did not predict self-management behaviors. Individuals' levels of knowledge were not associated to behavior adjustments to manage diabetes effectively. They might have performed self-care activities that differed from what they were taught or knew what to do. Diabetes regimens are complex; one's knowledge could not be a sole measure for one's ability to perform complex tasks of self-management.

2. **Summary of Aim I**

Engagement in diabetes self-management behaviors for diabetes care was average among middle-aged to elderly Thais with T2DM. Self-management behaviors were likely affected by a combination of social-cognitive learning factors (diabetes self-efficacy and risk perception for developing complications) and culture-related religious beliefs (Buddhist values). General diabetes knowledge and A1C may also affect engagement in diabetes self-management behaviors, but further investigation in those relationships is required. The direct relationships between self-management behaviors and associated independent variables (R^2 = .211) retained a large portion of unexplained variance among Thai adults with T2DM. The interrelationships remain unknown among associated independent variables, including general diabetes knowledge and A1C, on self-management behaviors. Future study using sequential multiple regression or path analysis in a larger and heterogeneous population (rural and urban) could more accurately estimate these relationships.

B. Aim II

The second aim of this study was to examine whether self-management behaviors combined with Buddhist values, social support, self-efficacy, general diabetes knowledge, and risk perception for developing complications significantly contributed to the prediction of A1C.

1. Overview of Results

Findings did not support the hypothesis that self-management behaviors combined with the six associated independent variables predicted glycemic control. In primary findings of this population, glycemic control rate was fair to poor: approximately 80% had A1C levels greater than the recommended goal of 7%. Comparable to the associated predictors, compliance with self-management behaviors was moderate. Gender and education had no relationship to A1C. The older were more likely to have lower A1C (r = -.136*, p < .029) but those with longer length of diabetes were more likely to have higher A1C (r = .139*, p < .026). An additional year living with diabetes in this sample resulted in an increase roughly of .07 of A1C.

Participants in this population were diagnosed between 1 and 30 years previously, and approximately 85% had diabetes less than 10 years. Participants who had diabetes of longer duration were treated with more intensive therapy by oral medications, insulin alone, and both insulin and oral medications. As discussed earlier, oral medications and insulin are commonly added as a consequence of poor control. Unlike T1DM, persons with T2DM are less likely to have severe blood glucose swings and may consequently adhere less to their diabetes self-care.

The fact that there was no association between gender and glycemic control is consistent with prior studies (Glasgow et al., 1987; Schectman et al., 2002). The positive correlation between age and duration of diabetes is understandable. Those older had been diagnosed with diabetes longer. The older adults with diabetes had better control. The adults with longer living with diabetes results in poorer glycemic control. A lack of correlation between age and self-management behaviors did not support that the older become accustomed to their diabetes self-care; nor did it support that the participants with longer diagnosed with diabetes do so. In this population, there was no relationship between any single of the predictors and glycemic control.

Results regarding the relationship between psychosocial factors and A1C were inconclusive. It has been shown in several studies that social cognitive factors and psychosocial factors (social support, diabetes knowledge, self-efficacy) did not influence chronic glycemic control measured by A1C (Allison, 2003; Chan & Molassiotis, 1999; Chlebowy & Garvin, 2006; He & Wharrad, 2007; Wilson et al., 1986). However, it has been reported in previous studies that chronic glycemic control appeared to be influenced by social support, Buddhist values, and self-management behaviors (Griffith, Field, & Lustman, 1990; Sowattanangoon et al., 2008; C. Y. Wang & Fenske, 1996; Whittemore et al., 2005). In addition, one prospective study on intensive individual education of 189 diabetes patients, two thirds of those with T2DM showed improved A1C and moderately increased perceived severity of diabetes, perceived ability to carry out recommended behaviors, and perceived benefits of treatment; however, neither health belief nor self-reported adherence was associated with A1C (Wooldridge, Wallston, Graber, Brown, & Davidson, 1992).

According to standard ADA recommendations, specific diabetes self-care regimens for T2DM must consistently maintain physical activity, medications, and diet control to achieve target goals of optimal glycemic control (ADA, 2011). The Summary of Diabetes Self-Care Assessment (SDSCA) is a measure of self-reported physical activity habits, eating habits, and medication taking from the past seven days. The SDSCA does not take into account intensity of specific self-care activities. The exercise questions only ask about activity such as walking at least 30 minutes and a specific exercise session (other than what was done around the house). The diet subscale asks about eating plan and following the eating plan, spacing carbohydrates evenly throughout the day, and eating high-fat foods and vegetable or fruits in the past seven days. The diabetes self-care regimen is a series of complex tasks that need greater lifestyle modifications such as exercise and dietary changes. It is unlikely that a single self-care activity could strongly impact glycemic control. No clear relationship between adherence and glycemic control could be identified through bivariate or regression analyses. Rather, assuming that adherence to self-management behaviors and psychosocial factors may influence chronic glycemic control, then stress, individual metabolic factors, and medication choices could be considered as important factors of diabetes regimens (Glasgow et al., 1987).

The Buddhist values in this population were inconsistent with the first published study by Sowattanangoon et al. (2008), in which those with high Buddhist values were more likely to have lower A1C. When sample characteristics were compared, they were very similar in age, duration of diabetes, gender, education, type of diabetes and Buddhist values scores; except, the average A1C of 8.59% in the current study was

higher than the A1C in the prior study, in which the sample only included non-insulin users (average A1C = 7.6%). However, the actual cause of the different findings remains unknown. A lack of association between Buddhist values and A1C in this study may be related to study design and sample characteristics, including differences in medications, treatments, or recommendations. Sample characteristics and differences in treatments, medications, recommendations, and self-care behaviors may have affected the relationship between Buddhist values and A1C levels for several reasons. As discussed earlier, participants received more intensive therapy due to poor glycemic control. The mechanisms of how Buddhist values are linked with A1C remain unknown. The Buddhist values scale measured only attitudes toward certain diabetes care activities; however, psychological and mental factors related to stress, depressed mood, and other emotional factors that can affect metabolism were unmeasured in this study. It could be hypothesized that one who regularly follows Buddhist teachings and practices (especially mindful meditation) may achieve stability of mood and emotion that leads to better glycemic control. Such an association has been demonstrated previously for breathing meditation with respect to hypoglycemic effect (Chaiopanont, 2008) and the effectiveness of meditation therapy for anxiety disorders (Krisanaprakornkit, Sriraj, Piyavhatkul, & Laopaiboon, 2006). Adopting Buddhist teachings and practices in daily living activities may lead to lower A1C.

C. **Limitations of the Study**

There are some limitations that need to be considered in interpreting the findings of this study. Although the study sample was a broad range of the adult lifespan, duration of diabetes, mixed types of treatments, and a convenience sample may

introduce bias in sample selection, which could possibly affect the internal validity of the study and generalizability of the findings. Study participants might not be representative of all Thais with T2DM. The principal investigator translated the four instruments (SDSCA, CIRS, DSE, and RPS-DM) from the English to Thai language. The content validity of translation could not be determined. Three bilingual nurses checked the translation with suggestions to change words. Only one diabetes researcher determined language and cultural equivalence. That might involve errors of measurement related to internal validity that falls into type I error. Although the investigator was the only interviewer in order to maximize reliability, fatigue in a long interview with the lower-educated is prone to decline in reliability.

The reliability of general diabetes knowledge is acceptable (Alpha = .645, see Appendix C, p.111). Subjects in this study were over 75% lower-educated, which could affect reliability. Thus, the impact of general diabetes knowledge as a variable could not be examined on self-management behaviors. Reliability of the self-reported SDSCA is adequate for total item scale (Cronbach's alpha = .752, see Appendix C). The internal consistency reliability was acceptable for subscales of general diet, exercise, and medication; however, the blood glucose monitoring subscale (Cronbach's alpha = .459), foot care subscale (Cronbach's alpha = .547) and specific diet (Cronbach's alpha = .588) were unreliable. That limited analyses between predictors and specific self-care regimens.

D. **Implications**

Diabetes self-care practices have an important impact on diabetes management and glycemic control. The factors of Buddhist values, psychosocial and social cognitive

variables examined in this study may possibly enhance self-management behaviors among Thai adults with T2DM in rural communities. Self-management behaviors combined with other associated variables did not lead to optimal glycemic control. Diabetes patients generally lack understanding of the development of complications, leading to poor performance of self-care activities and glycemic control. Low optimism, increased confidence of one's ability to carry out certain self-care activities, and increased Buddhist values may possibly help improve diabetes self-management behaviors among Thai adults with T2DM. Diabetes education will help patients understand exactly how diabetes tasks must be done to succeed at achieving optimal glycemic control. In the clinical setting, all diabetes patients need to be taught by health care providers (nurses, diabetes educators, physicians) about living with diabetes and self-management strategies that will increase confidence in being able to carry out certain diabetes self-care tasks and understanding diabetes management strategies. Understanding the mechanisms of diabetes complication development may decrease unrealistic optimistic bias. Which teaching strategies of self-management program are best needs to be clarified. In addition, Buddhism philosophy approaches might help in accepting diabetes as life-threatening so that adapting healthy living habits will be easier. Alternatively, diabetes self-management education programs should be delivered to all newly diagnosed diabetes patients and again when blood glucose levels become higher than the standard ADA goal.

APPENDICES

Appendix A

Study Instruments

Summary of Diabetes Self-Care Activities

Diet

How many of the last SEVEN DAYS have you followed a healthful eating plan?

0 1 2 3 4 5 6 7

On average, over the past month, how many DAYS PER WEEK have you followed your eating plan?

0 1 2 3 4 5 6 7

On how many of the last SEVEN DAYS did you eat five or more servings of fruits and vegetables?

0 1 2 3 4 5 6 7

On how many of the last SEVEN DAYS did you eat high fat foods such as red meat or full-fat dairy products?

0 1 2 3 4 5 6 7

Exercise

On how many of the last SEVEN DAYS did you participate in at least 30 minutes of physical activity? (Total minutes of continuous activity, including walking).

0 1 2 3 4 5 6 7

On how many of the last SEVEN DAYS did you participate in a specific exercise session (such as aerobic dance, jogging, walking, biking) other than what you do around the house or as part of your work?

0 1 2 3 4 5 6 7

Blood Sugar Testing

On how many of the last SEVEN DAYS did you test your blood sugar?

0 1 2 3 4 5 6 7

On how many of the last SEVEN DAYS did you test your blood sugar the number of times recommended by your health care provider?

0 1 2 3 4 5 6 7

Foot Care

On how many of the last SEVEN DAYS did you check your feet?

0 1 2 3 4 5 6 7

On how many of the last SEVEN DAYS did you inspect the inside of your shoes?

0 1 2 3 4 5 6 7

Smoking

Have you smoked a cigarette—even one puff—during the past SEVEN DAYS?
No
Yes
If yes, how many cigarettes did you smoke on an average day?
Number of cigarettes:_____

Which of the following medications for your diabetes has your doctor prescribed?
Please check all that apply.

☐[a] An insulin shot 1 or 2 times a day.
☐[b] An insulin shot 3 or more times a day.
☐[c] Diabetes pills to control my blood sugar level.
☐[d] Other (specify):
☐[e] I have not been prescribed either insulin or pills for my diabetes.

Diet

On how many of the last SEVEN DAYS did you space carbohydrates evenly through the day?

0 1 2 3 4 5 6 7

Medications

On how many of the last SEVEN DAYS, did you take your recommended diabetes medication?

0 1 2 3 4 5 6 7

On how many of the last SEVEN DAYS did you take your recommended insulin injections?

0 1 2 3 4 5 6 7

On how many of the last SEVEN DAYS did you take your recommended number of diabetes pills?

0 1 2 3 4 5 6 7

Foot Care

On how many of the last SEVEN DAYS did you wash your feet?

0 1 2 3 4 5 6 7

On how many of the last SEVEN DAYS did you soak your feet?

0 1 2 3 4 5 6 7

On how many of the last SEVEN DAYS did you dry between your toes after washing?

0 1 2 3 4 5 6 7

Diabetes self-efficacy

How confident do you feel that you can eat your meals every 4 to 5 hours every day, including breakfast every day?

Not at all confident	1	2	3	4	5	6	7	8	9	10	Totally confident

How confident do you feel that you can follow your diet when you have to prepare or share food with other people who do not have diabetes?

Not at all confident	1	2	3	4	5	6	7	8	9	10	Totally confident

How confident do you feel that you can choose the appropriate foods to eat when you are hungry (for example, snacks)?

Not at all confident	1	2	3	4	5	6	7	8	9	10	Totally confident

How confident do you feel that you can exercise 15 to 30 minutes, 4 to 5 times a week?

Not at all confident	1	2	3	4	5	6	7	8	9	10	Totally confident

How confident do you feel that you can do something to prevent your blood sugar level from dropping when you exercise?

Not at all confident	1	2	3	4	5	6	7	8	9	10	Totally confident

How confident do you feel that you know what to do when your blood sugar level goes higher or lower than it should be?

Not at all confident	1	2	3	4	5	6	7	8	9	10	Totally confident

How confident do you feel that you can judge when the changes in your illness mean you should visit the doctor?

Not at all confident	1	2	3	4	5	6	7	8	9	10	Totally confident

How confident do you feel that you can control your diabetes so that it does not interfere with the things you want to do?

Not at all confident	1	2	3	4	5	6	7	8	9	10	Totally confident

Buddhist Values

Buddhist Value Item	**Not at all**		**A moderate amount**		**A great deal**
	1	**2**	**3**	**4**	**5**
Diabetes (illness) is part of normal life cycle (birth, aging, illness, death)	☐	☐	☐	☐	☐
Do good, receive good; do evil receive evil	☐	☐	☐	☐	☐
Chanting makes me feeling good (sabaay jai)	☐	☐	☐	☐	☐
Buddhism (Dharma) helps reduce unhealthful imaginations	☐	☐	☐	☐	☐
Buddhist practices help control craving	☐	☐	☐	☐	☐
Meditation relieves stress	☐	☐	☐	☐	☐
To be moderate in living and eating is good	☐	☐	☐	☐	☐

Risk Perception for Diabetes Mellitus (RPS-DM)

The first one is…	Increase the risk of getting diabetes complications	Have NO effect on the risk, or	Decrease the risk of getting diabetes complications
1. Having diabetes for more than 15 years, does this…	☐	☐	☐
2. Checking your feet every day, does this…	☐	☐	☐
3. Keeping blood sugar levels close to normal, does this…	☐	☐	☐
4. Having a yearly eye exam, does this…	☐	☐	☐
5. Having high blood pressure, does this…	☐	☐	☐

The next set of questions are about your risks, or chances, of having diabetes health problems. Please answer by saying that you “strongly agree,” “agree,” “disagree,” or “strongly disagree.”

First…	Strongly Agree	Agree	Disagree	Strongly Disagree
6. I feel that I have little control over risks to my health.	☐	☐	☐	☐
7. If I am going to get complications from diabetes, there is not much I can do about it.	☐	☐	☐	☐
8. I am very concerned about getting diabetes health problems.	☐	☐	☐	☐
9. Compared to other people **with diabetes** of my same age and sex, I am *less* likely than they are to get diabetes complications.	☐	☐	☐	☐
10. Compared to other people **with diabetes** of my same age and sex, I am *less* likely to have serious health problems.	☐	☐	☐	☐
11. My own efforts can help control my risks of getting diabetes complications.	☐	☐	☐	☐
12. I worry about getting diabetes complications.	☐	☐	☐	☐
13. If I make a good effort to control the risks of diabetes complications, I am much less likely to get complications.	☐	☐	☐	☐

The next group of questions ask about your own personal risk for several health problems. For each one, please tell me if you think your own personal health is at “almost no risk,” “slight risk,” “moderate risk,” or “high risk” for having these problems. I’ll then ask if you now have or had this health problem.

How would you rate your risk of:	Almost No Risk	Slight Risk	Moderate Risk	High Risk	Have you ever had _____?	Yes	No
14. Heart attack, is it…	☐	☐	☐	☐	14a.	☐	☐
15. Foot amputation, is it…	☐	☐	☐	☐	15a.	☐	☐
16. Cancer, is it…	☐	☐	☐	☐	16a.	☐	☐
17. Vision problems, is it…	☐	☐	☐	☐	17a.	☐	☐
18. High blood pressure, is it…	☐	☐	☐	☐	18a.	☐	☐
19. Numb feet, is it…	☐	☐	☐	☐	19a.	☐	☐
20. Stroke, is it…	☐	☐	☐	☐	20a.	☐	☐
21. Blindness, is it…	☐	☐	☐	☐	21a.	☐	☐
22. Kidney failure, is it…	☐	☐	☐	☐	22a.	☐	☐

I’m going to read a list of possible hazards or dangerous conditions in the environment. For each one, please tell me if your own personal health is at "almost no risk," "slight risk," "moderate risk" or "high risk.."

How would you rate your risk from:	Almost No Risk	Slight Risk	Moderate Risk	High Risk
23. Medical tests (e.g., X-rays, MRI)	☐	☐	☐	☐
24. Violent crime	☐	☐	☐	☐
25. Extreme weather (hot or cold)	☐	☐	☐	☐
26. Driving/riding in an automobile (car)	☐	☐	☐	☐
27. "Street" drugs (illegal drugs)	☐	☐	☐	☐
28. Air pollution	☐	☐	☐	☐
29. Pesticides	☐	☐	☐	☐
30. Household chemicals (cleaners)	☐	☐	☐	☐
31. Cigarette smoke from people smoking around you	☐	☐	☐	☐

Brief Chronic Illness Resources Survey (CIRS)

Social support for illness self management

Over the **past 6 months**, to what extent…	Not at all 1	2	A moderate amount 3	4	A great deal 5
Has your doctor involved you as an equal partner in making decisions about illness management strategies and goals?	☐	☐	☐	☐	☐
Has your doctor or other health care advisor listened carefully to what you had to say about your illness?	☐	☐	☐	☐	☐
Has your doctor or other health care provider thoroughly explained the results of tests you had done (e.g. cholesterol, blood pressure or other laboratory tests?	☐	☐	☐	☐	☐
Have family or friends exercised with you?	☐	☐	☐	☐	☐
Have you shared healthy low-fat recipes with friends or family members?	☐	☐	☐	☐	☐
Family or friends bought food or prepared food for you that were especially healthy or recommended?	☐	☐	☐	☐	☐
Have you focused on the things you did well to manage your illness instead of those you did not?	☐	☐	☐	☐	☐
Have you thought about or reviewed how you were doing in accomplishing your disease management goals?	☐	☐	☐	☐	☐
Have you arranged your schedule so that you could more easily do the things you needed to do for your illness?	☐	☐	☐	☐	☐
Have you walked or exercised outdoors in your neighborhood?	☐	☐	☐	☐	☐
Have you walked or done other exercise activities with neighbors?	☐	☐	☐	☐	☐
Have you eaten at a restaurant that offered a variety of tasty, low-fat food choices?	☐	☐	☐	☐	☐
Have you gone to parks for picnics, walks or other outings?	☐	☐	☐	☐	☐
Have you read articles in newspapers or magazines about people who were successfully managing a chronic illness?	☐	☐	☐	☐	☐
Have you had health insurance that covered most of the costs of your medical needs including medicine?	☐	☐	☐	☐	☐
Have you seen billboards or other advertisements that encouraged not smoking, low-fat eating or regular exercise?	☐	☐	☐	☐	☐
Have you attended free or low-cost meetings (e.g. Weight Watchers, church groups, hospital programs) that supported you in managing your illness?	☐	☐	☐	☐	☐

Social support for illness self management (Continued)	Not at all		A moderate amount		A great deal
Over the **past 6 months**, to what extent…	1	2	3	4	5
Have you volunteered your time for local organizations or causes?	☐	☐	☐	☐	☐
Have you attended wellness programs or fitness facilities?	☐	☐	☐	☐	☐
Have you had a flexible work schedule that you could adjust to meet your needs? (Leave blank if you don't work.(W)	☐	☐	☐	☐	☐
Has your workplace had rules or policies that made it easier for you to manage your illness (such as no smoking rules or time off work to exercise)? (Leave blank if you don't work.) (W)	☐	☐	☐	☐	☐
Have you had control over your job in terms of making decisions and setting priorities? (Leave blank if you don't work.(W)	☐	☐	☐	☐	☐

General Diabetes Knowledge

	Yes	No	Do not know
Diabetes mellitus is likely to **be cured** by treatment.	☐	☐	☐
Insulin is produced by **kidney**.	☐	☐	☐
Normally, blood sugar levels should be 90 – 130 mg/dl.	☐	☐	☐
Stress causes blood sugar levels to increase.	☐	☐	☐
Genetic problems are one of the causes of diabetes mellitus.	☐	☐	☐
If you are beginning to have a low blood sugar reaction, you may feel sweating, shaking, and faint.	☐	☐	☐
You are at greater risk of heart disease than people that do not have diabetes.	☐	☐	☐
Poor blood sugar control can cause numbness in the hands and feet.	☐	☐	☐
Poor blood sugar control can result in kidney failure.	☐	☐	☐
Good blood sugar control usually reduces or delays occurrence of diabetes complications.	☐	☐	☐
Drinking alcohol can affect blood sugar levels.	☐	☐	☐
You should **continue to exercise** if you have chest pain or severe illness.	☐	☐	☐
You should check your feet every day.	☐	☐	☐
In patients with diabetes, infections can cause high sugar levels.	☐	☐	☐
If you are sick, you should drink more liquids and eat meals.	☐	☐	☐
In a sick period, you **do not need** to take medications since your blood sugar levels are usually low.	☐	☐	☐
You should **do not take your medications or insulin twice** if you realize that you forgot your medication or insulin.	☐	☐	☐
When you begin having signs of low blood sugar, you should take sweetened food or drink.	☐	☐	☐
When you take diabetes drugs before meal and do not eat your meal, your blood sugar usually decreases.	☐	☐	☐
Alcohol is likely to cause diabetes drugs not to work.	☐	☐	☐
While you are receiving diabetes drugs and you continue eating sweet desserts, this may result in poor blood sugar control.	☐	☐	☐

Appendix B

Institutional Review Board Approval

UNIVERSITY OF ILLINOIS
AT CHICAGO

Office for the Protection of Research Subjects (OPRS)
Office of the Vice Chancellor for Research (MC 672)
203 Administrative Office Building
1737 West Polk Street
Chicago, Illinois 60612-7227

Approval Notice
Continuing Review

February 2, 2012

Boontuan Wattanakul, MS,BSN
Department of Biobehavioral Health Science
845 S. Damen Avenue
M/C 802
Chicago, IL 60612
Phone: (312) 282-1068 / Fax: (312) 996-8945

RE: **Protocol # 2009-0406**
"Perceived Risk for Diabetes Complication and Self Management"

Dear Dr.Wattanakul:

Your Continuing Review was reviewed and approved by the Expedited review process on February 2, 2012. You may now continue your research.

Please note the following information about your approved research protocol:

Protocol Approval Period: February 9, 2012 - February 7, 2013
Approved Subject Enrollment #: 500 (limit data analysis for 347 enrolled subjects)
Additional Determinations for Research Involving Minors: These determinations have not been made for this study since it has not been approved for enrollment of minors.
Performance Sites: UIC, Panomsarakham Hospital - Thailand, Sanamchaikhet Hospital - Thailand, Plaengyao Hospital - Thailand
Sponsor: None
PAF#: Not Applicable
Research Protocol(s):

a) Research Protocol for Perceived Risk for Diabetes Complications and Self Management Behaviors; Version 5, 03/03/2011

Recruitment Material(s):

a) N/A: Limited to data analysis only

Informed Consent(s):

a) N/A: Limited to data analysis only

Your research meets the criteria for expedited review as defined in 45 CFR 46.110(b)(1) under the following specific category(ies):

(7) Research on individual or group characteristics or behavior (including but not limited to research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Please note the Review History of this submission:

Receipt Date	Submission Type	Review Process	Review Date	Review Action
01/31/2012	Continuing Review	Expedited	02/02/2012	Approved

Please remember to:

→ Use your **research protocol number** (2009-0406) on any documents or correspondence with the IRB concerning your research protocol.

→ Review and comply with all requirements on the enclosure,
"**UIC Investigator Responsibilities, Protection of Human Research Subjects**"

Please note that the UIC IRB has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

Please be aware that if the scope of work in the grant/project changes, the protocol must be amended and approved by the UIC IRB before the initiation of the change.

We wish you the best as you conduct your research. If you have any questions or need further help, please contact OPRS at (312) 996-1711 or me at (312) 355-0816. Please send any correspondence about this protocol to OPRS at 203 AOB, M/C 672.

Sincerely,

Alison Jones, MSW, MJ
IRB Coordinator, IRB # 2
Office for the Protection of Research Subjects

Enclosure(s):

1. **UIC Investigator Responsibilities, Protection of Human Research Subjects**
2. **Data Security Enclosure**

cc: Mariann R. Piano, Department of Biobehavioral Health Science, M/C 802
Lauretta Quinn (Faculty Sponsor), Biobehavioral Health Science, M/C 802

Appendix C

Instrument Development

Reliability of the Instruments

Reliability is presented for main outcome variable (self-management behaviors) and predictor variables used in analysis. Table XVI demonstrated the internal consistency reliability of the study instruments.

Table XXII

RELIABILITY OF THE STUDY INSTRUMENTS

Subscale	Cronbach's alpha
SDSCA	.752
General Diet	.952
Specific Diet	.588
Exercise	.624
Blood Glucose Testing	.459
Medication	.947
Foot Care	.547
Buddhist Values	.812
CIRS	.881
CIRS (unemployed, *n* = 59)	.811
DSE	.812
General Diabetes Knowledge	.645*
RPS-DM	.829

* Alpha coefficient is computed for KR-20.

UNIVERSITY OF ILLINOIS
AT CHICAGO

Global Health Leadership Office (MC 802)
College of Nursing
845 South Damen Avenue
Chicago, Illinois 60612-7350

World Health Organization
Collaborating Centre for
International Nursing Development
in Primary Health Care

March 7, 2009

Deborah J. Toobert, Ph.D.
Senior Research Scientist
Oregon Research Institute
1715 Franklin Blvd.
Eugene, OR 97403-1983

Dear Dr. Toobert,

In follow up an earlier email request, I am writing to request to reprint the Summary of Diabetes Self-Care Activities in my study and dissertation. The SDSCA will be translated into Thai language. I will use for acknowledgement as of the conventional style of the Graduate College of the University of Illinois at Chicago.

A copy of this letter is included for your records. I have enclosed self-addressed stamped envelope. Please return a signed copy of this letter of permission at earliest of your convenience. Thank you for your kind consideration of my request.

Sincerely,

B. Wattanakul
Boontuan Wattanakul, MSc, RN
Doctoral student

The above request is approved.

Approved by Deborah J. Toobert Date 3/20/09

UIC

Phone (312) 996-3035 • Fax (312) 996-8945

UNIVERSITY OF ILLINOIS
AT CHICAGO

Global Health Leadership Office (MC 802)
College of Nursing
845 South Damen Avenue
Chicago, Illinois 60612-7350

World Health Organization
Collaborating Centre for
International Nursing Development
in Primary Health Care

March 7, 2009

Russell E. Glasgow, Ph.D.
Clinical Research Unit
Kaiser Permanente Colorado
Kaiser Foundation Research Institute
335 Road Runner Road
Penrose, CO 81240 USA

Dear Dr. Glasgow,

In follow up an earlier email request, I am writing to request to reprint the Chronic Illness Resources Survey in my study and dissertation. The CIRS will be translated into Thai language. I will use for acknowledgement as of the conventional style of the Graduate College of the University of Illinois at Chicago.

A copy of this letter is included for your records. I have enclosed self-addressed stamped envelope. Please return a signed copy of this letter of permission at earliest of your convenience. Thank you for your kind consideration of my request.

Sincerely,

B. Wattanakul
Boontuan Wattanakul, MSc, RN
Doctoral student

The above request is approved.

Approved by Russell C Glasgow Date 3/17/09

UIC

Phone (312) 996-3035 • Fax (312) 996-8945

UNIVERSITY OF ILLINOIS
AT CHICAGO

Global Health Leadership Office (MC 802)
College of Nursing
845 South Damen Avenue
Chicago, Illinois 60612-7350

World Health Organization
Collaborating Centre for
International Nursing Development
in Primary Health Care

March 7, 2009

Elizabeth A. Walker, PhD, RN
Professor of Medicine, and of Epidemiology & Population Health
Director, Prevention and Control Division
The Diabetes Research Center
Albert Einstein College of Medicine
1300 Morris Park Avenue
Belfer Bldg Rm 705a
Bronx, NY 10461

Dear Dr. Walker,

In follow up an earlier email request, I am writing to request to reprint the Risk Perception Survey-Diabetes mellitus in my study and dissertation. The RPS-DM will be translated into Thai language. I will use for acknowledgement as of the conventional style of the Graduate College of the University of Illinois at Chicago.

A copy of this letter is included for your records. I have enclosed self-addressed stamped envelope. Please return a signed copy of this letter of permission at earliest of your convenience. Thank you for your kind consideration of my request.

Sincerely,

B. Wattanakul
Boontuan Wattanakul, MSc, RN
Doctoral student

Best wishes!

The above request is approved.

Approved by E A Walker Date 16 March 2009

UIC

Phone (312) 996-3035 • Fax (312) 996-8945

UNIVERSITY OF ILLINOIS
AT CHICAGO

Global Health Leadership Office (MC 802)
College of Nursing
845 South Damen Avenue
Chicago, Illinois 60612-7350

World Health Organization
Collaborating Centre for
International Nursing Development
in Primary Health Care

November 12, 2010

Napaporn Sowattanangoon, Ph.D.
ASEAN Institute for Health Development,
Mahidol University, Salaya,
Nakornpathom, Thailand 73170

Dear Dr. Napaporn,

In follow up an earlier email request, I am writing to request to reprint the Buddhist Values Questionnaires in my study and dissertation. The Buddhist Values Questionnaires will be used in original Thai language and translated into English language for dissertation. I will use for acknowledgement as of the conventional style of the Graduate College of the University of Illinois at Chicago.

A copy of this letter is included for your records. I have enclosed self-addressed stamped envelope. Please return a signed copy of this letter of permission at earliest of your convenience. Thank you for your kind consideration of my request.

Sincerely,

B. Wattanakul
Boontuan Wattanakul, MSc, RN
Doctoral student

The above request is approved.

Approved by Napaporn S Wattanakul Date Nov 25, 2010

UIC

Phone (312) 996-3035 • Fax (312) 996-8945

May 10, 2009

Chairperson of Institutional Review Broad Committee
University of Illinois at Chicago
Chicago, IL 60612

To Chairperson of the IRB committee:

I am a faculty member of Adult and the Aged department at Faculty of Nursing, Thammasat University, Thailand. I have been studying about the diabetes and self-management among Thai populations and have publications about effect of diabetes self-management program in both Thai and international journals.

I have examined of the enclosure research documents, including (a) the Diabetes Knowledge Test, (b) the Chronic Illness Resource survey, (c) the Summary of Diabetes Self-Care Activities, and (d) the Risk Perception of Developing Diabetes Complications, (e) a demographic questionnaire, and (f) consent document, in both Thai and English version.

I approve that the translations of documents from English to Thai language have adequately expressed the same sense of the original, and are culturally sensitive to adult people.

Sincerely,

Chodchoi Wattana

Chodchoi Wattana, PhD, MNS, RN
Senior Lecturer
Faculty of Nursing
Piyachat Building, Floor 11th
Thammasat University (Rangsit Campus),
99 Paholyothin Road,
Klongluang, Patumthani 12121,
Thailand

UNIVERSITY OF ILLINOIS
AT CHICAGO

Department of Women, Children and Family Health Science (MC 802)
College of Nursing
845 South Damen Avenue
Chicago, Illinois 60612-7350

April 13, 2009

Chairperson of Institutional Review broad Committee
University of Illinois at Chicago
Chicago, IL 60612

To Chairperson of the IRB committee:

I am a faculty member at the University of Illinois at Chicago, College of Nursing. I am a native Thai speaker and a fluent English speaker.

I have approved of the enclosure research documents, including (a) the Diabetes Knowledge Test, (b) the Chronic Illness Resource survey, (c) the Summary of Diabetes Self-Care Activities, and (d) the Risk Perception of Developing Diabetes Complications, (e) a demographic questionnaire, (f) inform consent, and (g) information sheet, in both Thai and English version.

I certify that the translations of documents from English to Thai language have adequately expressed the same sense of the original, and are culturally sensitive to adult people.

Sincerely,

Wacharee Jamjun, MS, RN
Clinical Instructor
WCFHS
College of Nursing (MC 802)
University of Illinois at Chicago
845 South Damen Avenue,
Chicago, IL 60612
Phone: 312-996-7948

UNIVERSITY OF ILLINOIS
AT CHICAGO

Department of Women, Children and Family Health Science (MC 802)
College of Nursing
845 South Damen Avenue
Chicago, Illinois 60612-7350

May 15, 2009

Chairperson of Institutional Review broad Committee
University of Illinois at Chicago
Chicago, IL 60612

To Chairperson of the IRB committee:

I am a nurse and was born in Thailand. I graduated with a Ph. D. in nursing from the College of Nursing, University of Illinois at Chicago. I speak both Thai and English fluently.

I have approved of the enclosure research documents, including (a) the Diabetes Knowledge Test, (b) the Chronic Illness Resource survey, (c) the Summary of Diabetes Self-Care Activities, and (d) the Risk Perception of Developing Diabetes Complications, (e) a demographic questionnaire, (f) inform consent, and (g) information sheet, in both Thai and English version.

I certify that the translations of documents from English to Thai language have adequately expressed the same sense of the original, and are culturally sensitive to Thai people.

Sincerely,

Amnuayporn Rasamimari, Ph.D., RN
College of Nursing (MC 802)
University of Illinois at Chicago
845 South Damen Avenue,
Chicago, IL 60612
E-mail: amy.rasamimari@gmail.com

UNIVERSITY OF ILLINOIS
AT CHICAGO

Department of Women, Children and Family Health Science (MC 802)
College of Nursing
845 South Damen Avenue
Chicago, Illinois 60612-7350

March 30, 2010

Chairperson of Institutional Review broad Committee
University of Illinois at Chicago
Chicago, IL 60612

To Chairperson of the IRB committee:

Currently, I am studying in Ph.D. research program at College of Nursing, University of Illinois at Chicago. I also have experienced as a faculty member of **Boromarajonani College of Nursing, Sawanpracharak, Boromratchanok** Institute, Ministry of Public Health, Thailand.

I have examined of the enclosure research documents, including (a) the Diabetes Knowledge Test, (b) the Chronic Illness Resource survey, (c) the Summary of Diabetes Self-Care Activities, and (d) Diabetes Self-Efficacy (DSE), and (e) the Risk Perception of Developing Diabetes Complications, and (f) a demographic questionnaire, in both Thai and English version.

I approve that the translations of documents from English to Thai language have adequately expressed the same sense of the original, and are culturally sensitive to adult people.

Sincerely,

Srisuda Ngamkham, Ph.D. candidate, RN
College of Nursing (MC 802)
University of Illinois at Chicago
845 South Damen Avenue,
Chicago, IL 60612
E-mail: sngamk2@uic.edu
Phone; 312.355.5913

UNIVERSITY OF ILLINOIS
AT CHICAGO

Department of Women, Children and Family Health Science (MC 802)
College of Nursing
845 South Damen Avenue
Chicago, Illinois 60612-7350

March 30, 2010

Chairperson of Institutional Review broad Committee
University of Illinois at Chicago
Chicago, IL 60612

To Chairperson of the IRB committee:

I am a nursing instructor of **Boromarajonani College of Nursing, Prabudthabat Saraburi,** Boromratchanok Institute, Ministry of Public Health, Thailand. I am an active Ph.D. student at Faculty of Nursing, Chulalongkorn University, Bangkok, Thailand. Currently, I am studying with Dr. Catherine Ryan at College of Nursing, University of Illinois at Chicago.

I have examined of the enclosure research documents, including (a) the Diabetes Knowledge Test, (b) the Chronic Illness Resource survey, (c) the Summary of Diabetes Self-Care Activities, and (d) Diabetes Self-Efficacy (DSE), and (e) the Risk Perception of Developing Diabetes Complications, and (f) a demographic questionnaire, in both Thai and English version.

I am writing to certify that the translations of documents from English to Thai language have adequately expressed the same sense of the original, and are culturally sensitive to adult people.

Sincerely,

Padthayawad Pragodpol

Padthayawad Pragodpol, Ph.D. candidate, RN
College of Nursing (MC 802)
University of Illinois at Chicago
845 South Damen Avenue,
Chicago, IL 60612
E-mail: pprago4@uic.edu
Phone; 773.936.1174

Panomsarakham Hospital
490 Moo 4 Panomsarakham District
Chachoengsao, Thailand 24120
Phone: 66 (38) 837-199, 551-444

April 19, 2009

Chairperson of Institutional review Board Committee
Office for the Protection of Research Subjects (OPRS)
1737 West Polk Street
Chicago, Illinois 60612 – 7227

Re: Boontuan Wattanakul

To Chairperson of the UIC IRB Committee:

As following review of research documents including questionnaire, demographic information, consent forms, and research protocol of 'Perceived risk of complications and self-management", this study does not involve serious risk to subjects. The information obtained from questionnaire is not sensitive, and no information reveals identity of individual subject. The investigator will keep information in confidential that will protect the subjects from loss of confidentiality. I understand that participation of subjects in this study is voluntary. If subjects decide to participate, they are free to stop responding to the study or withdraw any time if they feel uncomfortable.

I, the hospital director, give Ms. Boontuan Wattanakul permission to collect data in Panomsarakham hospital, Chachoengsao, Thailand.

Sincerely,

Namphol

Mr. Namphol Danpipat
Director
Panomsarakham Hospital
Chachoengsao, Thailand.
Email: Namphol60@hotmail.com

I certify that I have explained the research goals and methods, the instrument, and inform consent to director of Panomsarakham hospital, and the director of hospital has given permission for recruitment the potential participants at the diabetes clinic.

B. Wattanakul

Signature of Project Investigator

April 13, 2009
Date

Boontuan Wattanakul
Printed Name of Project Investigator

CITED LITERATURE

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