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# Determinants of readiness to adopt regular physical activity among Thai patients at risk for cardiovascular disease: A transtheoretical model.

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# DETERMINANTS OF READINESS TO ADOPT REGULAR PHYSICAL ACTIVITY AMONG THAI PATIENTS AT RISK FOR CARDIOVASCULAR DISEASE: A TRANSTHEORETICAL MODEL

by

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ABSTRACT OF DISSERTATION
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The Transtheoretical Model (TTM) was employed as a conceptual framework to explore the determinants of readiness for adopting regular physical activity and to evaluate the validity of the TTM constructs among Thai patients at risk for cardiovascular disease (CVD). This non-experimental correlational study used a convenience sample of 436 Thai adults diagnosed with hypertension, diabetes, hyperlipidemia, or both diabetes and hyperlipidemia, who came for follow-up treatment at hypertension, cardiac, and endocrine out-patient clinics at four public hospitals in Bangkok, Thailand. Data were collected using a demographic characteristics-questionnaire, physical activity characteristics questionnaire, and the questionnaires from the TTM constructs including (a) stages of readiness for adopting regular physical activity; (b) ten processes of change; (c) self-efficacy; and (d) decisional balance (pros and cons). Data were analyzed by using descriptive statistics, paired-*t* test, analysis of variances, multivariate analyses of variance, and discriminant analysis.

The subjects were predominantly female, with a mean age of 54.3. Most individuals were married and had a primary school education. The common diseases related to the risk of cardiovascular disease were hypertension, diabetes, and both hypertension and hyperlipidemia. The distribution of stages of change was 12% in precontemplation, 22%

in contemplation, 35% in preparation, 12% in action, and 19% in maintenance. Most subjects participated in leisure-time activities, and the weekly moderate-intensity physical activity (MPA) was 65.3 minutes. There were significant moderate relationships between stages of changes and weekly MPA ($\eta = .75$) as well as behavioral processes ($\eta = .61$). Across five stages of change, there were weak associations ($\eta = .04$-$.46$) among age, education level, experiential processes, self-efficacy, pros, and cons.

Mean age and educational level for the precontemplation stage were lower than means for age and educational level in each of the other stages. For weekly MPA, there was a significant increase in mean MPA from contemplation stage to maintenance stage. The mean scores for experiential processes, behavioral processes, and self-efficacy variables significantly increased from precontemplation to action. In terms of decisional balance, the mean pros score for individuals in the preparation stage was less than the mean pros score for those in the maintenance stage. The mean score for cons in the action stage was lower than mean scores in the precontemplation, contemplation, and preparation stages. Additionally, the discriminant analysis showed that the set of variables including processes of change, self-efficacy, decisional balance, age, and educational level were able to classify stages of change correctly for 62.0% of participants.

These findings support the applicability of TTM to physical activity in a Thai population at risk for CVD. Therefore, TTM may provide a basis for further testing TTM-based interventions among that population. Moreover, knowing the determinants of regular physical activity can provide guidance to develop health promotion programs that match physical activity interventions with stages of change.

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# CHAPTER 1

## INTRODUCTION

Cardiovascular disease (CVD) has long been recognized as the number one cause of mortality and morbidity in both men and women of all racial and ethnic groups in the United States (Centers for Disease Control and Prevention [CDC], 1997). In Thailand, cardiovascular disease has been the leading cause of death since 1993. The mortality rate from CVD increased from 58.5% in 1993 to 65.4% in 1998 (Statistic Division of Public Health, 1999). Treatment of CVD patients requires long-term care and high-technology medical equipment, and, as a result, the economic costs of CVD have become one of the largest expenditures in national health care budgets (Visutthikul, 1997).

The health benefits of physical activity (PA) and fitness, in terms of decreased mortality have been recognized in many scientific studies. The National Institutes of Health (NIH) Consensus Development Panel on Physical Activity and Cardiovascular Health indicated that PA is important in the treatment of patients with CVD or those who are at increased risk for developing CVD (NIH, 1996). Moreover, previous studies suggest that performing regular PA can reduce the incidence of CVD (Lee & Paffenbarger, 2001) and non-insulin-dependent diabetes mellitus (NIDDM; Folsom, et al., 1996; Hu, et al., 1999), and decrease serum lipid levels (Durstine, 2001).

In studies of the effects of aerobic exercise on blood pressure levels, results revealed that the average systolic and diastolic blood pressures were substantially

reduced 6 to 7 mm Hg among hypertensive patients (Chintanadilok & Lowenthal, 2001). Physically active women were 30% less likely than sedentary women to develop hypertension (Folsom et al., 1996). Moreover, several prospective studies indicated that PA can reduce the development of NIDDM. Approximately 35% of people whose deaths were caused by NIDDM did not engage in PA. PA is believed to reduce blood glucose and enhance sensitivity of receptors to insulin, as well as reduce central obesity (Goodpaster & Kelly, 2001). Similarly, PA can greatly affect blood lipid levels. About 30 studies found that PA increases high-density lipoproteins (HDL; Thompson, Yurgalevitch, & Flynn, 1997) and reduces the levels of triglycerides, which are fats in the blood that raise the risk of CVD (Durstine 2001).

The U.S. Surgeon General's report included the new recommendation that "significant health benefits can be obtained by including a moderate amount of PA on most, if not all, days of the week" (U.S. Department of Health and Human Services, 1996, p. 4). This recommendation allows great flexibility in the methods individuals select to achieve this PA goal. Such a recommendation emphasizes moderate-intensity physical activity (MPA) which can be performed for a longer period of time, usually at least 30 min per session, 5 days a week (American College of Sports Medicine [ACSM], 1998). Similarly, the World Health Organization and Internal Federation of Sports Medicine recommend that adults should perform at least 30 min of MPA every day (Blair, et al., 1995).

In Thailand, the Ministry of Public Health (MPH) established a four-year plan, spanning the period from 2002 to 2006 titled "Development Planning for National Health version 9" (DPNH V9) that focuses mainly on disease prevention and promotion

of physical and mental health among Thai people. The plan recommends the development of personal and social environment capacity in order to stimulate individual awareness of the need to perform healthy behaviors (MPH, 2000). In terms of secondary prevention, the goals of DPNH V9 are that the mortality rates of CVD in 1999 would decrease from 0.1% to 0.09% (MPH). In addition, regarding exercise habits, the plan anticipates that "at least 60% of people will participate in regular exercise" (MPH, 2000, p. 25). Consequently, changing individual life styles has become recognized as a national health action necessary to reduce health care expenditures and other morbidity and mortality-related economic losses. In particular, the integration of individual life style changes, along with environmental support of such health-promoting behaviors as regular PA, can potentially decrease cardiovascular risk factors (Morgan & Marsh, 1998).

Although health promotion programs are established to emphasize the importance of exercise behavior modification, high patient drop out rates from the programs are commonly found, particularly in prospective study designs. A study of health promoting behaviors among coronary artery disease patients demonstrated that only 30% of the patients participated in physical exercise (Inkoom, 1998). Similarly, Marcus and colleagues (1993) indicate that approximately half of individuals in every age group who participate in exercise programs drop out during the first 3-6 months. Therefore, it is necessary that health care providers explore other health behavior modification models to help maintain participation rates and clearly identify the more effective strategies for PA intervention.

## Statement of the Problem

CVD has been the leading cause of death in Thailand, and the number of high-risk patients has continued to increase each year (Tunyavinichkul, 1998). The mortality rate for CVD has dramatically increased from 51.3% in 1990 to 65.4% in 1998 (The Statistic Division of Public Health, 1999). In spite of knowing the benefits of regular PA, most Thai people do not recognize the benefits of particular health behaviors. Only 27% of men age 35 years and over living in Bangkok perform regular exercise (Chaovalitnithikul, as cited in Chaichana, 1997). The study of Namchai (as cited in Sriaka, 2000) reported that the average frequency of the performance of exercise behavior among officers working at the Ministry of Public Health was approximately 1-5 times a month. Similarly, a study of the Department of Health investigated exercise behavior among Thai people over 15 years old. The results demonstrated that 57.8% of people in rural regions did exercise; however, only 38.4% actually performed exercise more often than 3 days a week (MPH, 2000).

The studies related to CVD risks show that a sedentary life style is becoming more prevalent among Thai patients with hypertension (Hongwachin, 1999; Kijjachanchaikul, 1999), diabetes (Cennoy, 1999; Totermsuk, 2000), and obesity (Boonkwamdee, 1998). These studies indicated that a lack of exercise was the major cause of health behavior problems among these particular patients (Boonkwamdee; Chaisri; Cennoy; Hongwachin; Kijjachanchaikul). Results of these studies indicated that fewer than 50% of the patients performed regular exercise behavior, and some of them did not realize the benefits of exercise in terms of reducing their risk for CVD (Boonkwamdee; Cennoy; Kijjachanchaikul,). These previous studies have similarly

concluded that the risk for CVD among Thai people, in terms of the lack of physical activity, is increasing because people in all age groups do not perform regular exercise.

Therefore, the goals of DPNH V 9 (MPH, 2000), which indicated that at least 60% of people should participate in regular exercise, present a challenge for health care providers to initiate effective strategies and health promotion programs within the Thai population. To respond to these national public health goals, health care providers should target patients at high risk for CVD by finding effective methods to enhance their regular physical activity or regular exercise adoption.

Among theories focusing on health promotion behavior, the Transtheoretical Model (TTM) has been successfully applied to a wide range of health behaviors, including exercise behavior (Frenn & Malin, 1998; Marcus, et al., 1993; Marcus & Owen, 1992; Marcus, Rossi, et al., 1992). Moreover, TTM has been shown to be useful for explaining physical activity or exercise adoption in the United States and other countries, such as Australia (Gorely & Gordon, 1995). However, TTM has never been applied to PA behaviors in Thailand; this model should be tested among Thai people to obtain a better cross-cultural understanding of the regular PA adoption.

## Statement of the Purpose

The purpose of this present study is to explore the determinants of readiness for adopting regular PA, and to evaluate the validity of the TTM constructs among Thai patients at risk for CVD. Specifically, the proposed study aims to (a) describe the distributions of the five stages of readiness for adopting regular PA, characteristics of MPA, weekly MPA, and selected demographic factors; (b) describe the relationships

between the five stages of readiness for adopting regular PA, and ten processes of change, self-efficacy, decisional balance, weekly MPA, and selected demographic variables; (c) evaluate the validity of the five stages of readiness for adopting regular PA among the constructs of TTM using the mean differences between experiential processes and behavioral processes within the early stages and later stages, using the pattern of the mean scores of experiential processes and the mean scores of behavioral processes of change among the five stages of change, and using patterns of the mean scores of decisional balance and self-efficacy across the five-stage of change groups; and (d) to identify the determinants of readiness for adopting regular PA among Thai patients at risk for CVD.

## Research Questions

According to the purpose of this study, the following research questions were explored:

1. What are the distributions of the five stages of readiness for adopting regular PA, characteristics of MPA, weekly MPA, and selected demographic factors among Thai adult patients at risk for CVD?

2. What are the associations between the five stages of readiness for adopting regular PA and each of the following: the ten processes of change, self-efficacy, decisional balance, weekly MPA, and selected demographic variables?

3. Are there differences in the means of the ten processes of change, self-efficacy, decisional balance, weekly MPA, and selected demographic variables across the five stages of readiness for adopting regular MPA among Thai adult patients at risk for CVD?

4. What are the mean differences between the mean T scores of experiential processes and the mean T scores of behavioral processes within the five stages, and what is the pattern of the mean T scores of each across the five stages?

5. What are the patterns of the mean T scores of decisional balance (pros and cons) and self-efficacy among the five stages of change groups?

6. What are the determinants of the five stages of readiness for adopting regular PA behavior among Thai adult patients at risk for CVD?

## Research Hypotheses

Hypothesis 1 states that there are significant relationships between the five stages of readiness for adopting regular PA and ten processes of change, self-efficacy, decisional balance, weekly MPA, and selected demographic factors.

Hypothesis 2 states that the mean scores of ten processes of change, self-efficacy, decisional balance scores, weekly MPA, and selected demographic variables are different across five stages of change.

Hypothesis 3 states that the mean differences between the mean T scores of experiential processes and the mean T scores of behavioral processes are not equal to zero across the five stages of change.

Hypothesis 4 states that (a) the pattern of the mean T scores of pros increases across the five stages from precontemplation to maintenance stages, whereas the pattern of the mean T scores of cons decreases from contemplation to maintenance stages; (b) the mean T scores of pros are higher than the mean T scores of cons in the action and maintenance stages, whereas the mean T scores of cons are higher than the mean T

scores of pros in the precontemplation and contemplation stages; and (c) the increase in the mean T scores of pros followed by the decrease in the mean T scores of cons occurs prior to the action stage.

Hypothesis 5 states that the pattern of the mean T scores of self-efficacy increases across the five stages from the precontemplation stage to the maintenance stage.

## Conceptual Framework

The Transtheoretical Model (TTM), developed by Prochaska and DiClemente (1983), will be used to guide this study. Over the past 20 years, empirical and clinical support for the scope and utility of the TTM has been applied to most behaviors typically considered addictive behaviors, including abuse of and dependence on alcohol, nicotine, cocaine, heroin, obesity, and eating disorders (DiClemente, & Prochaska, 1998). Moreover, a number of studies have shown that the stages of change are applicable to positive health behaviors such as exercise (Marcus, Rossi, et al., 1992; Marcus, Selby, et al., 1992; Marcus, et al., 1996), condom use (Grimley, Prochaska, Velicer, & Prochaska, 1995) and other health behaviors for understanding and intervening with intentional behavior change that can be employed to help individuals modify their health behaviors (Frenn & Malin, 1998).

Marcus, Rossi, et al. (1992) suggested that applying the TTM to the adoption and maintenance of exercise yields vital information for "enhancing exercise adoption, adherence, and relapse prevention at both individual and public health levels" (p. 425). Additionally, Marcus, Selby, et al. (1992) demonstrated that tailoring interventions to an individual's specific stage of change for exercise behavior may assist an individual to move to the next stage of exercise adherence. Similarly, Buckley, Holmes, & Mapp

(1999) explained that health care providers can use TTM to enhance the probability of successful behavior change by developing interventions matched to the specific stage of change that individuals presently occupy. Therefore, the TTM can guide the health care provider to design and implement strategies to encourage people to adopt health-promoting behaviors until the clients can maintain their desired outcome.

The TTM has four major constructs: stages of change, processes of change, self-efficacy, and decisional balance (Prochaska, Redding, & Evers, 1997). The five stages of change include precontemplation, contemplation, preparation, action, and maintenance (Prochaska & Velicer, 1997).

### *Stages of Change*

The stages of change describe five different stages of change among individuals who desire to change their unhealthy behavior. This construct emphasizes the dynamic nature of health behavior change that people go through in a cyclical rather than linear fashion (DiClemente & Prochaska, 1998). Before individuals are able to maintain their behavior change, they might be progressing from an earlier stage to a later stage, getting stuck at a certain stage, relapsing to an earlier stage, or cycling through stages (DiClemente & Prochaska; Marcus, Selby, et al., 1992). Cycling and recycling among the five stages is a normal behavior of people who intend to change their unhealthy behavior (DiClemente & Prochaska).

The five sequential stages of change are identified as follows:

1. *Precontemplation.* People in this stage do not think they have to adopt healthy behaviors, nor have they desired to change in the next six months. Individuals in this stage do not perceive their behavior to be high risk, and they are not interested in reading,

talking, or thinking about new behavior. People in this stage are not ready to participate in traditional health promotion programs because they do not have the motivation to adopt new behaviors.

2. *Contemplation.* People intend to adopt healthy behaviors within the next six months. In this stage, people are realizing the benefits (pros) of adopting healthy behavior, such as seeking more information about how they can exercise to manage blood pressure, blood sugar, and blood cholesterol. At the same time, they are also aware of the barriers (cons) such as the amount of time required to perform the behavior, and lack of motivation. Usually, people will get stuck in this stage for long periods of time because the pros and cons of changing a new behavior are viewed as balanced (Prochaska, Redding, et al., 1997).

3. *Preparation.* In this stage, people intend to take action in the next month. People in this stage have already taken some significant actions, such as reading an exercise book, discussion with their physician, or irregularly performing physical activity. They intend to change behavior in the immediate future, which Prochaska and collegues defined as "usually measured as the next month" (Prochaska, Redding, et al., 1997, p. 61). Therefore, people in this stage should be recruited for participating in a health promotion program because they have intention to adopt a new behavior.

4. *Action.* People are actually performing the healthy behavior but for less than six months. Prochaska, Redding, et al. (1997) stated that "not all modification of behavior counts as action in this model" (p. 63). Individuals must satisfy the criteria that professionals or experts in a particular area agree to be sufficient to reduce the risk of disease. In the exercise area, the recommendations from experts concluded that PA should be performed regularly, at least 30 min of MPA (such as brisk walking) on all, or

most, days of the week (U.S. Department of Health and Human Services, 1996). Thus, to obtain health benefits, an individual should perform regular PA, at moderate intensity, three to five times a week, at least 30 min per session. The greater health benefits can be obtained by engaging in PA of more vigorous intensity or longer duration.

5. *Maintenance.* People have engaged in healthy behavior for more than six months; they have less chance to relapse, which increases confidence that they can continue their new behavior.

### *Processes of Change*

The next construct, the ten processes of change have been derived from many diverse theories of behavior change composed of cognitive, experiential, behavioral, and humanistic existential theories of psychotherapy (DiClemente & Prochaska, 1998). This construct has been used as a strategy and technique for intervention programs, commonly known as stage-matched intervention that facilitates people to move through the various stages of change by using ten different processes of change over time (DiClemente & Prochaska, 1998). Once a particular individual's stage has been assessed, interventionists have a better idea of which process should be emphasized to help the individual progress to the next stages of change (Marcus, et al., 1996).

Processes of change are categorized into two higher-order factors, with a set of five experiential processes and another set of five behavioral processes (Prochaska & DiClemente, 1983; Prochaska, Velicer, DiClemente, & Fava, 1988; Marcus, Rossi, et al., 1992). Experiential processes include consciousness raising, dramatic relief, environmental reevaluation, social liberation, and self-reevaluation. Behavioral processes include counterconditioning, helping relationships, reinforcement management, self-liberation,

and stimulus control (Marcus, Simkin, et al., 1996; Prochaska, Redding, & Evers, 1997; Prochaska, Johnson, & Lee, 1998). The ten processes of change consist of experiential and behavioral processes.

*Experiential Processes*

1. Consciousness raising involves enhanced awareness related to unhealthy behavior by finding and learning new information to increase knowledge.

2. Dramatic relief increases negative emotional experiences, which are related to the negative impact or risks of unhealthy behavior.

3. Environmental reevaluation realizes the positive impact or negative impact of performing unhealthy behavior to social environment, such as individuals realizing that if they do not perform regular PA, they may get ill and be a burden to other people.

4. Social liberation recognizes that the individual should employ social opportunities to adopt healthy behavior.

5. Self-reevaluation assesses one's self-image and compares the self-image with and without an unhealthy behavior.

*Behavioral Processes*

1. Counter-conditioning finds alternative methods related to healthy behavior to substitute for unhealthy behavior.

2. Helping relationship obtains many kinds of social support from other people such as family or friends to facilitate behavioral changes.

3. Reinforcement management provides reward to increase healthy behavior or provides punishment to decrease unhealthy behavior.

4. Self-liberation demonstrates the strong commitment to change unhealthy behavior.

5. Stimulus control adds reminders or cues to enhance healthy behavior as well as removes reminder or cues that stimulate individual to perform unhealthy behavior.

Both cross-sectional and longitudinal studies among healthy behaviors indicate that experiential processes are most helpful and more often used in the earlier stages of contemplation and preparation (Marcus, et al., 1996; Perz, DiClemente, & Carbonari, 1996). On the other hand, the behavioral processes are most important and more often utilized when people move from action to maintenance (Prochaska & Velicer, 1997).

### *Self-Efficacy*

Self-Efficacy is the third construct that Prochaska and DiClemente derived from Bandura's self-efficacy theory (Bandura, 1977). Self-Efficacy (SE) demonstrates a close relationship to the performance of many behaviors, such as smoking cessation (DiClemente, Prochaska, et al., 1985), sun exposure (Rossi, Blais, et al., 1995), and weight-loss (Rossi, S., Rossi, R., et al., 1995), and it is also a good predictor of relapse (Velicer, et al., 1998). In Transtheoretical Model, self-efficancy is described as the confidence in one's ability to perform and maintain a specific behavior in difficult or challenging situations (Prochaska, et al., 1997). Self-Efficacy consists of two parts: confidence and temptation. Confidence is "the situation-specific awareness people believe that they can cope with high-risk situations without relapsing into their unhealthy or high risk habits" (Prochaska, et al., 1997 p., 65). In addition, temptation is "reflects

the intensity of urges to engage in a specific habit when in the midst of difficult situations" (Prochaska, et al., p. 65).

In exercise behavior, self-Efficacy has been important for the understanding of both exercise adoption and drop out (Gorely & Gordon, 1995; Marcus, Selby, et al., 1992; Sallis, Pinski, Grossman, Patterson, & Nader, 1988). SE increases consistently across five stages, particularly action and maintenance stages.

### *Decisional Balance*

The last construct is decisional balance, derived from Janis and Mann's model of decision-making (Prochaska & Velicer, 1997). The decision to adopt or maintain healthy behavior for an individual is based on the increases or decreases in the relative strength of the perceived gains (pros) and losses (cons) of changing behavior (Nigg, Norman, Rossi, & Benisovich, 1999). The pros represent the positive aspects (i.e., the advantages or the benefits of changing behavior). In contrast, the cons represent the negative aspects (i.e., the disadvantages, or the barriers of changing behavior; Prochaska, et al., 1997). The decisional balance is composed of four categories, as recommended by Janis and Mann's model (a) gains and losses expected for oneself; (b) gains and losses expected for significant others with whom the individual is affiliated; (c) self approval and disapproval as a result of the individual's basic morals and value system; and (d) self approval and disapproval as a result of significant others' basic morals and value system (Marcus, Rakowski, & Rossi, 1992).

In exercise behavior, the pros and cons should be equal at the preparation stage (Marcus, Rossi, et al., 1992), with the pros becoming higher than the cons as the indivi-

dual reaches the action stage and becomes ready to perform the desired activity (Prochaska, Velicer, et al., 1997).

### *Conceptual Framework for the Study*

To promote regular PA or exercise behavior in patients at risk of CVD, nurses have to provide health education programs that directly assess behavioral intention stages of change of patients to perform exercise behaviors. The TTM is an integrative model for understanding intention of behavior modification (DiClemente & Prochaska, 1998).

The TTM contains strategies (ten processes of change) that can be used as a guideline for nurses to provide stage-matched intervention to assist patients in adopting and performing regular PA. Thus, in the present study, five stages of readiness for adopting regular PA are viewed as the major variables determining participation in regular PA among patients at risk for CVD. According to this model, weekly MPA should be associated with stage of readiness to adopt PA, from precomtemplation to maintenance stages.

The selected demographic data in this model are viewed as the personal factors that influence regular PA patterns across the five stages, and self-efficacy and decisional balance are viewed as mediators. These demographic variables include age, gender, marital status, and educational attainment. Age should show a negative relationship with regular PA. Males should be more likely to adopt and engage in regular PA than are females (Marcus, Pinto, et al., 1994; Thitisak, 1997). Couples people should be more likely to participate and engage in regular PA than single,

separated, or widowed individuals. People with higher education levels should be more likely to adopt and engage in regular PA.

The Processes of adopting regular PA are composed of experiential and behavioral processes. They have been used over time as a strategy to help people to progress through the various stages by using self-efficacy and decisional balance as mediators. In exercise behavior, people in the earlier stages should use experiential processes more often than people in later stages. In contrast, behavioral processes will be used mostly in the later stages. Individuals who use different processes should perceive self-efficacy and decisional balance differently.

Self-efficacy and decisional balance (Pros & cons) are the mediator variables affecting the probability of adopting and maintaining regular PA through five stages. Self-efficacy should increase consistently across five stages, particularly in the later stages through facilitation by the ten processes of change. Decisional balance is the other mediator that focuses on individuals' decisions to perform regular PA based on the relative strength of the perceived pros and cons of adopting PA. Progressing from precontemplation stage to contemplation stage, individuals should increase in the pros by using the experiential processes. Progressing from contemplation to action should produce a decrease in the cons because the individual is using behavioral processes as a strategy.

In this model, the levels of self-efficacy and decisional balance between pros and cons to move up or down depending on how individuals use the ten processes, in terms of frequency and types of process. Furthermore, demographic factors play a role by operating through self-efficacy and decisional balance as the mediator variables to performing regular PA through the five stages.

Given the framework of this study, in which TTM is used to guide health promotion programs, individualized information is provided to each patient according to what stage she or he is in. Using this framework for development of PA intervention programs may improve success rates and reduce recidivism and drop-out rates. The framework used for this study appears in Figure 1.

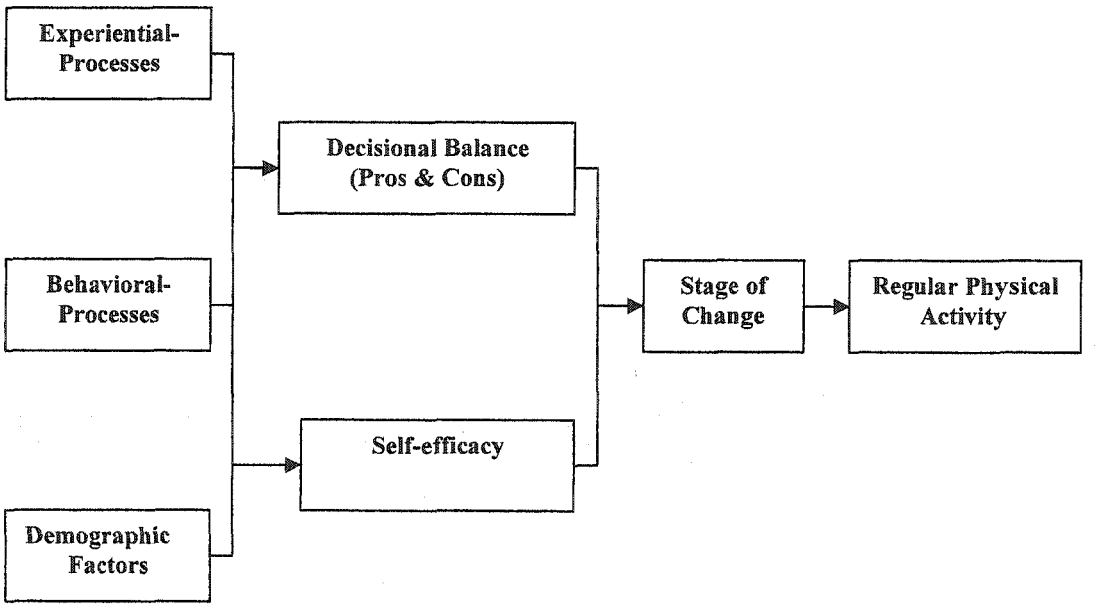


*Figure 1.* Conceptual Framework for the study

## Definitions of Terms

For the purpose of this study, the terms used in the present study were defined as follow.

*The determinants of regular physical activity* are variables contributing to the performance of regular PA among Thai patients at risk for cardiovascular disease. The variables included perceived stage of readiness to adopt regular physical activity,

experiential and behavioral processes change, self-efficacy, decisional balance, age, gender, marital status, and educational level.

*Personal factors* are defined as individual characteristics influencing physical activity in Thai patient adults. Those included in this study are age, gender, marital status, and educational attainment.

*Physical activity* (PA) is defined as any bodily movements produced by skeletal muscles and performed at a moderate or vigorous intensity level. Types of physical activity include all exercise, leisure, and household or occupational activities, planned or unplanned, those are part of everyday life (e.g., washing floors, climbing stairs, brisk walking, dancing, etc.).

*Regular physical activity* (PA) is defined as any bodily movement produced by skeletal muscles and includes all types of physical activity and exercise activity that an individual performs regularly in order to achieve health benefits. Therefore, regular PA must be performed at least 3 to 7 times per week, at least at moderate intensity for 30-60 min per session, or an accumulated three short bouts of activity at least 10-15 min per session, 5 to 7 days per week. Regular PA was assessed by using the Physical Activity Questionnaire (PAQ) which was developed by the investigator using the Seven-Day Physical Activity Recall (PAR; Sallis, 1997) as a guideline. PAQ was a semi-structure interview that estimated an individual's time spent in MPA expressed in minutes per week.

*Weekly MPA* is the average time spent in minutes per week that individuals perform MPA. The weekly MPA was obtained from the PAQ, and it was calculated by the following formula: Weekly MPA = duration (minutes/session X no. of session/ day) X frequency (times/ week)

*Moderate intensity* is defined as the level of intensity that causes individuals breathing rate to increase until they do not have enough breath to sing, but they are still able to talk in sentences (Hall, 1993).

*Short-bout activities* are measured by accumulating minutes with at least 10 min per session per day (NIH, 1996). The frequency of short-bout activities depends on the daily duration goals of the individual.

*Perceived stages of readiness for adopting regular physical activity* is defined as the current stages of physical activity that individuals report based on the definition of regular PA. It was measured by using 5 statements of the Stages of Physical Activity Questionnaire (SPAQ; Bishop & Aldana, 1999). The categories of five stages of change are as follow:

*Precontemplation* includes individuals who are not engaging in regular PA and have no intention of becoming involved in particular activity in the next 6 months.

*Contemplation* includes individuals who are not engaging in regular PA, but are considering becoming involved in this activity in the next 6 months.

*Preparation* includes individuals who are participating in regular PA occasionally, and also are planning to engage in regular PA in the next 30 days.

*Action* includes individuals who have actively participated in regular PA (at least 3-5 times per week for at least 30 min each time) for less than 6 months.

*Maintenance* includes individuals who have engaged in regular PA for 6 months or longer.

*Early stages* are defined as the first three stages, including Precontemplation Contemplation, and Preparation.

*Later stages* are the Action and Maintenance stages.

*Perceived processes of change* is defined as individual perception of the method that could help her or him moving forward through the series of five stages. It was measured by using the Processes of Change Questionnaire (POCQ; Marcus, Rossi, et al., 1992; Nigg, Norman, Rossi, & Benisovichal, 1999) which was categorized into two factors, the experiential and behavioral processes. The experiential process questions included 1-5, 11-15, and 21-25, whereas the behavioral process questions included 6-10, 16-20, and 26-30.

*Perceived Self-Efficacy* is defined as an individual's confidence in her or his ability to perform regular PA in difficult or challenging situations. It was measured by using the Self-Efficacy Questionnaire (SEQ; Marcus, Selby, et al., 1992; Rossi, Benisovich, Norman, & Nigg, 1998).

*Perceived Decisional balance* is defined as an individual's perception of the benefits (pros) and costs (cons) of performing regular PA. It was measured by scores on the Decisional Balance Questionnaire (DBQ; Marcus, Rakowski, et al., 1992). The pro questions include 1-2, 4-5, 7-8, 11-12, 14, and 16. The cons questions include 3, 6, 9-10, 13, and 15.

*Thai patients at risk for CVD* is defined as Thai patients diagnosed with hypertension, non-insulin-dependent diabetes, hyperlipidemia, or a combination of the three, treated in out patient clinics of four hospitals in Bangkok, Thailand.

## Assumptions

The assumptions for the study are as follow: (a) Performing regular PA can decrease the risks of CVD; (b) Reducing risk of CVD is a desirable outcome; (c) Individuals are responsible for making informed decisions regarding their health; and (d) Helping people to achieve their maximal health is a goal of nursing.

## Limitations

There are some limitations that must also be considered. First, regular PA is based on self-report. This method may produce a self-reporting bias because the subjects may respond in a socially desirable manner. Next, this study employs a cross-sectional design. Thus, it is impossible to draw any cause-and-effect conclusion between independent variables and dependent variables. Third, the generalizability of this study is limited to a similar patient population. In this case, a non-probability sample of patients at risk of CVD coming to follow-up at four hospitals in Bangkok, Thailand produces an unknown generalizability to similar patients in other areas of Thailand. Finally, some variables that may predict stages of readiness to adopt regular PA are not included in the present study; thus the explanation of predictive factors of readiness to change may be limited.

## Significance of the Study

Although the benefits of regular PA are well identified, studies of health behavior in Thailand among patients with hypertension, diabetes, hyperlipidemia, and obesity have shown that fewer than 50% of the patients performed regular exercise (Cennoy, 1999; Hongwachin, 1999; Kijjachanchaikul, 1999). Knowing the determinants of regular PA adoption are important for health care providers in designing and implementing interventions to facilitate the adoption and maintenance of regular PA. Transtheoretical Model (TTM) has been used successfully in previous studies to design health-promoting exercise programs in the United States. However, the TTM has never been applied among Thai patients at cardiovascular risk; moreover, cultural differences might affect the applicability of the TTM in that particular population. Therefore, examination of the application of the TTM to explain physical activity behavior in Thai patients at risk for

CVD is needed. If the ten processes of change, self-efficacy, decisional balance, and selected demographic characteristics are related to the five stages of regular PA adoption, it may provide a basis for testing TTM-based interventions, and provide guidance to develop health promotion programs that match physical activity interventions with stages of change.

## Summary

In this chapter, the background, statement of the problem, and theoretical framework have been discussed to explain the significance of this study. The purpose and research questions were designed to examine the application of TTM in regular PA among Thai patients at risk for CVD. The results of this study may encourage health care providers to apply TTM as a guideline in the initiation of PA adoption programs. TTM yields important information regarding stage-matched intervention, the intervention that provides information and techniques for an individual's specific stage of exercise behavior, and an intervention that health care provider can use to design and implement strategies in order to encourage people to adopt regular PA behavior until individuals can maintain their regular PA.

# CHAPTER 2

# REVIEW OF LITERATURE

In this chapter, the literature review involves modifiable risk factors for cardiovascular disease (CVD), which are primarily physical inactivity, hypertension, non-insulin dependent diabetes mellitus (NIDDM), and lipid disorders. Additionally, the beneficial influence of physical activity (PA) on cardiovascular risk factors, the new recommendations for amount of PA, the amount of PA for adults at risk for CVD, and factors influencing PA adoption are reviewed. The factors under investigation include selected demographic factors, stages of change, processes of change, self-efficacy, and decisional balance.

## Modifiable Risk Factors for Cardiovascular Disease

### *Physical Inactivity*

Major scientific conferences and reports in recent years have compiled extensive studies on physiology, development of epidemiology, and the behavioral aspects of physical inactivity. These have led to recommendations on physical activity (Wood, et. al., 1998). Prospective epidemiological studies have shown that a sedentary lifestyle is associated with a greater chance of death from CVD. This usually is a result of increased coronary heart disease, which is the most deadly form of CVD (Blair, et al., 1995; Pate et al., 1995). Regular PA has also been shown to lower resting systolic and diastolic blood pressure, reduce serum triglyceride and plasma low-density lipoprotein

(LDL) cholesterol, HDL cholesterol levels, and enhance glucose tolerance and insulin-sensitivity (Blair et al., 1995; Wood et al., 1998). In middle-aged or older adults, even a modest change in lifestyle with the adoption of MPA can have a beneficial effect in terms of decreasing CVD mortality (Blair et. al).

### *Hypertension*

Hypertension is a primary risk factor for CVD such as stroke, congestive heart failure, angina, renal failure, and myocardial infarction in males and females (Kannel, 1992). The highest risks are for stroke and congestive heart failure. Meta-analysis of the major randomized trials of hypertensive therapy demonstrated a 42% reduction in the incidence of stroke and a 14% reduction in coronary heart disease (Stamler, Neaton, & Wentworth, 1993). Coronary heart disease is the most common outcome of hypertension (Kannel) because of direct vascular injury and adverse effects on the myocardium wall, which include increased wall stress and myocardial oxygen demand (Moss & Gordon, 2001). In response, the sixth report of the Joint National Commission (NIH, 1997) on Detection, Evaluation, and Treatment of High Blood Pressure recommended lifestyle modifications, including weight reduction, increased physical activity, and moderation of dietary sodium and alcohol intake, as a substantial part of treatment for hypertension.

### *Diabetes*

Diabetes Mellitus is a group of diseases characterized by excessive levels of glucose in the blood and inability of insulin to metabolize glucose. Diabetes is also

associated with a lower level of HDL cholesterol and increased levels of LDL cholesterol and triglycerides, which are the cause of coronary heart disease (Harper & Jacobson, 1999). Non-insulin dependent diabetes accounts for about 90% of all diabetes cases. In developed nations; between 3 and 6% of adults are diagnosed with NIDDM (Kriska, Blairs, & Pereira, 1994). Non-insulin dependent diabetes is recognized as a substantial risk factor for CVD and coronary heart disease, which is the most common cause of death in patients with NIDDM, especially in women (Goodpaster & Kelley, 2001). One-fourth of myocardial infarctions occur in patients with diabetes (Butler, Ostrander, Carman, & Lamphier, 1985), and the mortality from coronary heart disease in patients with NIDDM may be as high as in non-diabetic individuals with previous myocardial infarction (Goodpaster & Kelley).

### *Lipid Disorders*

In blood plasma, lipids such as cholesterol and triglycerides bind to various proteins to form lipoproteins. The degree to which lipoproteins cause atherosclerosis depends on their size. High-density lipoprotein cholesterol levels are the smallest lipoproteins and they do not attach to the artery wall, thus HDL cholesterol does not cause atherosclerosis. In contrast, LDLs are easily attached if they are chemically modified by oxidation, and they cause atherosclerosis. Evidence from experimental investigations, epidemiological studies, and clinical trials indicate conclusively that high serum levels of LDL cholesterol are a major cause of coronary heart disease, and lowering LDL cholesterol levels can reduce the risk (The American Heart Association, 1990).

A low level of serum HDL cholesterol is also an important predictor of coronary heart disease. Several large epidemiological studies have suggested that for each 1 mg/dL increase in HDL cholesterol, a 2% decrease in coronary heart disease risk is observed in men and a 3% decrease in women (Harper & Jacobson, 1999; Stamler, Wentworth, & Neaton, 1986). The Framingham risk prediction model incorporates HDL cholesterol as a negative risk factor for CVD (Gordon, et al., 1997). Meta-analyses and epidemiological studies have more clearly identified that hypertriglyceridemia is a risk factor for CVD, especially coronary heart disease, but the association is not as strong as for LDL (Goodpaster, & Kelley, 2001).

From scientific research reports, it can be concluded that lifestyle modifiable factors, including physical inactivity, hypertension, NIDDM, elevated LDL cholesterol and plasma triglycerides, and low plasma HDL cholesterol can tremendously affect risk of CVD, with coronary heart disease as the most common result. Lifestyle modification and risk factor reduction can prevent the development of CVD. Regular PA, which has favorable effects on multiple modifiable CVD risk factors such as body weight, blood pressure, plasma lipids, glucose tolerance, and insulin sensitivity, is particularly important for reducing CVD risk.

## The Beneficial Influence of PA on CVD Risk Factors

### *Physical Activity and Hypertension*

The typical blood pressure response to acute bouts of aerobic exercise is a gradual increase in systolic blood pressure and a gradual decrease or no change in diastolic blood pressure. There are several possible hemodynamic mechanisms through

which exercise may lower blood pressure. One hypothesis is that exercise lowers both cardiac output and peripheral vascular resistance at rest. Other possible mechanisms include reduction of serum catecholamines and plasma renin activity (Dubbert, Martin, Cushman, Meydrech, & Carroll, 1994).

Acute and chronic aerobic exercise can improve cardiac function. Most studies of endurance exercise training of individuals with hypertension have shown decreases in systolic and diastolic blood pressure (NIH, 1996). A study of black men with severe hypertension indicated that, after 16 weeks of regular aerobic exercise, blood pressure was lower, left ventricular wall thickness was reduced, and substantial reductions in the dosage of hypertensive medication were achieved (Kokkinos, et.al., 1995).

### *Physical Activity and Diabetes*

Sallis & Owen (1999) explained that physical activity is useful in the prevention and treatment of NIDDM because of two mechanisms. First, physical activity reduces blood glucose and enhances the sensitivity of insulin receptors. This is partly because active muscles use glucose as fuel. Second, physical activity can reduce central obesity which is one of the leading causes of NIDDM. Therefore, physical activity is part of the accepted treatment regimen for NIDDM.

The American Diabetes Association (ADA) has recommended regular PA for individuals with NIDDM. Endurance exercise appears to be beneficial in improving insulin sensitivity (Pate et al., 1995), controlling daily blood glucose, and causing a decrease in glycosylated hemoglobin (ADA, 2000; Wallberg-Henriksson, Rincon, & Zierath, 1998). Improving insulin sensitivity causes lower fasting insulin levels, lower

blood pressure, and improvement in blood lipid profiles. A study was conducted by Horton (1991) among individuals who had been diagnosed NIDDM and mild to moderate hypertension. The results suggest that the lowered blood pressure may be associated with lowered insulin levels, which affect renal sodium retention. Thus, performing exercise appears to improve insulin sensitivity, which may help decreasing blood glucose and blood pressure, which are the important targets for overall improvement in cardiovascular risk prevention (Goodpaster & Kelley, 2001).

Several prospective studies show that PA reduces the risk of developing NIDDM. Data available from cross-sectional studies have shown that glucose intolerance and diabetes mellitus occur more often in sedentary individuals than in active individuals (Dowse, et.al., 1991). In a prospective study of 70,102 women from 40-65 years old, Hu and colleagues (1999) reported that women who exercised even moderately on a regular basis had a significantly lower risk of developing NIDDM than women who did not exercise regularly.

### *Physical Activity and Lipid Disorders*

The benefits of PA to decrease cholesterol levels remain inconsistent in the findings. Exercise training studies of 3 weeks to 1 year duration have reported no change in plasma cholesterol concentration (Kokkinos, et al., 1995; Thompson, et al., 1997). Conversely, some studies reported that cholesterol reductions up to 11% have been described after some physical activity interventions, although cholesterol levels were not statistically significant (Michielli, et al. 1990). To explain inconsistent findings from these studies, some investigators have suggested that most of the beneficial

lipoprotein changes are permanent if the exercise program continues for at least a year and is subsequently sustained with at least the same dosages (Kokkinos & Fernhall, 1999; Williams, Krauss, Vranizan & Wood, 1990; Wood, Stefanick, Williams & Haskell, 1991). Thus, those studies may conclude that consistent benefits of a regular exercise program are obtained by engaging in long-term exercise training that may have an effect the metabolism of lipoproteins (Thomas & LaFontaine, 2001).

High-density lipoprotein cholesterol has a role in lowering coronary artery disease risk. High-density lipoprotein cholesterol is generally responsive to aerobic training and increases in a dose-dependent manner with increased energy expenditure (Kokkinos, et al., 1995; Williams, 1997). Middle-aged and older men and women engaged in regular PA have significantly higher HDL cholesterol levels than individuals who are sedentary (NIH, 1996). In addition, regular PA participation or exercise training that lasts 12 weeks or more will likely increase HDL levels (Michielli et al., 1990; Thompson et al., 1997). Similarly, other studies have observed significant correlations between distance run per week and HDL cholesterol change (Kokkinos et al., 1995; Williams, 1997). These results provide strong support for the association between increased physical activity and increased HDL levels.

Low-density lipoprotein cholesterol is a major predictor of cardiovascular disease (Israel, Sullivan, Marks, et al., 1994). Plasma LDL is occasionally lower after regular endurance exercise (Ziogas, Thomas, & Haris, 1997), but not always (Kokkinos, et al., 1995; Thompson, et al., 1997; Williams, 1997). Another study conducted by Halle and colleagues (1997), using a cross-sectional design, evaluated physically active and inactive hypercholesterolemic (cholesterol > 240 mg/dl) men. The results showed

that triglyceride and LDL concentrations were lower in physically active men than they were in nonactive men. Moreover, the amount of LDL particles present was related to maximal oxygen consumption ($V0_2$ max) and not to body mass index (Halle, et al.).

Both cross-sectional and exercise training studies indicate that plasma triglyceride concentrations are usually decreased by regular exercise training. However, decreased levels are related to baseline concentrations of triglyceride before engaging in exercise programs (Marti et al., 1990). Thomas and Lafontaine (2001) suggested that 45 min of aerobic exercise 4 or more days per week substantially lower triglyceride levels.

In conclusion, accumulating evidences from several studies have shown that regular physical activity reduces overall mortality from CVD. Blood pressure in hypertensive patients can be significantly lowered and patients may eliminate or reduce the need for antihypertensive medication after participating in aerobic exercise. Increased physical activity also appears to benefit individuals with NIDDM and lipid disorders. Benefits include improving insulin sensitivity as well as blood lipid profiles, and weight loss, if accompanied by dietary intervention. In obese individuals, exercise that improves insulin sensitivity can decrease the risk of developing NIDDM.

Although the results of some studies have not shown reduction in fasting plasma glucose because of insufficient study duration or amounts of physical activity, they have shown reduction in the dosage of insulin required to control blood sugar levels and weight loss. In addition, the benefit of physical activity for lipid disorders is recommended, if the exercise program can continue for at least a year with at least the same dosages. High-density lipoprotein cholesterol levels are positively associated with physical activity, while levels of LDL cholesterol and plasma triglyceride concentra-

tions shown inverse relationship with physical activity. If these lipid levels do not decrease after performing physical activity, individual baseline concentration of lipid profiles and exercise dose-responses should be reviewed.

### *The New Recommendations for the Amount of PA in Adults*

During the 1970s, scientific evidence began to accumulate on the beneficial effect of vigorous exercise on cardiorespiratory fitness. The American College of Sports Medicine (ACSM), the American Heart Association (AHA), and other national health organizations proposed the particular benefits to the public of performing cardiorespiratory endurance with vigorous physical activity at least 20 min on 3 or more days per week. However, the majority of individuals were unable to follow the ACSM recommendations as indicated by little or no increase in the percentage of adults who exercised. Consequently, in the late 1980s, there was a strong movement aiming to determine the minimal amount of physical activity that was required to significantly improve health and fitness. Accumulating studies indicated that MPA can reduce all-cause mortality (Lee & Skerrett, 2001), primarily by decreasing cardiovascular morbidity and mortality (Armstrong, 1997; Powell, Thompson, Caspersen, & Kendrick, 1987).

In 1995, a statement from the Center for Disease Control and Prevention (CDC) and ACSM proposed new recommendations for physical activity that every American adult should accumulate 30 min or more of moderate-intensity PA on most days of the week. For example, an individual may perform brisk walking of at least moderate intensity (3-6 Metabolic Equivalents), 3 times a day for 10-15 min each session, 5-7

days of the week; otherwise, using stairs instead of elevators at the same rate of brisk walking is an additional means of accumulating moderate exercise intensity (Pate et al., 1995).

In the National Institutes of Health (NIH, 1996), experts from a variety of health-related fields recommended that individuals should set a long-term goal to accumulate at least 30 min or more of MPA on most, or preferably all, days of the week. Additionally, people may select intermittent or shorter bouts of activity of at least 10 min per session at a level of moderate intensity, such as brisk walking with an accumulated duration of at least 30 min per day.

The World Health Organization and International Federation of Sports Medicine recommended that individuals of all age groups should be encouraged to increase habitual activity gradually, aiming to carry out every day at least 30 min of MPA (e.g., brisk walking and stair climbing). More vigorous activities (e.g., jogging, cycling, soccer, tennis, swimming) could provide additional benefits (Blair, et al., 1995).

The recommendations for health benefits depend on the levels of intensity, duration, and frequency such that individuals have their own choices to address any kinds of physical activity in which they prefer to participate to meet the requirements of the national guidelines. In fact, evidence from several studies still indicates that more health benefits and fitness outcomes are gained from vigorous activity, and even moderate intensity activity is likely sufficient to decrease the risk of coronary heart disease (Lee & Paffenbarger, 2001; Sallis & Owen, 1999). Physical activity can be categorized by intensity, duration, frequency, and type.

*Intensity*

Physical intensity has been recommended to be performed at "moderate" intensity for most adults (ACSM, 2001; Pate et al., 1995; U.S. Department of Health and Human Services, 1996). Physical intensity can be determined by several approaches. One of the most common methods is based on a standard, linear, age-dependent chronotropic response to activity. For healthy individuals who are not taking beta-blocker medications, this method can be helpful for determining the appropriate intensity of aerobic activity. Intensity can also be determined based on the functional capacity or metabolic equivalent prediction. Metabolic equivalent is the unit of measurement used to describe the oxygen costs of an activity (Armstrong, 1997). Another method can be determined based on a more subjective, quantified approach, related to the individual perception of exercise efforts, such as the Rating of Perceived Exertion scales (ACSM, 1995). Additionally, breathlessness is a helpful subjective method commonly used in self-report physical activity questionnaires. Hall (1993) proposes breathlessness as the most effective means of teaching exercise participants the skills of self-monitoring. Sing-Talk-Gasp is the simplest method to evaluate three intensity levels. If individuals are able to sing as they are exercising, their activity will be placed on light intensity. If they do not have enough breath to sing but they are still able to talk in sentences, they are doing moderate intensity. If they are unable to talk in sentences as they exercise and are gasping for breath, it means that they are doing vigorous intensity.

Similarly, the recommendation of Harvard Women's Health indicated that moderate-intensity aerobic exercise determined by rapid breathing is a level in which

the individual is able to carry on a conversation (Manson, 2001). The ACSM (2001) recommends that if the goal of physical activity is for health, an adequate prescription of moderate intensity might be "hard enough to increasing breathing, but not too hard to make you breathless or exhausted" (ACSM, 2001, p. 453).

### *Duration*

To achieve health benefits, adults should perform a minimum of 30 consecutive min per day or accumulated short-bouts of activity at least 10- to 15-min sessions, 2 to 3 sessions a day to reach 30 min (Pate et al., 1995). The ACSM (2001) guidelines further indicate that either continuous long–bout or multiple short-bout training can be performed. Winett and Carpinelli (2000) describe the assumption of short-bout that accumulating time across a day depends on a specific duration goal that is necessary to increase aerobic capacity and decrease CVD risks.

Otto and colleagues (1999) compared the effects of 4-min versus 20-min of aerobic exercise at 70%-85% maximal heart rate (vigorous intensity), in frequency four times per week for 6 weeks. The results showed that both groups significantly increased in aerobic capacity, with no significant difference between the 4-min and 20-min groups. There were two randomized trials conducted to evaluate lifestyle physical activity against structured exercise activity (Dunn et al., 1999). Participants in the lifestyle group were advised to accumulate at least 30 min of MPA on most days of the week. The structured group received a traditional exercise prescription (moderate intensity, 20-60 min, for 3 to 5 days a week). The results suggested that the lifestyle activity group, with accumulated short bouts of activity, also achieved improvements in

cardiovascular risk factors including physical fitness, blood pressure, lipid profiles, and body weight.

### *Frequency*

The guidelines (Pate et al., 1995; U.S. Department of Health and Human Services, 1996) regarding activity recommend that for cardiovascular benefits, physical activity should be conducted on most days of the week, at least 3 days a week. In fact, frequency, intensity, and duration are interrelated. The frequency recommendations for health benefits depend on the intensity and/or duration of an individual's physical activity (Pate et al., 1995). For example, higher intensity or longer duration activities could be performed approximately 3 times weekly, whereas for low-intensity or shorter-duration, the frequency should be increased from 5 days per week to preferably everyday.

### *Type*

The NIH Consensus Conference on Physical Activity and Cardiovascular Health (NIH, 1996) suggested that the appropriate type of activity is best determined by the individual's preferences to perform and sustain activity. People should enjoy physical activity on a regular basis. People of younger ages may be encouraged to participate in exercise activities that are structured, planned programs of activity because these exercise activities are usually more interesting and provide more vigorous activity. Additionally, they can accumulate their exercise duration through a variety of sports. Generally, individuals perform aerobic exercise using large muscle groups. According

to Harvard Women's Health Watch, Manson (2001) has suggested that brisk walking is a nearly perfect exercise, particularly in women because it is an aerobic exercise and weigh-bearing resistant training. Individuals can warm-up with appropriate stretching exercise, and it hardly causes skeletal injury.

Randomized trials have been performed to compare two types of physical activity, an intervention of lifestyle physical activity versus structured exercise (Dunn et al., 1999). Dunn and colleagues defined lifestyle physical activity as "the daily self selected activity, which includes all leisure, occupational, or household activities and could be planned or unplanned activity that are part of everyday life" (p. 401). These trials showed that lifestyle PA was sufficient to decrease cardiovascular risk factors. Similarly, Prescatello (2001) indicated that lifestyle PA may be more successful than structured exercise programs in terms of motivating sedentary and overweight individuals to become physically active.

In conclusion, to achieve cardiovascular benefits of physical activity, adults should follow the recommendations that encourage them to perform regular physical activity of at least moderate-intensity, 30 min per session, 5 to 7 days a week, or selecting shorter bouts of activity of at least moderate-intensity, 3 times a day for 10-15 min each session, 5 to 7 days a week. While vigorous intensity or longer duration (> 30 min per day) activity could be performed approximately 3 times a week, moderate intensity or shorter duration (< 30 min per day) should be performed more often than 3 times weekly.

## The Amount of Physical Activity for Adults at Risk of CVD

### *Hypertension*

There are no specific guidelines in exercise management of hypertension regarding intensity and frequency. In addition, there is insufficient evidence to justify the role of high intensity exercise (>70% $VO_{2\ max}$) in lowering blood pressure (Chintanadilok & Lowenthal, 2001). Chintanadilok & Lowenthal, (2001) suggested that regular aerobic PA such as brisk walking, with moderate physical intensity (40-60% of $VO_{2R}$) at 30 to 40 min on most days of the week, could safely decrease blood pressure. Fagard (2001) conducted a meta-analyses of 44 randomized controlled intervention trials to analyze the relationships between endurance exercise and blood pressure response among healthy normotensive and hypertension subjects. The exercise involved walking, jogging, running, and cycling. In hypertensive patients, the results demonstrated that the blood-pressure-lowering effect is reduced approximately 7/6 mm Hg by training from 3 to 5 times per week, 30-to 60-min per session at an moderate intensity, about 40-50% of $VO_{2R}$. Rogers, Probst, Gruber, Berger, and Boone (1996) compared the effects of training at about 45% and at about 75% of $VO_{2R}$ in patients with borderline hypertension. They found that the lower intensity (45% of $VO_{2R}$) exercise was more effective than the higher intensity (75% of $VO_{2R}$) in reducing resting blood pressure, but the lower intensity required longer duration.

Exercise at 60 to 70% of maximum work capacity, 3 days per week of 45 min per session for 1 month has the same hypotensive effect as exercise at 47% maximum work capacity, 3 days per week of 60 min, for 2.5 months (Braith, Pollock, Lowenthal, Graves, & Limacher, 1994). Furthermore, exercise training programs longer than 10

weeks appear to reduce systolic blood pressure by 1 to 2 mmHg and diastolic blood pressure by 2 to 2.5 mmHg more than shorter duration programs (Hagberg, & Brown, 1995). Chintanadilok and Lowenthal (2001) suggested that the level of exercise usually was achieved by 3 or 4 times weekly, at 60 to 70% of maximal heart rate (moderate intensity) for 30 to 45 min. The exercise training should be performed continuously at least 1 to 3 months and maintained indefinitely because the hypotensive effect of exercise training persists only as long as an endurance exercise training program is maintained.

The guideline from the sixth report of the Joint National Commission (JNC VI; 1997) recommended aerobic exercise for mild hypertension to reduce blood pressure. The exercise recommended to achieve this effect, generally similar to those prescribed for healthy adults (ACSM, 2001), is aerobic PA using large muscles (e.g., brisk walking, jogging, cycling, stair climbing, or swimming, etc.), at an intensity of 50-85% of $VO_{2R}$, for 30-60 min, 3-5 days per week. For these reasons, training at moderate intensity from 3 to 5 times per week 30-60 min per session is an acceptable amount of PA to reduce blood pressures in hypertensive patients.

### *Non-Insulin Dependent Diabetes*

The benefits of exercise for patients with an established diagnosis of diabetes have been known for many years. Moreover, epidemiological studies emphasize the valuable contribution of exercise in preventing diabetes, but the role of exercise on reduction of blood glucose is still controversial. The big picture of prospective studies indicates that higher levels of PA are clearly associated with a lower incidence of

NIDDM. Kelley and Goodpaster (2001) evaluated the effectiveness of PA in the treatment and prevention of NIDDM. The investigators reported that no sufficient data has clearly identified the relationship between a dose-response (intensity) of exercise and improved metabolic control of NIDDM. Thus far, there are no randomized controlled trials conducted to address the dose-response effect of exercise or PA on diabetes treatment or prevention.

A prospective analysis from the Nurses Health Study showed that participation in vigorous PA was associated with a reduced relative risk for diabetes (Hu et al., 1999). Similarly, Manson and colleagues conducted prospective studies on the association between PA and the development of diabetes (Manson, et al., 1991). The investigators found that the vigorous intensity was related to a decreased incidence of diabetes in a cohort of 87, 252 women over an 8-year period. However, a dose-response effect of PA in the prevention of diabetes in these women was not clearly observed.

The general PA guidelines for adults with NIDDM (ACSM, 2001; Goodpaster & Kelly, 2001) are aerobic PA using large muscles (e.g., brisk walking, jogging, cycling, stair climbing, or swimming, etc.), at an intensity of 50-85% of maximal aerobic capacity, for 30-60 min plus 5-10 min warm-up and cool-down period, or 2-3 times of short-bout, 3-5 times weekly, avoiding exercise time with peak insulin absorption.

The evidence from the prospective studies conclude the effects of PA on diabetes prevention by suggesting that an increase in PA prevents or, at least, delays development of NIDDM in adults, but the dose-response to control daily blood glucose is still elusive. The recommendations for healthy people with NIDDM, include moderate-

intensity PA, 30-60 min consecutively, or 2-3 times of short-bout, 3-5 times weekly, and avoiding exercise time with peak insulin absorption.

### *Lipid Disorders*

Wood and colleagues (1991) observed that only 121 weeks of aerobic exercise training could increase the level of HDL cholesterol. There is usually no change in HDL level when exercise training programs are performed 10 weeks or less in duration (Wood et al.); however, some studies found a significant correlation between hours spent in exercise training and change in HDL cholesterol (Durstine, 2001). The PA guidelines for improving blood lipids (ACSM, 2001) are aerobic PA using large muscles (e.g., brisk walking, jogging, cycling, stair climbing, or swimming, etc.), at an intensity of 50-85% of maximal aerobic capacity, for 30-60 min per session, 3.5-7 days weekly.

Because of different comparisons among exercise frequency, intensity, and duration, the analysis of effectiveness of exercise training programs should be carefully interpreted and applied. Thus, several issues should be taken into account when comparing the effectiveness of dose-response in different studies. The exercise training of insufficient intensity, duration, and longevity will not affect lipoprotein metabolisms. Normally, in PA training, triglyceride and HDL cholesterol are the lipids that can be decreased the most and the time it takes to achieve this goal is about 9 to12 months.

## Factors Influencing Physical Activity Adoption

In regard to physical activity determinants for adults age 18 and older, Sallis and Owen (1999) found that different variables could be strong influences for different

people, and the strength of influences for each individual may vary at different stages of change and age. A number of variables have been consistently associated with adult PA modification and many variables from the demographic, psychological, and behavioral domains were determined to have significant associations with physical activity, including social support, stages of change, self-efficacy, perceived barriers, perceived benefits, enjoyment of activity, processes of change, intention to exercise, lower intensity of exercise, and eating habits (Sallis & Owen).

Among those variables, the four major construct variables from the TTM were indicated as the determinant variables that can influence an individual's intention to be more physically active. Consequently, selected demographic factors (age, gender, educational attainment, and marital status), stages of change, processes of change, self-efficacy, and decisional balance (pros & cons) variables were examined as possible determinant variables among Thai adults at risk for CVD.

### *Demographic Factors*

The demographic factors found to be associated with PA participation include gender, age, educational attainment, and marital status.

#### *Gender*

Women participate less in vigorous intensity activity than moderate intensity activity, especially at younger ages. Moreover, women usually do more moderate intensity activity than men (Dishman & Sallis, 1994). Conversely, Lox, Burns, Treasure, and Wasley (1999) indicated that men and women did not differ significantly on the

frequency, duration, or intensity dimensions. Stephens & Caspersen (1994) reported that men tend to be engaged in vigorous physical activity to a greater extent than women. However, men and women appear to be engaged in moderate intensity exercise equally. In contrast to other findings, Cardinal (1997) indicated that gender was not significantly related to stage of exercise.

In examining the adoption of exercise in sedentary adults, surveys have shown that about 5% of women adopt vigorous physical activities (running) annually, whereas 34% of women adopt moderate activities (walking). Attrition rates from vigorous exercise reach 50%, compared to 30% from moderate exercise. These data suggested that women may be more likely to adopt a moderate-intensity activity and less likely to drop out of moderate-intensity exercise programs (Pinto, Marcus, & Clark, 1996).

Marcus, Pinto, Simkin, Audrain, and Taylor (1994) indicated that women who are employed and have one or more young children in the home are less likely to exercise than women who do not have children; moreover, time and money frequently have a greater impact among women and low-income individuals. In Thailand, Thitisak, (1997) revealed that 52.5% of 200 women with hypertension in Bangkok participated in exercise behavior at below the recommended level. One of the common reasons that most participants did not perform physical exercise is the culture and social values of Thai traditional people, who perceive that women should only perform housework and look after the children. Therefore, traditional Thai women perform exercise behavior less than men.

*Age*

Sallis, Howell, and Hofstetter (1992) reported that age is a predictor of adoption and maintenance of vigorous PA in men. The amount of exercise engaged in is likely to be reduced when people get older (Lox, et al., 1999). Increasing age is associated with lower levels of PA and time spent (Dishman & Sallis, 1994; Pataravongsa, 1999). Stephens & Caspersen (1994) suggested that exercise engagement declines with age at least until age 65. Lee (1993) indicated that sedentary people (precontemplators) are older than individuals who are more physically active in other stages. Cardinal (1997) reported older adults are more likely to be in earlier stages of exercise.

King, et al. (1992) summarized the determinants of all levels of PA intensities in adults. They concluded that physical activity consistently has been found to decrease with age after late adolescence or early adulthood. However, this observation is complicated by changes in terms of biomedical factors such as the reduction in cardio-vascular fitness that is typically seen with increasing age. The proportion of men demonstrating regular and intense activity increases around retirement, approximately ages 60-65 years, and remains relatively stable through age 80. Conversely, the proportion of women reporting regular and intense activity continues to decline in older age groups.

*Educational Attainment*

Sallis, et al. (1992) reported that education is a predictor of adoption and maintenance of vigorous physical activity in women. Some studies reported that education was not significantly related to stage of exercise (Cardinal, 1997; Marcus, et

al., 1994). Among Thai population, educational level is positively associated with physical activity in healthy elderly (Pataravongsa, 1999), in elderly with NIDDM (Totermsuk, 2000), and in elderly with coronary artery disease (Inkoom, 1998). Moreover, educational level is positively associated with health behavior of Thai women with NIDDM (Borisut, 1997; Pornviriyasup, 1997).

Suwan (as cited in Thitisak, 1997) found that individuals with higher education used more information seeking skills for disease inquiry to understand their disease and treatment, and used the available resources more than did individuals with lower education. Yamchanchai (1995) indicated that education level had a significantly positive relationship with health-promoting behavior among elderly. Similarly, a 1994 study by Kainil (as cited in Thitisak, 1997) suggested that education level had a significant positive relationship with self-care behavior among diabetes patients. However, Sumpunyou (as cited in Thitisak, 1997) indicated that educational level did not have a significant relationship with health-promotion behavior among hypertension patients. Thitisak indicated that educational level had a non-statistically significant relationship with health behaviors of the women in the Bangkok Metropolitan area.

*Marital Status*

Cardinal (1997) reported that marital status is significantly related to stages of exercise behavior in adults. Marcus, et al. (1994) conducted a study of stage of exercise adoption among employed women. The results indicated that marital status was not significantly related to stages of exercise adoption. Pothikanun (1999) indicated that marital status can predict the health promotion behavior in Thai patients with coronary

heart disease. However, marital status has not been significantly related to exercise behavior in healthy elderly (Pataravongsa, 1999). A 1993 study by Raglin and Wallace (as cited in Pinto, et al., 1996) reported that individuals who exercise with their spouses have higher rates of exercise adherence than those who exercise alone. In contrast, Evan & Nies (1997) indicated that married women participated in exercise behavior less than unmarried women because married women have more problems with time constraints of being mothers and wives, and of working outside the home.

### *Weekly Moderate-intensity Physical Activity*

Hellman (1997) evaluated the predictors of exercise adherence (stages of change) among 349 older participants discharged from a cardiac rehabilitation program. The result showed that engaging in more minutes of moderate to hard exercise activities was associated with each subsequent stage of exercise adherence from individuals who think about starting exercise (contemplation stage) to individuals who regularly engage in exercise (maintenance stage).

### *Factors in the TTM Influencing Physical Activity Adoption*

The factors including the stages of readiness for adopting physical activity, processes of change, and decisional balance variables have never been reported in the Thai population. As shown in TTM, only the self-efficacy variable from social cognitive theory has been tested to explain health behaviors across Thai populations. Consequently, the scientific evidence related TTM from Thai literature is limited.

*Stages of Readiness for Adopting PA*

The TTM postulates that movement through the stages occurs in a cyclical manner (Prochaska, DiClemente, & Norcross, 1992). Many individuals must make several attempts at behavior change before reaching maintenance (Marcus & Simkin, 1994). Boyle, Connor, Pronk, and Tan (1997) investigated the stages of change for PA, diet, and smoking among Health Maintenance Organization (HMO) members with chronic conditions in a sample of 8000 Health Maintenance Organization members, aged 40 or over with hypertension, diabetes, dyslipidemia, or heart disease. The results of stages of change for physical activity showed that 45% of the sample were in the maintenance stage, and more than 27% were in either- precontemplation or contemplation. Logistic regression analysis indicated that members with one or more chronic conditions were more ready to change all behavioral risk factors. Members with heart disease reported having greater readiness for changing all behavioral risk factors. In addition, members with hypertension reported greater readiness for changing their smoking and PA behaviors.

*Processes of Change*

The 10 processes of change are grouped into two second-order factors, experiential and behavioral. Individuals tend to use more than one process of change at a time to progress through a stage. These sets of processes are used differentially across the stage of change. In a number of cross-sectional, longitudinal, and intervention studies, it has been found that different processes of change are emphasized at different

stages of change (Prochaska, Velicer, DiClemente, & Fava, 1988; DiClemente, Prochaska, & Fairhurst, 1991; Marcus, Rossi et al., 1992).

Pertz, et al. (1996) conducted a longitudinal study with 6-month follow-up among 388 volunteer participants in a smoking cessation program. The results of this study supported the hypothesis that smoking cessation would be associated with a pattern of high use of experiential processes and low use of the behavioral process during contemplation and preparation stage of change, then during the action stage a reverse pattern of low use of experiential processes and high use of behavioral processes.

Jue and Cunningham (1998) described the processes of change used in the different stages among subjects after coronary artery bypass graft surgery. The subjects in the precontemplation and preparation stages used processes of change the least; on the other hand, the contemplators and actors used processes of change the most. Furthermore, there was a slight decline in the used of the processes of change by the maintainers. However, the individual processes of change used by the subjects at different stages showed no statistical significance.

Gorely and Gordon (1995) examined the relationship between stages of change and processes of change among older healthy adults in Australia. The study revealed that the use of 10 processes of change fluctuates across five stages. Only two experiential processes (self-reevaluation and conciousness raising) and three behavioral processes (counter conditioning, self-liberation, and stimulus control) were significant predictors across the five stages of exercise.

Marcus, Rossi, Selby, Niaura, & Abrams (1992) examined the association between stages of change and processes of change among 1172 participants in a worksite setting. The results showed that the behavioral processes increased progressing from action to maintenance; however, different results were found regarding the use of experiential processes. Use of experiential process peaked in the action stage, followed by a decrease in use in the maintenance stage.

Marcus, et al., (1996) employed a longitudinal study with baseline and 6-month follow-up survey to examine the usefulness of using the stages and processes of change model to explore exercise adoption and maintenance over time. Results showed that processes of change use increased for those who adopted PA by shifting from precontemplation or contemplation to preparation, action, or maintenance, and decreased for those who relapsed from PA by shifting from preparation, action, or maintenance to precontemplation or contemplation (15%).

Ounpuu, Woolcott, and Greene (2000) studied the stages of change for dietary fat reduction among 491 women in Canada. The results show that participants in the maintenance stage had more frequent and high level use of processes of change than subjects classified in the precontemplation stage. Moreover, individuals in lower-fat maintenance group reported more frequent use of all processes of change than did those in the higher-fat maintenance group.

*Self-Efficacy*

Self-efficacy is one's confidence in being able to successfully perform a specific activity or behavior (Bandura, 1977). It has been associated with physical activity in

recent correlational studies of healthy individuals (Marcus, Selby, et al., 1992). As Bandura (1986) points out, the impact of efficacy on behavior is generally the greatest during the early stages of behavior change. Research has demonstrated that self-efficacy scores increase in a linear fashion with advancing stage (DiClemente, Prochaska & Gibertini, 1985; Marcus, Selby, et al.). Gorely and Gordon (1995) examined the relationship between stages of change and self-efficacy among older healthy adults in Australia. The results showed that self-efficacy significantly increased from precontemplation to maintenance stages. Similarly, the studies of Marcus and colleagues (1994; 1996) revealed that higher scores on self-efficacy were significantly associated with higher stages of change.

Hellman (1997) evaluated the predictors of exercise adherence (stages of change) among 349 older participants discharged from a cardiac rehabilitation program. The study showed that perceived self-efficacy was a significant predictor of readiness to adopt exercise behavior. In addition, Sallis, et al. (1986) demonstrated that higher doses of exercise adoption may be predicted by exercise self-efficacy.

Sallis, et al. (1992) studied predictors of adoption and maintenance of vigorous PA in a sample of 1,719 men and women. The results showed that adoption of vigorous PA by sedentary men and women was predicted by self-efficacy. Additionally, in active men and women, maintenance of vigorous PA was also predicted by self-efficacy.

In Thailand, self-efficacy has been significantly associated with exercise behavior among Thai elderly in Bangkok (Pataravongsa, 1999). Moreover, two studies demonstrated that self-efficacy is also a major variable related to self-care behavior to

control blood pressure among hypertension patients (Hongwachin, 1999; Kijjachanchaikul, 1999). Chinuntuya (2001) developed a causal model to explain exercise behavior including leisure-time exercise and lifestyle PA among 300 elderly people in the Bangkok metropolis. The findings indicated that perceived self-efficacy had a significant positive direct effect on leisure-time exercise, and self-efficacy indirectly affected lifestyle PA through commitment to a plan of participating in a lifestyle PA model.

*Decisional balance (Pros and Cons)*

Perceptions of the pros and cons of exercise vary greatly by the stage of change, indicating that they are important for adopting PA behavior from early stages to later stages (Marcus & Simkin, 1994). Lee (1993) indicated that the main difference between people in precontemplation stage and people in action and maintenance stages is their perception of barriers. Previous studies have shown that pros and cons were significantly different across the five stages of exercise (Gorely and Gordon, 1995; Hellman, 1997).

Prochaska and colleagues (1994) employed cross-sectional comparisons to examine the relationships among the stages of change and the pros and cons. The 12 behavioral studies were smoking cessation, quitting cocaine, weight control, reducing high-fat diets, stopping delinquent behavior, safer sex, condom use, using sunscreens, radon gas exposure, acquisition of exercise, mammography screening, and physician's preventive practice with smokers. Results showed that the pros of changing among the 12 problem behaviors were higher for subjects in the contemplation stage than for those

in the precontemplation stage, whereas, the cons outweighed the pros for subjects who were in the precontemplation stage. In terms of cons of changing, there was no consistent pattern of differences between the contemplation and precontemplation stages; however, there was a consistent pattern of differences in the cons of changing between subjects in the contemplation stage and those in the action stage. The cons of changing were lower for subjects in the action stage than for those in contemplation. In 7 of the 12 behaviors, the crossover between the pros and cons of changing occurred during the contemplation stage. In exercise acquisition, the pros increased from precontemplation to maintenance stages, whereas the cons increased from precontemplation to contemplation, then continuously decreased from contemplation to maintenance stages. In addition, the crossover was evidenced during the preparation stage.

## Summary

Although previous research on the health benefits of PA has been concerned with vigorous exercise, there is accumulating evidence that moderate activity is also positively associated with improvement in health. The New CDC/ACSM physical activity guidelines recommending moderate or vigorous activities are more flexible; thus, these guidelines could result in a higher proportion of individuals who are regularly active. Physical activity interventions need to accommodate the current needs of these individuals and address potential barriers to PA participation, recognizing that different individuals may have different needs and face different barriers to becoming physically active. The relationship between stages of change in PA, processes of change, self-efficacy, and decisional balance among adults has been clearly established.

Additionally, those variables from TTM have been used to effectively design exercise health promotion programs in the United States.

However, the TTM has never been tested among Thai adults at risk for CVD. It is possible that cultural differences might affect the patterns so that they differ from those observed in the United States. The goal for this study is to determine whether TTM can be applied to the Thai culture. Although many health-promotion programs in Thailand have been conducted, the investigator could not find any program to determine the stage-matched exercise intervention among adults at risk of CVD as specifically and appropriately as TTM. If the processes of change, self-efficacy, decisional balance, and selected demographic characteristics can predict the five stages of exercise behavior, TTM will be an alternative model to further explore other health-promotion behaviors in Thai populations. Identifying the predictors of exercise behavior among those individuals is essential for planning health-promotion programs. Furthermore, empirical data from this study will help expand nursing knowledge in terms of health promotion to prevent the increasing CVD risk levels in Thailand.

# CHAPTER 3

# METHODOLOGY

The purpose of this study was to evaluate determinants of readiness for adopting regular PA and the validity of the stages of change model among Thai patients at risk for cardiovascular diseases. A descriptive design was employed to examine the relationships among processes of changes, self-efficacy, decisional balance, selected demographic variables, and stages of readiness for adopting physical activity. This chapter explains the research method that was used in this study.

## Research Design

### *Population and Sample*

A power analysis was used to determine the required sample size related to significance level, effect size, and desired power (Cohen, 1988). A significance level of .05 has been adopted as the standard for the alpha criterion. The conventional standard for power is .80, and the commonly used effect size is a modest effect size (Polit & Sherman, 1990; Polit & Hungler, 1999). In previous TTM studies, Hellman (1997) determined that 65 cases of older adults with a cardiac diagnosis were needed in each of the five stages to obtain .83 power for moderate to large effect sizes at a significance level of .05. Moreover, nursing studies and social science research have found that medium effect sizes are commonly conservative (Polit & Hungler; Stevens, 1996). Therefore, a significance level of .05, power of .80, and moderate effect size

were used for the power analysis for this study. The number of subjects required in this study was 85 cases in each of the five stages of change. Thus, the recruitment goal was 425 adult Thai patients at risk for CVD. Convenience sampling was used in this study. The subjects were patients coming follow-up treatment at cardiac and endocrine out-patient clinics at the four hospitals in Bangkok, Thailand: Rajchavithee, Nopparat, Siriraj, and Chula hospitals. These four hospitals serve as the major hospitals in Bangkok that provide treatment for patients who have been diagnosed with hypertension, diabetes, hyperlipidemia, or a combination of the three.

To be qualified for this study, each subject must have met the following criteria: (a) have been diagnosed with hypertension, hyperlipidemia, diabetes, or a combination of the three for at least 6 months; (b) have no history of coronary artery disease or myocardial infarction; (c) have no history of musculoskeletal problems that prevent them from engaging in regular physical activity; and (d) be able to read and answer the questionnaires.

## Instrumentation

Structured self-report questionnaires and semi-structured interviews were used as the methods to collect data. All self-report questionnaires from TTM constructs were originally developed in English; hence, four steps were used to develop these questionnaires. First, all self-report questionnaires were translated into the Thai language by three translators using the symmetrical translation method (Jones & Kay, 1992). Next, the Thai version of instruments was reviewed for clarity and readability by five healthy Thai people and another translator fluent in both American English and Thai language.

Then, some questions or words that were confusing or not sensitive to Thai culture were modified. Third, the Thai version of all instruments was translated back into the English language by two translators fluent in both English and Thai languages (Brislin, 1980). Finally, items with apparent discrepancies between Thai and English versions were modified, and the back translation was repeated until the translators were satisfied that both versions conveyed the same meaning.

The questionnaire consisted of 70 items that examined each subject's demographic characteristics and PA characteristics, and four parts representing the core constructs of TTM: Part I, stages of physical activity; Part II, processes of change; Part III, self-efficacy; and Part IV, decisional balance (Appendix C, Instrument). The demographic questions included age, gender, education attainment, and marital status. Physical activity characteristics included intensity, frequency, time (duration), and types. To obtain more accurate answers, the investigator conducted structured interviews with subjects on the PA characteristics and Part I, stages of PA. Because some subjects did not actually understand the definitions of regular PA and moderate-intensity PA due to the flexibility of intensity, types and time of such activities, they may have overestimated or underestimated such behaviors.

Sallis and Saelens (2000) suggested that investigator and subject have to share the understanding of ambiguous terms such as "*physical activity, moderate intensity, and leisure-time physical activity*" (p. s6) in order for individuals to accurately recall their PA.

*Regular Physical Activity* is defined as any bodily movement produced by skeletal muscles and includes all types of physical activities and exercise activity (e.g., leisure,

household, and/or occupational activities) including planned or unplanned activities that are part of everyday life. For individuals to achieve health benefits, Regular physical activity must be performed at least 3 to 5 times per week, at least at moderate intensity for 30-60 min per session, or an accumulated three short-bouts of activity at least 10-15 min per session, 5–7 days per week.

Regular Physical Activity was assessed by using the *Physical Activity Questionnaire* (PAQ), which was developed by the investigator using the Seven-Day Physical Activity Recall (Sallis, 1997) as a guideline. Physical Activity Questionnaire was a semi-structure interview that estimates an individual's time spent in moderate-intensity physical activity (MPA), expressed in minutes per week. Individuals were asked to report the PA that they usually performed during the past month. The questions were focused on the activity components, covering leisure-time, occupation, or household physical activities, as well as the quantitative data of the types, frequency, intensity, and time or duration of activities.

To estimate weekly MPA, only moderate-intensity activities were counted toward the number of minutes. For example, an individual who performed cooking, standing, and walking might be considered as performing only light-intensity PA; thus, the investigator needed to verify whether those activities met the moderate-intensity criteria. If those PAs did not meet MPA criteria, then they could not be counted toward number of minutes. In contrast, if individuals performed any physical activities that met the criteria of moderate-intensity level, such as cleaning floors by hand, brisk walking, or doing sit-ups, then those activities could be counted toward the number of minutes.

*Part I, Stages of readiness for adopting regular PA* is defined as each cardio-vascular at-risk subject's perception of his or her intention and current stage of regular

PA. The stage of regular physical activity was assessed by using five items of the *Stages of Physical Activity Questionnaire (SPAQ)* adapted by Cardinal (1995). Marcus, Selby, and colleagues (1992) developed the Stages of Change Instrument (SCI) to describe PA behavior by modifying an existing instrument that had previously been developed for smoking cessation (Prochaska & DiClemente, 1983). To develop and refine the Stages of Change Instrument, Marcus, Selby, et al. (1992) conducted three studies and reported a Kappa index of reliability of 0.78 ($n = 20$) for the SCI over a 2-week period. Courneya (1995) further adapted this instrument and reported a 2-week test-retest reliability of 0.79 ($n = 148$). Since then, Bishop and Aldana (1999) adapted that particular instrument to make it easier for subjects to follow.

Bishop and Aldana's version (1999) has five statements (one for each stage) that match the definitions of the five stages of change in TTM. The participants were asked to mark the one statement that applied to his or her intention and current PA status. Consequently, the SPAQ was designed to classify subjects into either the precontemplation, contemplation, preparation, action, or maintenance stage.

*Precontemplation* describes an individual who is not engaging in regular PA and has no intention of becoming involved in this behavior in the next 6 months. *Contemplation* describes an individual who is not engaging in regular PA, but is thinking about becoming involved in the behavior within the next 6 months. *Preparation* is defined as participating in regularly PA occasionally, and also planning to engage in regular PA in the next 30 days. *Action* is defined as having actively participated in regular PA (at least 3-5 times per week for at least 30 min each session; ACSM, 1998) for less than 6 months. *Maintenance* describes an individual who has engaged in regular PA for 6 months or longer. For example,

the precontemplator would endorse the item, "I am currently physically inactive, and I do not intend to change in the next 6 months," whereas the contemplator would endorse, "I am currently physically inactive, but I am thinking about starting moderately intense activity within the next 6 months." Participants selected only one statement that presently indicated their regular PA. The SPAQ was assessed using a 5-point ordered categorical scale from 1 *(precontemplation)* through 5 *(maintenance).* For example, an individual in the precontemplation stage was scored "1," whereas an individual in the maintenance stage was scored "5."

*Part II, Processes of change* defines individuals' perceptions of the strategies or methods that help them move forward through a series of five stages. This construct was measured using the 30-item *Processes of Change Questionnaire (POCQ)* that the investigator modified from the POCQ version revised by Nigg and colleagues (1999). Originally, a PCQ version that consisted of 39 items was developed by Marcus, Rossi, et al. (1992) using a worksite sample of middle-aged adults. Then, Nigg and colleagues refined the PCQ because the results of some studies using the first PCQ scales illustrated inconsistent findings in processes of change across five stages among different populations (Gorely & Gordon, 1995; Hellman, 1997; Jue & Cunningham, 1998). Thus, Nigg and colleagues suggested that the scale of Marcus's version may not be sensitive enough to capture the processes of change used by the general population. Moreover, there are fewer items in the new version than in the old version, thus it may reduce a response burden for subjects. The new PCQ version consists of 30 items from 10 subscales that measure 10 processes of change, including (a) consciousness raising, (b) dramatic relief, (c) environmental reevaluation, (d) self-reevaluation, (e) social liberation, (f) counter-conditioning, (g)

helping relationship, (h) reinforcement management, (i) self-liberation, and (j) stimulus control.

Nigg and colleagues (1999) evaluated the measurement structure and psychometric properties of the POCQ on a sample of 346 adults aged 18 to 75 and in another study on 226 young adults. The internal consistency across the 10 subscales of processes of change in exercise behavior ranged from 0.72 to 0.88 for experiential processes and from 0.76 to 0.85 for the behavioral processes. In addition, the internal consistency (alpha) coefficients for each of the 10 POCQ scales were as follows: consciousness raising = 0.85; dramatic relief = 0.73; environmental reevaluation = 0.76; self-reevaluation = 0.88; social liberation = 0.72; counter-conditioning = 0.82; helping relationship = 0.85; reinforcement management = 0.83; self-liberation = 0.76; and stimulus control = 0.78 (Nigg, et al). Acceptable reliability for a new instrument was defined as Cronbach alpha coefficients greater than 0.70. Thus, the alpha coefficients of the POCQ were acceptable.

For this study, the investigator modified 10 items from the original version because these items were (a) not specific for patients at risk of CVD, (b) repeated content between some items, or (c) were inappropriate for the Thai culture. First, the six-item subscale (1, 2, 7, 9, 19, and 22) was adapted to make the items more specifically applicable to cardio-vascular at risk subjects. For example, the statement of Item 1, "I read articles about exercise in an attempt to learn more about it," was changed to "I read articles about how exercise would lower my risks for heart disease." Item 22, "one of the rewards of regular exercise is that it improves my mood," was changed to "one of the rewards of regular exercise is that it could improve my blood pressure levels, blood sugar and/or

blood lipid levels." Item 17 in the counterconditioning subscale, as well as Items 20 and 21 in the helping relationship subscales, have similar meanings; thus they were deleted.

The investigator created two statements to substitute for Items 20 and 21. Item 20 stated "I have someone who encourages me to exercise." This is similar to the meaning of Item 21: "My friends encourage me to exercise." Thus, the two new statements were "I have someone who provides useful information about my exercising," and "I have someone who helps me with my job, so that I have free time to exercise." The final reason to adopt the new version was to make the statement more applicable to Thai culture. Item 30, "I make sure I always have a clean set of exercise clothes" was deleted because in Thailand, a set of exercise clothes does not play a role for people of low-socioeconomic status. Instead, a new statement was substituted, "I post notes to remind me to exercise regularly at home," because this behavior is more likely to occur than the previous one.

The POCQ was scored by asking subjects to rate the frequency of occurrence of each item on a 5-point Likert-type scale ranging from 1 *(never)* to 5 *(repeatedly)*. For example, Item 1, "I read articles about how exercise would lower my risks for heart disease" was representative of the process of consciousness raising (Appendix C). The scores for the 10 processes of change were generated from the 30 items by evaluating the responses for each question. The five experience processes and five behavioral processes each had 15 items. The experiential processes of change questions included Items 1-5, 11-15, and 21-25, whereas the behavioral processes questions included Items 6-10, 16-20, and 26-30. Scores for experience and behavioral processes can range from 15 to 75. The higher the score, the more the subject is using processes of change. In this study, the alpha coefficients were .88 for experiential processes and .87 for behavioral processes, and the

alpha coefficients for the entire questionnaire were .93 ($n = 436$). These results indicate that the POCQ for regular PA was reliable.

*Part III Self-efficacy* is defined as an individual's confidence in his or her ability to perform regular PA in difficult or challenging situations. This variable was measured by using 10 items that the investigator adapted from the *Exercise Self-Efficacy Questionnaire* (ESEQ) developed by Rossi and colleagues (1998). Originally, Marcus and colleagues (Marcus, Selby, et al. (1992) developed five items of global ESEQ in middle-aged government and hospital employees. In 1998, Rossi and colleagues developed a multidimensional measure of situation-specific exercise self-efficacy in order to fully understand exercise adoption and adherence.

In developing the instrument, five items from the Marcus, Selby et al. (1992) self-efficacy scale were included because that scale was well accepted in exercise research and has been validated with the stages of change (Rossi, et al., 1998). Additionally, items were included that represented two additional factors of exercise self-efficacy (e.g., resisting relapse, and making time for exercise) proposed by Sallis, Pinski, Grossman, Patterson, & Nader (1988). After initial development, 32 items were selected by Ph.D. and graduate students with expertise in the field of exercise so that those items included a variety of affects and situations specific to exercise self-efficacy. Exercise Self-Efficacy Questionnaire was validated in 224 college students and analyzed using a series of dimensional reduction and structural analyses. It was categorized in two forms, the short (6 items) and long forms (18 items). The ESEQ long form consisted of three items in each of six factors: (a) negative affect, (b) excuse making, (c) exercising alone, (d) inconvenience to exercise, (e) resistance from others, and (f) weather. Reported internal consistency coefficients of

the long form were .77 to .87. Also, the short forms consisted of one item in each of six factors, and the internal consistency coefficient was .82 ($n = 224$). From a total of 18 items (long form) in Rossi's version of the ESEQ, the investigator deleted some items in each of the six factors to insure that all items were applicable to the Thai culture.

Consequently, in the present study, the Self-Efficacy Questionnaire (SEQ)-included 10 items designed to measure a subject's confidence in ability to perform regular PA in difficult or challenging situations. The 10 items represented the following six areas: (a) negative affect; (b) excuse making; (c) exercising alone; (d) inconvenience to exercise; (e) resistance from others; and (f) weather.

The negative affect factor (Items 1 and 2) represented situations in which one feels stressed or tired. An example of a particular item was "I am under a lot of stress." Items 3 and 4 represented excuse making, for example lack of time, such as "I feel I do not have the time." Next, exercising alone (Items 5 and 6) involved situations in which one exercises alone as well as when an exercise partner cancels. For instance, Item 5 was "I have to exercise alone." Inconvenience to exercise, Items 7 and 8, included situations in which one's regular resources for performing regular MPA were unavailable. An example of this factor was "I do not have access to exercise equipment." Item 9 represented resistance from others and involved situations in which significant others, such as friends and family, put pressure on the individual to not exercise, such as "I am spending time with friends or family who do not exercise." Finally, the last factor, weather, in Item 10, involved situations of heat, cold, and rain. For example, "The weather is too hot, cold, or rainy outside" (Appendix A). The SEQ contained 10 items on a 5-point Likert-type scale ranging from 1 *(not at all confident)* to 5 *(completely confident).* Scores for SEQ ranged

from 10 to 50. The higher the score, the more the subject was confident in his or her ability to perform regular PA in difficult or challenging situations. In this study, the alpha coefficients for SEQ were .85 ($n = 436$). This result indicated that the SEQ for regular PA was reliable.

*Part IV, Decisional Balance* is defined as an individual's perception of the benefits (pros) and cons (costs) of performing regular PA. It was measured using 16 items of the *Decisional Balance Questionnaire (DBQ)* developed by Marcus, Rakowski, et al. (1992). The DBQ consisted of 16 items on a 5-point Likert-type scale ranging from 1 *(not at all important)* to 5 *(extremely important).* Participants rated how important each of the statements was in their decision to exercise or not. The items represented the four categories of decision making recommended by Janis and Mann's model: (a) gains or losses expected for oneself, (b) gains or losses expected for significant others, (c) self-approval or disapproval to perform regular exercise, and (d) approval or disapproval by others due to particular behavior. This instrument showed internal consistency coefficients of 0.95 for the pros subscale and 0.79 for the cons subscale (Marcus, Rakowski, et al.) that were acceptable.

In the present study, the investigator adjusted four items of pros and one item of cons to be more appropriate to Thai culture and subjects at risk for CVD. However, the four decisional categories of pros and cons were not changed from the TTM construct. For instance, an original pro item "I would feel more confident if I exercised regularly," was adapted to "I could control blood sugar level, lipid levels, and/or blood pressure levels if I exercised regularly." An example of a con item before adaptation was "I would find it difficult to find an exercise activity that I enjoy that is not affected by bad weather." It was

revised to "I would find it difficult to find a physical activity that I enjoy" (Appendix C). The items were scored onto two subscales, one representing the positive aspects of regular PA (pros: $n$ = 10 items) and the other representing negative aspects of regular PA (cons: $n$ = 6 items). The scores for the pros subscale ranged from 10 to 50, and the scores for the cons subscale ranged from 6 to 30. The higher the score for pros, the more the subject perceived the benefits of performing regular PA. Conversely, the higher the score for cons, the more the subject perceived the costs of performing regular PA. In this study, the alpha coefficients for the pros and the cons were .86 and .71 ($n$ = 436) respectively. The overall alpha coefficient for 16 items of the DBQ were .75 ($n$ = 436). Although the cons subscale has been used to study exercise behavior among healthy people, it has not been used previously in Thai culture. Thus, the requisite alpha coefficients for the cons subscale were satisfied.

## Protection of Human Subjects

Before collecting data, an expedited application and consent form were submitted to the Institutional Review Boards (IRB) of the University of Alabama at Birmingham (UAB) and the five hospitals in Bangkok, where the researcher conducted the pilot project and collected data. After obtaining permission to collect the data, the study was conducted at the cardiovascular and endocrine out- patient clinics of particular hospitals. The prospective subjects were informed about the purpose and method of the study. They were also informed that participation in the study was voluntary, and that they could refuse to participate in the study without being penalized or losing any benefits. There were no risks or costs involved with participation in this study. The prospective subjects were notified

that their responses were kept confidential and that their identities were not revealed. The prospective subjects who agreed to participate in this study were asked to sign a written consent before answering the survey.

## Instrument Testing

### *Test for Validity*

The revised questionnaires consisting of the SPAQ, SEQ, DBQ, and initial 30-item POCQ were reviewed and evaluated for format and content validity by a panel of experts. The panel was composed of two experts in TTM and one expert in exercise physiology. The roles of the content specialists were to evaluate whether the instruments were relevant to the objectives and represented the content domain of the study (Nunnally & Bernstein 1994; Waltz, Strickland, & Lenz, 1991). The scales were evaluated for appropriate and suitable items in the domains of the five stages of change, 10 subscales in processes of change, exercise self-efficacy, exercise decisional balance, and the specifics for exercise behavior of patients at risk for CVD. To determine content validity, a content validity index (CVI). was calculated to assess the relevance of each item across the panel experts' ratings. The common technique is to have an expert rate items on a 4-point rating scale from 1 *(not relevant)* to 4 *(very relevant)*. The acceptable levels of CVI scores are greater than or equal to 0.80 (Waltz, et al., 1991; Polit & Hungler, 1999). After the review was completed and the feedback was given, the investigator revised four items in the PCQ, in order to better measure the 10 subscales in processes of change, and one item in the ESEQ. In the present study, the CVI of

SPAQ was 1, POCQ was 0.86, SEQ was 0.90, and DBQ was 1; these content validity indices were acceptable.

*Test for Reliability*

A pilot study was conducted to evaluate the reliability of the Thai versions of the questionnaires. A sample of 30 Thai cardiovascular at-risk patients was recruited at Rajchavithee Hospital in Bangkok in order to detect any problems in the clarity of the questionnaires (e.g., language, instruction, format) and in the data collection procedure. The SPAQ and PAQ were administered as an interview by the investigator to ensure that the subject understood the definitions of regular PA and regular exercise before completing the SPAQ and PAQ. Then, the rest of questionnaires were self-completed by the individual subjects. In addition, individuals were asked to describe any problems, such as with the clarity of questions or burden. Some words were changed for clarity. To prevent increasing workload on or conflict with clinical staff, the investigator briefly explained the objective of data collection and asked the clinical staff to provide some feedback and recommendations that could help the investigator and clinical staff to work together.

The internal consistency of all instruments was examined using Cronbach's alpha coefficients. From the pilot study ($n = 30$), the alpha coefficients were .87 for experiential and behavioral processes of change, .87 for exercise self-efficacy, .84 for pros, and .79 for cons. These results indicated that those instruments were reliable. Additionally, two-week test-retest reliabilities of the PA questionnaire for weekly MPA

and stage of PA yielded Spearman-Brown correlation coefficients of .68 and .79 ($n$ = 10), respectively.

## Data Collection Procedures

The data were collected after the research proposal was approved by the Institutional Review Boards (IRB) of the University of Alabama at Birmingham (UAB), as well as the Human Subjects Committee of the four hospitals in Bangkok. This study was conducted from May to September of 2002. The recruitment process and procedures were conducted as follows.

1. The researcher met with the nursing staff from each out-patient clinic of the four hospitals to explain the scope of the study as well as procedures, and to ask permission to examine patients' records to identify eligible subjects.

2. In each of the settings, the investigator reviewed the medical records to identify qualified subjects. Then, the investigator recorded the qualified subjects' names in the participant list and labeled the sticker at the right corner of patients' records, so that the clinical staff knew that who the participant was. Each participant then received a routine blood pressure and weight check-up.

3. After the participants completed the routine check up, the clinic's staff referred those patients to the investigator. The investigator then introduced herself to the patients and explained the objective of the research project. A study information sheet was provided to each participant. Then, the investigator asked the patients for permission to conduct this study. If they were willing to participate, they would be requested to sign a consent form.

4. After the subjects signed the consent form, the researcher would describe how to complete the questionnaire. To ensure accuracy, the investigator would collect information on the PAQ and the SPAQ using a semi- structured interview. Then, the subjects would be asked to complete the remaining four parts composed of demographic characteristics, 10 POCQ, SEQ, and DBQ.

Each individual would be given 20-40 min to complete the four parts of the questionnaire. To control the influence from physician suggestions, individuals had to complete the questionnaires before being called in to see a physician. If they were called in to see a physician before completing the questionnaires of SEQ and PAQ, they would not be included in the study. Once completed, the investigator would review the questionnaire with the subject to ensure that no data were missing and that the responses reflected subject intent.

## Data Analyses

The data were analyzed using the SAS computer program (version 8.2). Data verification and cleaning were implemented after the data were entered into the SAS program. The data were printed and checked with the original data for accuracy, and outliers were reassessed to evaluate the accuracy of the entered data. Moreover, alpha coefficient reliabilities for all measures were computed. A significance level of .05 or 95% confidence interval, where applicable, was used to answer the research questions. The distributions of five stages of readiness to adopt regular PA, weekly MPA, and selected demographic factors were described using descriptive statistic, including frequencies, percentages, means, and standard deviations.

ANOVA was conducted to examine the association between the five stages of readiness to adopt regular PA and 10 processes of change, self-efficacy, decisional balance, age, education level, and weekly MPA. Additionally, non-parametric measures of association, that were suitable to ordinal data, were used to describe the association between the five-stages of readiness to adopt regular exercise and gender as well as marital status.

ANOVA was used to test for the overall significance for differences in mean scores of those variables including 10 processes of change, self-efficacy, decisional balance, weekly MPA, and selected demographic variables across five stages of readiness to adopt regular PA. The results showed that the overall differences in mean scores were significant; thus post-hoc procedures were used to compare the pairs of stage means while maintaining an overall .05 type I error rate.

Paired-*t* tests were employed to test for mean differences between experiential processes and behavioral processes within each of the five stages. In addition, the raw mean scores of those processes and decisional balance were converted to T-scores having $M = 50$, $SD = 10$ to examine the pattern of the mean T scores of ten processes of change and decisional balance (pros and cons) across the five stages.

To identify the determinants of the five stages of readiness to adopt regular PA, two analysis steps were employed. First, MANOVA was used to test for the overall significance of ten processes of change, self-efficacy, decisional balance, and selected demographic variables across the five stages of readiness to adopt regular MPA. The results showed the overall statistical significance of 10 processes of change, self-efficacy, decisional balance, and demographic data across the five stages of readiness to

adopt regular PA. Then, finally, a discriminant function analysis was conducted to explore the determinants of five stages of readiness to adopt regular PA behavior.

# CHAPTER 4

# FINDINGS

Results of the data analysis are presented in this chapter. This study focused on: (a) the distributions of five stages of readiness for adopting regular moderate intensity physical activity (MPA), characteristics of MPA, weekly MPA, and selected demographic variables; (b) the associations between stages of readiness and ten processes of change, self-efficacy, decisional balance, and selected demographic variables; (c) the differences in the means of weekly MPA, ten processes of change, self-efficacy, decisional balance, and selected demographic variables across five stages of change; (d) the mean differences between experiential processes and behavioral processes within the five stages of change and the patterns of the mean T-scores of processes of change; (e) the patterns of the mean T-scores of self-efficacy and decisional balance (pros and cons) among the five stages; and (f) the identification of the determinants of five stages of readiness for adopting regular MPA.

## Demographic Characteristics of the Sample

The sample in this study consisted of 436 patients who came for follow-up treatment at hypertension, cardiac, and endocrine out-patient clinics at four public hospitals in Bangkok, Thailand. Patients meeting the selection criteria were invited to participate in the study. Four of the invited patients declined because they did not have

enough time to participate. The data for this study were collected from May 25, 2002 to September 20, 2002. All 436 study participants had completed data for all questionnaires.

Participants in this study ranged in age from 21 to 81, with a mean age of 54.1 ($SD$ = 9.9), and more than half (63%) were female (see Tables 1 and 2). The majority (71%) of the subjects were married, reported a primary school education (35%), and diagnosis of hypertension (22%), diabetes (21%), or both hypertension and hyper-lipidemia (19%). Participants indicated moderate-intensity physical activity (MPA) characteristics by responding to the PAQ. Weekly MPA ranged from 0-350 min with a mean of 65.3 min ($SD$ = 65.2). The zero number came from the participants who indicated they performed PA at less than MPA. Most subjects participated in more leisure-time PA (40%) than other types of PA which were leisure-time and household PAs (18%), and occupational PA (15%). The three typical PA behaviors in this study were housework (35%), walking (28%), and brisk walking (23%). There were 154 subjects (35%) in the preparation stage, 96 (22%) in the contemplation stage, and 82 (19%) in the maintenance stage (see Table 3). The two stages containing the fewest number of subjects were the action stage ($n$ = 50; 12%) and the precon-templation stage ($n$ = 54; 12%).

## Findings Related to the Research Questions

Five self-report questionnaires were administered to address the research questions: (a) Demographics, (b) Stage of Readiness for adopting regular PA (SPAQ), (c) Processes of Change (POCQ), (d) Self-Efficacy (SEQ), and (e) Decisional Balance (DBQ). Results pertaining to each research question are presented in the following section.

*Research Question 1*

The first research question asked "What are the distributions of the five stages of readiness to adopt regular PA, characteristics of MPA, weekly MPA, and selected demographic factors among adult Thai patients who are at risk for cardiovascular CVD?" This question was answered by using descriptive statistics as shown in Tables 1 to 7. Tables 1, 3, 4, and 6 depict frequencies and percentages for nominal and ordinal scaled variables. Tables 2, 5, and 7 depict means, *SD*, and ranges for interval and ratio scaled variables. Tables 1 through 3 present demographic data, which summarized in a previous section (See Demographic Characteristics of the Samples).

*Table 1*
*Selected Demographic Characteristics of the Sample* (N = 436)

| Variables | *N* | % |
|---|---|---|
| Gender | | |
| Male | 161 | 36.9 |
| Female | 275 | 63.1 |
| Marital Status | | |
| Single | 48 | 11.0 |
| Married | 310 | 71.1 |
| Widowed | 42 | 9.6 |
| Divorced | 24 | 5.5 |
| Separated | 12 | 2.8 |
| Educational Levels | | |
| No education | 10 | 2.3 |
| Primary school | 154 | 35.3 |
| Middle grade | 47 | 10.8 |
| High school | 47 | 10.8 |
| Vocational education (Certificate level) | 60 | 13.8 |
| Bachelor degree | 99 | 22.7 |
| Master degree | 19 | 4.4 |
| Cardiovascular disease risks present | | |
| Diabetes (1) | 92 | 21.1 |
| Hypertension (2) | 94 | 21.6 |
| Hyperlipidemia (3) | 15 | 3.4 |

*Table 1 (Continued)*

| Variables | *N* | % |
|---|---|---|
| (1) & (2) | 62 | 14.2 |
| (1) & (3) | 28 | 6.4 |
| (2) & (3) | 84 | 19.3 |
| (1) & (2) & (3) | 61 | 14.0 |

*Table 2*
*Continuous Demographic Characteristics Variables*

| Variables | *M* | *SD* | Range |
|---|---|---|---|
| Age | 54.31 | 9.86 | 21-81 |
| Weekly moderate-intensity physical activity (MPA) | 65.31 | 65.18 | 0-350 |

To describe the characteristics of MPA behaviors, individuals were asked to describe the types and frequency of MPA they performed on a regular basis, including duration per session, number of sessions per day and number of days per week. As shown in Table 2, the weekly MPA ranged from 0 to 350 min, with a mean of 65.3 (*SD* = 65.2).

*Table 3*
*Frequency and Percentage of Subjects in Each Stage of Change*

| Stages of Change | *n* | % |
|---|---|---|
| Precontemplation | 54 | 12.4 |
| Contemplation | 96 | 22.0 |
| Preparation | 154 | 35.3 |
| Action | 50 | 11.5 |
| Maintenance | 82 | 18.8 |

*Table 4*
*Frequency and Percentage of Characteristics of Moderate-Intensity Physical Activity of the Sample by Stages*

| Characteristics | Stage | | | | | |
|---|---|---|---|---|---|---|
| | PC | C | P | A | M | Total |
| | *n* (%) | *n* (%) | *n* (%) | *n* (%) | *n* (%) | *n* (%) |
| Weekly MPA | | | | | | |
| < 30minutes | 43 (79.6) | 74 (77.1) | 37 (24.0) | 1 (2.0) | 1 (1.2) | 156 (35.8) |
| 30 - 89 minutes | 11 (20.4) | 22 (22.9) | 111 (72.1) | 4 (8.0) | 3 (3.7) | 151 (34.6) |
| 90 minutes | 0 | 0 | 6 (3.9) | 45 (90.0) | 78 (95.1) | 129 (29.6) |
| Total | 54 (100.0) | 96 (100.0) | 154 (100.0) | 50 (100.0) | 82 (100.0) | 436 (100.0) |
| Types of Physical Activity | | | | | | |
| Leisure-time physical activity (1) | 6 (11.1) | 16 (16.7) | 54 (35.1) | 37 (74.0) | 61 (74.4) | 174 (39.9) |
| Occupational physical activity (2) | 21 (38.9) | 18 (18.8) | 24 (15.6) | 2 (4.0) | 1 (1.2) | 66 (15.1) |
| Household physical activity (3) | 15 (27.8) | 28 (29.2) | 5 (3.2) | 0 | 0 | 48 (11.0) |
| 1 & 2 | 1 (1.9) | 10 (10.4) | 18 (11.7) | 4 (8.0) | 4 (4.9) | 37 (8.5) |
| 1 & 3 | 4 (7.4) | 13 (13.5) | 40 (26.0) | 5 (10.0) | 15 (18.3) | 77 (17.7) |
| 2 & 3 | 7 (13.0) | 10 (10.4) | 10 (6.5) | 0 | 0 | 27 (6.2) |
| 1 & 2 & 3 | 0 | 1 (1.0) | 3 (2.0) | 2 (4.0) | 1 (1.2) | 7 (1.6) |
| Total | 54 (100.0) | 96 (100.0) | 154 (100.0) | 50 (100.0) | 82 (100.0) | 436 (100) |
| Physical activity behaviors[a] | | | | | | |
| Walking | 22 (28.9) | 36 (24.3) | 55 (19.4) | 5 (5.8) | 6 (4.1) | 124 (16.7) |
| Brisk walking | 2 (2.6) | 3 (2.0) | 34 (12.0) | 21 (24.4) | 38 (25.9) | 98 (13.2) |
| Stair walking | 1 (1.3) | 12 (8.1) | 23 (8.1) | 1 (1.2) | 1 (0.6) | 38 (5.1) |
| Jogging | 0 | 2 (1.4) | 17 (6.0) | 11 (12.8) | 32 (21.8) | 62 (8.4) |
| Aerobic dance | 1 (1.3) | 0 | 7 (2.5) | 13 (15.1) | 7 (4.8) | 28 (3.8) |

*Note.* MPA = Moderate Intensity Physical Activity; PC = Precontemplation; C = Contemplation; P = Preparation; A = Action; M = Maintenance.

[a] These questions had multiple responses which resulted in the total frequency being more than 436.

*Table 4 (Continued)*

| Characteristics | Stage | | | | | |
|---|---|---|---|---|---|---|
| | PC | C | P | A | M | Total |
| | *n* (%) | *n* (%) | *n* (%) | *n* (%) | *n* (%) | *n* (%) |
| Stationary cycling | 0 | 1 (0.7) | 4 (1.4) | 7 (8.1) | 6 (4.1) | 18 (2.4) |
| Cycling for pleasure | 0 | 2 (1.4) | 2 (0.7) | 3 (3.5) | 4 (2.7) | 11 (1.5) |
| Various sports (swimming, basketball, tennis, & takraw) | 0 | 1 (0.7) | 6 (2.1) | 2 (2.3) | 7 (4.8) | 16 (2.2) |
| Housework (cooking, hand wash, clean house) | 24 (31.6) | 52 (35.1) | 58 (20.4) | 8 (9.3) | 12 (8.2) | 154 (20.8) |
| Gardening & Yard work (digging, manual cutting, etc) | 4 (5.3) | 8 (5.4) | 16 (5.6) | 1 (1.2) | 11 (7.5) | 40 (5.4) |
| Calisthenics (sit-up, stretching, flexibility, etc) | 2 (2.6) | 11 (7.4) | 40 (14.1) | 8 (9.3) | 15 (10.2) | 76 (10.3) |
| Heavy lifting | 8 (10.5) | 7 (4.7) | 11 (3.9) | 4 (4.7) | 3 (2.0) | 33 (4.5) |
| Driving (car, motorcycle) | 4 (5.3) | 1 (0.7) | 2 (0.7) | 0 | 0 | 7 (0.9) |
| Sitting (office work, sewing, knitting) | 7 (9.2) | 5 (3.4) | 2 (0.7) | 2 (2.3) | 0 | 16 (2.2) |
| Weighting training | 0 | 1 (0.7) | 3 (1.1) | 0 | 2 (1.4) | 6 (0.8) |
| Golf | 1 (1.3) | 1 (0.7) | 1 (0.4) | 0 | 2 (1.4) | 5 (0.7) |
| Dancing | 0 | 0 | 1 (0.4) | 0 | 0 | 1 (0.1) |
| Standing (Classroom teaching, beauty salon, etc) | 0 | 4 (2.7) | 2 (0.7) | 0 | 1 (0.6) | 7 (0.9) |
| Thai message | 0 | 1 (0.7) | 0 | 0 | 0 | 1 (0.1) |
| Total | 76 (100.0) | 148 (100.0) | 284 (100.0) | 86 (100.0) | 147 (100.0) | 741 (100.0) |

*Note.* MPA = Moderate Intensity Physical Activity; PC = Precontemplation; C = Contemplation; P = Preparation; A = Action; M = Maintenance.

[a] These questions had multiple responses which resulted in the total frequency being more than 436.

The highest percentage of subjects performed MPAs less than 30 min ($n$ =156; 35.8%). One hundred and fifty-one (34.6%) participated between 30-85 min, and 129 (29.6%) performed 90 min or more. When the weekly MPAs were compared between each of the five stages, the results showed that none of the 54 subjects in the precontemplation stage performed MPA for 90 min or more, but most of them ($n$ = 43; 79.6%) participated less than 30 min. Similarly, of the 96 participants in the contemplation stage, no one performed PA for 90 min or more; however, most of them ($n$ = 74; 77.1%) participated less than 30 min. In the preparation stage, most individuals ($n$ = 111; 72.1%) participated between 30–85 min, and the smallest number of subjects ($n$ = 6; 3.9%) performed 90 min or more. Subjects in action and maintenance stages tended to have higher levels of PA. In the action stage, 45 (90.0%) participants usually participated 90 min or more, and only one (2.0%) individual performed less than 30 min per week. Similarly, in the maintenance stage, 78 (95.1%) participants achieved MPA 90 min or more, and only one (1.2%) individual performed less than 30 min a week.

In terms of types of MPA, participants most frequently performed leisure-time PA ($n$ = 174; 39.9%). The second most frequent activity identified ($n$ = 77; 17.7%) consisted of both leisure-time and household PAs, and the smallest frequency ($n$ = 7; 1.6%) participated in all types of MPA. Interestingly, the four most common PA behaviors among the subjects of this study were housework ($n$ = 154; 20.8%), walking ($n$ = 124; 16.7%), brisk walking ($n$ = 98; 13.2%), and calisthenics ($n$ = 76; 10.3%).

When the types of MPA and PA behaviors in each of the five stages were compared, the results showed most of the individuals in the precontemplation stage regularly participated in occupational PA ($n$ = 21; 38.9%), and household PA had the second highest

number of participants ($n$ = 15; 27.8%). Only one participant (1.9%) participated in combination of leisure-time PA and occupational PA in this stage. Individuals in the precontemplation stage tended to participate more in housework (n = 24; 31.6%), walking ($n$ = 22; 28.9%), and sitting ($n$ = 7; 9.2%) than other types of PA behaviors. No precontemplator performed jogging, stationary bicycle, bicycle, or various sports; and only one individual performed stair walking and aerobic dance ($n$ = 1; 1.3%). In the contemplation stage, most individuals ($n$ = 28; 29.2%) also participated in household PA, with 8 (18.8%) subjects performing occupational PA, and 16 (16.7%) subjects engaging in leisure-time PA. When the number of subjects engaging in the 19 PA behaviors were compared, the results showed that housework had the highest number of participants ($n$ = 52; 35.1%), with walking being the next highest activity ($n$ = 36; 24.3%). The rest of the contemplators tended to perform more light-intensity PA behaviors, such as sitting and standing, than MPA behaviors such as brisk walking, jogging, etc.

One hundred and fifty-four participants (35.3%) were in the preparation stage. The largest number of them ($n$ = 54; 35.1%) participated in leisure-time PA, and 40 participants (26.0%) performed leisure-time and household PAs. Similar to the contemplation stage, the most frequently identified PA behavior for participants in this stage was housework ($n$ = 58; 20.4%), while 55 participants (19.4%) reported walking, and 40 participants (14.1%) performed calisthenics.

There were 50 subjects in the action stage. Leisure-time PA was the most common activity that individuals performed ($n$ = 37; 74.0%), and no individuals participated in household PA. In contrast, the participants in precontemplation, contemplation, and preparation stages performed fewer MPA behaviors than did participants in the action

stage. The most frequently reported MPA behaviors were brisk walking (n = 21; 24.4%), aerobic dance ($n$ = 13; 15.1%), and jogging ($n$ = 11; 12.8%).

Eighty-two participants were in the maintenance stage. The most frequently identified MPA among those participants was leisure-time PA ($n$ = 61; 74.4%), while15 individuals (18.3%) participated in leisure-time and household PAs, and no individuals participated in only household PA. In terms of the PA behaviors, the three major activities were brisk walking ($n$ = 38; 25.9%), jogging ($n$ = 32; 21.8%), and calisthenics ($n$ = 15; 10.2%). Furthermore, only a few participants reported light-intensity PA, such as house-work ($n$ = 12; 8.2%), gardening and yard work ($n$ = 11; 7.5%), and standing ($n$ = 1; 0.6%).

Table 5 summarizes the mean scores and standard deviations for 10 processes of change, self-efficacy, and decisional balance among Thai patients at risk of CVD. The results showed that the scores for the experiential processes ($M$ = 49.08; $SD$ = 11.32) were higher than the scores for behavioral processes ($M$ = 43.66; $SD$ = 11.92). For self-efficacy, the scores ranged from 10 to 49, and the mean score was 23.77 ($SD$ = 7.51). In decisional balance, the scores for pros ranged from 19 to 50 with a mean score of 38.05 ($SD$ = 6.42) and were higher than the scores for cons, which ranged from 6 to 27 and had a mean score of 12.28 ($SD$ = 4.33).

As in the overall sample, the relative frequency of females was higher than that of males in all stages but the maintenance stage. In the maintenance stage, males were in the majority ($n$ = 51; 62.2%). In terms of marital status, the relative frequency of participants who were married was higher than that for participants who were not married in every stage. The number of CVD risks across five stages indicated that diabetes had the highest percentage of participants in the precontemplation ($n$ = 19; 4.4%) and contemplation ($n$ =

*Table 5*
*Mean Scores and Standard Deviations for Ten Processes of Change, Self-efficacy, and Decisional Balance*

| Variables | Score range | *M* | *SD* |
|---|---|---|---|
| Ten processes of change | | | |
| Experiential processes | 20-75 | 49.08 | 11.32 |
| Behavioral processes | 18-75 | 43.66 | 11.92 |
| Self-efficacy | 10-49 | 23.77 | 7.51 |
| Decisional balance | | | |
| Pros | 19-50 | 38.05 | 6.42 |
| Cons | 6-27 | 12.28 | 4.33 |

*Table 6*
*Frequency and Percentage of Gender, Marital Status, and Cardiovascular Disease Risks by Stage of Change*

| Variables | Stages of Change | | | | |
|---|---|---|---|---|---|
| | PC<br>*n* = 54<br>F (%) | C<br>*n* = 96<br>F (%) | P<br>*n* = 154<br>F (%) | A<br>*n* = 50<br>F (%) | M<br>*n* = 82<br>F (%) |
| Gender | | | | | |
| Male | 15 (27.8) | 20 (20.8) | 55 (35.7) | 20 (40.0) | 51 (62.2) |
| Female | 39 (72.2) | 76 (79.2) | 99 (64.3) | 30 (60.0) | 31 (37.8) |
| Marital Status | | | | | |
| Married, | 39 (72.2) | 63 (65.6) | 109 (70.8) | 39 (78.0) | 60 (73.2) |
| Not Married (single, widowhood, divorced, and separated) | 15 (27.8) | 33 (34.4) | 45 (29.2) | 11 (22.0) | 22 (26.8) |
| Cardiovascular Disease Risks Present | | | | | |
| Diabetes (1) | 19 (4.4) | 25 (5.7) | 22 (5.0) | 9 (2.1) | 17 (3.9) |
| Hypertension (2) | 10 (2.3) | 24 (5.5) | 38 (8.7) | 8 (1.8) | 14 (3.2) |
| Hyperlipidemia (3) | 1 (0.2) | 2 (0.5) | 7 (1.6) | 1 (0.2) | 4 (0.9) |
| (1) & (2) | 12 (2.8) | 15 (3.4) | 16 (3.7) | 6 (1.4) | 13 (3.0) |
| (1) & (3) | 3 (0.7) | 4 (0.9) | 15 (3.4) | 3 (0.7) | 3 (0.7) |
| (2) & (3) | 2 (2.5) | 12 (2.8) | 39 (8.9) | 12 (2.8) | 19 (4.4) |
| (1) & (2) & (3) | 7 (1.6) | 14 (3.2) | 17 (3.9) | 11 (2.5) | 12 (2.8) |

*Note.* PC = Precontemplation; C = Contemplation; P = Preparation; A = Action; M = Maintenance.

25; 5.7%) stages, whereas hypertension and hyper-lipidemia had the highest percentage of participants in preparation ($n$ = 39; 8.9%), action ($n$ = 12; 2.8%), and maintenance ($n$ = 19; 4.4%) stages.

*Table 7*
*Means and Standard Deviations of Dependent Variables by Stages of Change*

| Variables | Stages of Change | | | | |
|---|---|---|---|---|---|
| | PC $n$ = 54 | C $n$ = 96 | P $n$ = 154 | A $n$ = 50 | M $n$ = 82 |
| Age | 51.6 (11.5) | 52.6 (8.4) | 53.7 (9.5) | 51.9 (9.0) | 60.7 (9.0) |
| Weekly MPA | 12.4 (16.0) | 17.0 (13.9) | 44.6 (23.2) | 131.8 (61.0) | 154.9 (53.4) |
| Educational-levels | 2.4 (1.1) | 3.7 (1.8) | 4.0 (1.8) | 4.3 (1.7) | 4.3 (1.7) |
| Ten processes of change | | | | | |
| Experiential | 33.4 (7.8) | 44.1 (8.0) | 50.5 (9.4) | 56.2 (6.9) | 58.3 (8.1) |
| Behavioral | 6.9 (5.4) | 36.1 (7.0) | 45.0 (8.3) | 52.8 (6.8) | 55.5 (8.9) |
| Self-efficacy | 15.9 (3.8) | 19.5 (4.7) | 23.5 (6.0) | 28.9 (5.8) | 31.3 (6.4) |
| Decisional-balance | | | | | |
| Pros | 33.1 (6.7) | 35.3 (6.0) | 38.4 (5.9) | 40.9 (4.9) | 42.2 (4.7) |
| Cons | 3.5 (4.2) | 13.0 (3.8) | 12.4 (4.2) | 10.4 (3.9) | 11.5 (5.0) |

*Note.* PC = Precontemplation; C = Contemplation; P = Preparation; A = Action; M = Maintenance.

The means for all dependent variables in each of the 5 stages were compared, and the results showed that the mean ages of participants in the precontemplation stage were the lowest ($M$ = 51.6; $SD$ = 11.5), whereas the mean ages of participants in the maintenance stage was the highest ($M$ = 60.7; $SD$ = 9.0). Also, individuals in the precontemplation stage reported lower mean weekly minutes in MPA than did individuals in contemplation, preparation, action, or maintenance stages; individuals in the maintenance

stage reported higher mean weekly minutes in MPA than did individuals in precontemplation, contemplation, preparation, or action stages. In the precontemplation stage, participants reported the lowest mean scores for education level ($M = 12.4$; $SD = 16.0$), experiential processes ($M = 33.4$; $SD = 7.8$), behavioral processes ($M = 26.9$; $SD = 5.4$), self-efficacy ($M = 15.9$; $SD = 3.8$), and pros ($M = 33.1$; $SD = 6.7$). In contrast, participants in the maintenance stage had the highest scores for experiential processes ($M = 58.3$; $SD = 8.1$), behavioral processes ($M = 55.5$; $SD = 8.9$), self-efficacy ($M = 31.3$; $SD = 6.4$), and pros ($M = 42.2$; $SD = 4.7$). However, the mean scores for cons fluctuated across the five stages of change. The mean scores of cons were the highest in precontemplation stage ($M = 13.5$; $SD = 4.2$) and slightly decreased in contemplation ($M = 13.0$; $SD = 3.8$), preparation ($M = 12.4$; $SD = 4.2$), and action ($M = 10.4$; $SD = 3.9$) stages, then slightly increased in maintenance ($M = 11.5$; $SD = 5.0$) stage.

Thus, the results of Table 7 can be summarized as following: Maintenance stage participants were the oldest, and tended to perform more weekly MPA than participants in every other stage; maintenance stage participants had the highest means for educational level, experiential processes, behavioral processes, self-efficacy, and pros. In contrast, participants in the precontemplation stage were the youngest, tended to perform lower weekly MPA than did participants in every other stage, and had the lowest mean education level. Precontemplation stage participants reported the lowest mean scores for experiential processes, behavioral processes, self-efficacy, and pros. In addition, the mean scores for all dependent variables increased across the five stages of readiness for change, except the mean scores for cons, which were the highest in the precontemplation

stage and slightly decreased in contemplation, preparation, and action stages, and then increased in the maintenance stage.

*Research Question 2*

The second research question asked "What are the associations between the five stages of readiness to adopt regular PA and each of the following: the ten processes of change, exercise self-efficacy, decisional balances, weekly MPA, and selected demographic variables among Thai adult patients who are at risk for CVD?" To test the association across five stages, ANOVA was used for testing differences in means for the following variables: ten processes of change, self-efficacy, decisional balance, age, education level, and weekly MPA; chi-square analyses appropriate for nominal variables such as gender and marital status were used to test associations involving those variables.

Chi-square analyses were conducted to test whether there were associations for gender and marital status with stages of change. The results demonstrated significant differences in the distribution for gender ($\chi^2$ [4, $N = 436$] = 35.4, $P < .0001$) across five stages, with more females than males in all stages; however, males were in the majority in the maintenance stage. There was no significant relationship with marital status ($\chi^2$ [4, $N = 436$] = 2.8, $p = .60$; see Table 8).

As indicated in Table 9, ANOVA was employed to test for differences in means between the five stages of readiness to adopt regular MPA. In this study, the following dependent variables were examined: experiential and behavioral processes of change, self-efficacy, pros and cons, age, educational level, and weekly MPA. ANOVA assumptions were examined, and the results showed a heterogeneity of variance for behavioral

*Table 8*
*Chi-Square Analyses for Relationship between the Gender and Marital Status and the Stages of Change*

| Variables | Chi-Square statistics likelihood ratio | | |
|---|---|---|---|
| | *Df* | $\chi^2$ | *P* |
| Gender | 4 | 35.4* | <.0001 |
| Marital status | 4 | 2.8 | .6000 |

*Note.* $\chi^2$ = Chi-square statistic; *Df* = degree of freedom; *$p < .05$

processes, self-efficacy, pros, educational levels, and average weekly MPA. Transformations were applied to those dependent variables to stabilize between group variances.

The ANOVA results from Table 9 show the associations between stages of change and the following variables: age, educational level, weekly MPA, experiential and behavioral processes of change, self-efficacy, and pros and cons. The magnitude of relationship was described by Eta ($\eta$; Polit, 1996). There was a moderate relationship between stages of change and average weekly minutes ($\eta = .75$) as well as behavioral processes ($\eta = .61$). The rest of the variables, including age, education level, experiential processes, self-efficacy, pros, and cons had weak associations ($\eta = .04$-$.46$) with stage of change (see Table 9).

### *Research Question 3*

The third research question asked "Are there differences in the means of the ten processes of change, exercise self-efficacy, decisional balance, weekly MPA, and selected demographic variables across the five stages of readiness to adopt regular MPA among Thai adult patients who are at risk for CVD?" This question examined whether there were differences in means between five stages of change for each variable. If the

overall test for difference in means was significant, post-hoc tests were employed to identify the pattern of differences among the five stages.

The ANOVA results indicated that at least one stage of change mean was different for each of the variables (see Table 9). Turkey's honestly significant difference post-hoc tests were conducted to determine which pairs of means among the 5 stages were signify-cantly different from one another. The mean age and educational levels for precontempla-tors were lower than means in each of the other stages. Individuals in contemplation, preparation, action, and maintenance stages had similar means for age and educational

*Table 9*
*One-Way Analysis of Variance (ANOVA) and Turkey Post-hoc Analyses for Differences in Means between Stages of Change*

| Variables | *SSb* | *MS* | *F* (4, 431) | η | Tukey's HSD ($p < .05$) |
|---|---|---|---|---|---|
| Age | 4314.85 | 1078.71 | 12.25* | .10 | PC< C, P, A, M |
| Educational level | 40.94 | 10.23 | 10.23* | .10 | PC<C, P, A, M |
| Weekly MPA | 5072.02 | 1268.01 | 315.70* | .75 | PC, C<, P, A, M<br>P<A, M<br>A<M |
| 10 processes of change | | | | | |
| Experiential-processes | 5431.76 | 6357.94 | 90.52* | .46 | PC<C, P, A, M<br>C< P, A, M<br>P< A, M |
| Behavioral-processes | 223.55 | 55.89 | 165.69* | .61 | PC<C, P, A, M<br>C< P, A, M<br>P< A, M |
| Self-efficacy | 3.96 | 0.99 | 92.37* | .46 | PC<C, P, A, M<br>C< P, A, M<br>P< A, M |
| Decisional balance | | | | | |
| Pros | 321810.46 | 80452.62 | 29.80* | .22 | PC, C<, P, A, M<br>P< M |
| Cons | 361.56 | 90.39 | 5.00* | .04 | A<PC, C, P |

*Note.* PC = Precontemplation; C = Contemplation; P = Preparation; A = Action; M = Maintenance. * $p < .001$.)

level. For weekly MPA, mean scores for precontemplation and contemplation stages were similar. However, there was a significant increase in mean MPA from contemplation to preparation, preparation to action, and action to maintenance stages.

The mean scores for experiential processes, behavioral processes, and self-efficacy variables significantly increased from precontemplation to contemplation, contemplation to preparation, and preparation to action. Precontemplators tended to use experiential processes, behavioral processes, and self-efficacy substantially less than did subjects in the other stages of change. However, differences between action and maintenance group means were similar for those variables.

In terms of decisional balance, the mean pros scores were similar between precontemplators and contemplators, and the mean pros scores for precontemplation and contemplation stages were less than the mean pros scores for preparation, action, and maintenance stages. Mean scores for the preparation stage were similar to the mean scores for action and maintenance stages. In addition, the mean pros score for the preparation stage was less than the mean pros score for maintenance stage. The differences among the mean scores for cons in the action stage were lower than means in precontemplation, contemplation, and preparation stages, but there were no statistically significant differences for maintenance stage mean.

### *Research Question 4*

Research question 4 asked, "What are the mean differences between experiential processes and behavioral processes within the five stages, and what is the pattern of the mean T scores of each across the five stages?"

The 10 processes of change are composed of five experiential processes of change and five behavioral processes of change. Thirty questions representing the 10 processes of change were utilized to obtain the experiential process scores and behavioral process scores. The experiential process and behavioral process scores were expressed as T scores to remove scaling effects. The paired-*t* test was employed to test for mean differences between experiential process and behavioral process among five stages of changes are shown in Table 10. Additionally, the pattern of the T-score means and standard deviations

*Table 10*
*Mean Differences (Experiential-Behavioral Processes) in the Mean Scores between Experiential Processes and Behavioral Processes across Five Stages of Change*

| Variables | *N* | $\bar{\delta}$ | *SD* | *t* | *P* |
|---|---|---|---|---|---|
| Precontemplation | 54 | 0.2 | 6.1 | 0.2 | 0.825 |
| Contemplation | 96 | 1.9 | 6.0 | 3.1* | 0.003 |
| Preparation | 154 | 0.1 | 5.6 | 0.3 | 0.778 |
| Action | 50 | -1.3 | 5.0 | -1.9 | 0.069 |
| Maintenance | 82 | -1.8 | 5.7 | -2.8* | 0.007 |

* paired-*t* test $p < .05$.

for the five experiential processes of change and the five behavioral processes of change are illustrated in Table 11 and Figure 2.

The paired-*t* test results indicated that the mean differences between experiential processes and behavioral processes in the contemplation stage (*t* test [95] = 3.1, $p = .003$) and the maintenance stage (*t* test [81] = -2.8, $p = .007$) were statistically significant. Conversely, there were no statistically significant mean differences in the precontemplation (*t* test [53] = 0.2, $p = .825$), preparation (*t* test [153] = 0.3, $p = .778$), or action stages (*t* test [49] = -1.9, $p = .069$).

As shown in Table 10, participants in the contemplation stage tended to have higher experiential process than behavioral process scores, whereas experiential process and behavioral process scores were similar in the precontemplation and preparation stages. In the later stages, only participants in the maintenance stage had higher behavioral process scores than experiential process scores. Participants in the action stage had similar experiential process and behavioral process scores.

Table 11 presents the T-score means and standard deviations for the five experiential processes of change and the five behavioral processes of change. To demonstrate the pattern of processes of change use across five stages, the T-score means for experiential and behavioral processes of change are illustrated in Figure 2.

*Table 11*
*T-Score Means and Standard Deviations of Processes of Change by Stages of Change*

| Variables | Stages of Change | | | | |
|---|---|---|---|---|---|
| | PC $n = 54$ | C $n = 96$ | P $n = 154$ | A $n = 50$ | M $n = 82$ |
| Processes of change | | | | | |
| Experiential | 36.2 (6.9) | 45.6 (7.0) | 51.2 (8.3) | 56.3 (6.1) | 58.1 (7.2) |
| Behavioral | 36.0 (4.5) | 43.7 (5.8) | 51.1 (7.0) | 57.6 (5.7) | 59.9 (7.5) |

*Note.* PC = Precontemplation; C = Contemplation; P = Preparation; A = Action; M = Maintenance.

The pattern of mean T scores for experiential and behavioral processes within each stage is presented in Figure 2. This figure illustrates that the mean scores of experiential processes were slightly higher than the mean scores of behavioral processes in early stages (precontemplation, contemplation, and preparation), with the pattern reversing and experiential process means becoming slightly lower than behavioral process

means in the later stages (action and maintenance). Behavioral processes were lowest in the precontemplation stage, then slightly increased along the stages of change, and were highest in maintenance.

*Research Question 5*

Research question 5 asked, "What are the patterns of the mean T scores of decisional balance (pros and cons) and self-efficacy among the five stages of change groups?" To examine the pattern of decisional balance and self-efficacy across the five stages of readiness to change, the raw mean scores of those variables were converted to T scores having $M = 50$, $SD = 10$. The patterns of standardized mean scores of decisional balance and self-efficacy progressing through the five stages are illustrated in Table 12 and Figures 3 and 4. Table 12 presents the T-score means and standard deviations for the decisional balance (pros and cons) and the self-efficacy.

*Table 12*
*T-Score Means and Standard deviations of Decisional Balance and Self-efficacy by Stages of Change*

| Variables | Stages of Change | | | | |
|---|---|---|---|---|---|
| | PC<br>*M (SD)*<br>*n* = 54 | C<br>*M (SD)*<br>*n* = 96 | P<br>*M (SD)*<br>*n* = 154 | A<br>*M (SD)*<br>*n* = 50 | M<br>*M (SD)*<br>*n* = 82 |
| Decisional Balance | 42.2 (10.4) | 45.7 (9.3) | 50.5 (9.2) | 54.4 (7.7) | 56.5 (7.3) |
| Pros | 52.8 (9.7) | 51.7 (8.8) | 50.3 (9.7) | 45.7 (9.1) | 48.2 (11.5) |
| Cons | 39.5 (5.1) | 44.3 (6.3) | 49.7 (8.0) | 56.8 (7.7) | 60.1 (8.6) |
| Self-efficacy | | | | | |

*Note.* PC = Precontemplation; C = Contemplation; P = Preparation; A = Action; M = Maintenance.

The Pattern of Processes of Change across Stages of Change

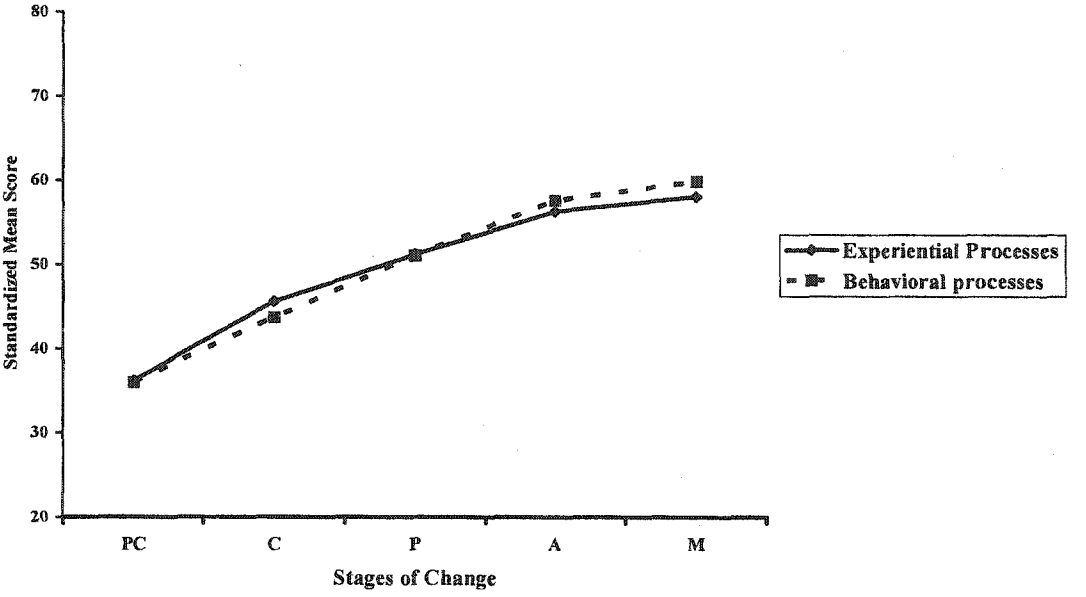


*Figure 2.* Mean T-scores of experiential and behavioral processes by stages of change; PC = precontemplation; C = contemplation; P = preparation; A = action; M = maintenance.

Figure 3 illustrates that the mean T scores of pros constantly increased from precontemplation to maintenance stages, whereas the mean T scores of cons consistently decreased from precontemplation to action, then slightly increased from action to maintenance stages. The mean T scores of pros were higher than the cons in the action and maintenance stages; in contrast, the mean T scores for cons were higher than the pros in the precontemplation and contemplation stages. In addition, the increase in the mean T scores of pros followed by a decrease in the mean T scores of cons led to a crossover at the preparation stage.

Figure 4 illustrates that the mean T scores of self-efficacy constantly increased from the precontemplation to maintenance stages. The mean T scores for self-efficacy in the precontemplation were lower than the mean T scores for self-efficacy in the contemplation, preparation, action, and maintenance stages.

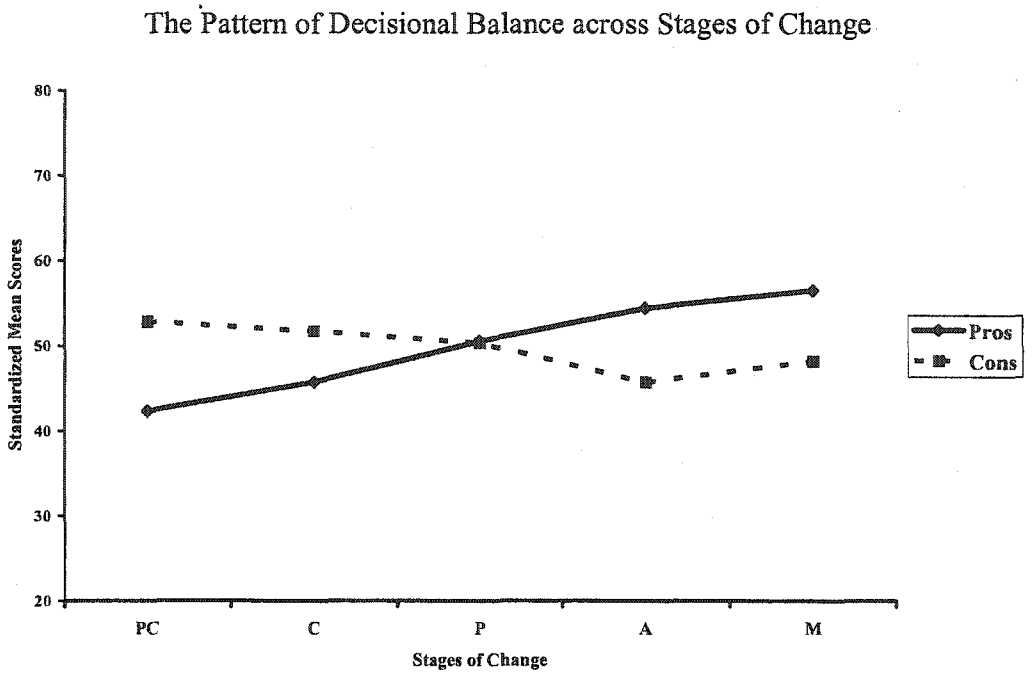


*Figure 3.* T-score means of decisional balance by stages of change; PC = precontemplation; C = contemplation; P = preparation; A = action; M = maintenance.

*Research Question 6*

Research question 6 asked "What are the determinants of the five stages of readiness to adopt regular exercise behavior among Thai adult patients who are at risk for CVD?"

MANOVA was conducted to test the overall significant difference in centroid consisting of ten processes of change, self-efficacy, decisional balance, and selected demographic data across the five stages. If the overall test was statistically significant, then the next step, discriminant function analysis, was conducted to explore the determinants across the five stages.

Discriminant analysis was used to determine the extent to which the set of the following variables was able to classify subjects into each stage of readiness to adopt

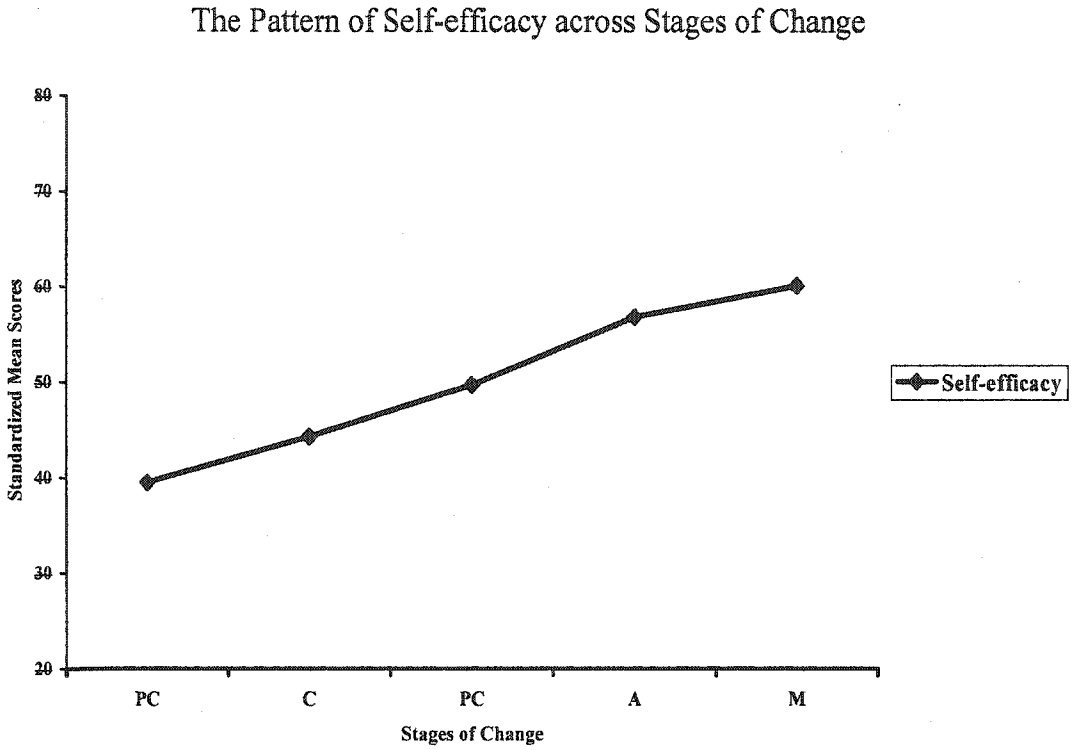


*Figure 4.* T-score means of self-efficacy by stages of change; PC = precontemplation; C = contemplation; P = preparation; A = action; M = maintenance.

regular PA: experiential and behavioral processes of change, self-efficacy, pros and cons, age, and educational level. Difference in centroids between the five stages of change was tested by MANOVA prior to the discriminant analysis. Assumptions for MANOVA were tested, and appropriate transformations applied to achieve homogeneity of covariance. As the MANOVA indicated, at least 1 centroid was different ($F$ [32, 1565.2] = 19.73, $p <$ .0001); therefore discriminant analysis was performed.

Table 13 presents the classification of individuals into each stage of readiness to adopt regular PA. The results indicated that, overall, 62.0% of cases were correctly classified. Across 5 stages, the highest percentage of participants ($n$ = 42; 77.8%) were correctly classified into the precontemplation stage. The second highest percentage

correctly classified were in the preparation stage, with 107 (69.5%) participants correctly classified. In contrast, the lowest percentage of participants correctly classified ($n = 14$; 28.0%) were in the action stage. The participants in the action stage were difficult to distinguish from the participants in the preparation stage, with 24 (48%) participants in the action stage incorrectly classified into the preparation stage.

*Table 13*
*The Number of Observations and Percentage Classified into Five Stages of Change*

| Stage | PC Observation (%) $n=54$ | C Observation (%) $n=96$ | P Observation (%) $n=154$ | A Observation (%) $n=50$ | M Observation (%) $n=82$ | Total $N=436$ |
|---|---|---|---|---|---|---|
| PC | 42 (77.8) | 8 (14.8) | 4 (7.4) | 0 (0.0) | 0 (0.0) | 54 (100.0) |
| C | 9 (9.4) | 51 (53.1) | 34 (35.4) | 0 (0.0) | 2 (2.1) | 96 (100.0) |
| P | 2 (1.3) | 24 (15.6) | 107 (69.5) | 3 (2.0) | 18 (11.7) | 154 (100.0) |
| A | 0 (0.0) | 0 (0.0) | 24 (48.0) | 14 (28.0) | 12 (24.0) | 50 (100.0) |
| M | 0 (0.0) | 0 (0.0) | 22 (26.8) | 5 (6.1) | 55 (67.1) | 82 (100.0) |
| Total | 53 (12.2) | 83 (19.0) | 191 (43.8) | 22 (5.1) | 87 (20.0) | 436 (100.0) |
| Error-count | 12 (22.2) | 45 (26.8) | 47 (30.5) | 36 (72.0) | 27 (32.9) | |
| Priors | 0.12 | 0.22 | 0.35 | 0.11 | 0.19 | |

*Note.* PC = Precontemplation; C = Contemplation; P = Preparation; A = Action; M = Maintenance.

# CHAPTER 5

# DISCUSSION

A non-experimental study was conducted to describe the determinants of readiness for adopting regular PA among Thai patients at risk of cardiovascular disease (CVD). The Transtheoretical Model (TTM) was used to guide the framework of this study. Data were analyzed by using descriptive statistics, chi-square, paired-*t* test, ANOVA, MANOVA, and discriminant analysis. This chapter focuses on a discussion of the findings related to the theoretical and conceptual framework according to the research questions. Conclusions are drawn based on the findings and hypotheses. Implications and recommendations for further research are also suggested.

## Discussion Related to Findings

### *Research Question 1*

What are the distributions of the five stages of readiness for adopting regular PA, characteristics of MPA, weekly MPA, and selected demographic factors among adult Thai patients who are at risk for CVD? Results showed that the sample in this study was predominantly female (63%), ranged in age from 21 to 81 years with a mean age of 54.3 years ($SD$ = 9.9; see Table 2). Most individuals were married (71%) and had only four years of primary education (35%; see Table 1). These findings are congruent with results that have been reported from several other studies. Among a high-risk age group of

patients with CHD in Bangkok, Kummabutr (2000) found that most subjects were female (68%), had a mean age of 53.3 years, had a primary level of education, and were married (66%). Studies related to health promotion behaviors in the elderly with essential hypertension showed that most participants were female, were married, and had a primary school education (Charoenkitkorn, 2000; Thitisak 1997; Thongpila, 1999). Similarly, studies among patients with diabetes found that most patients were 40 years or over, and over half of the patients had completed primary school (Kasekan, 1998; Nimnoy, 1999). In addition, the same results were reported by Kairoj, (1999) who found that most hypertensive participants ranged in age from 50 to 59 and had finished primary school.

The diseases commonly related to the risk of CVD in the current study were hypertension (22%), diabetes (21%), and both hypertension and hyperlipidemia diseases (19%; see Table 1). This finding was similar to the finding from the national health survey in 1995 among the Thai population who were ages 50 or over. The results showed that the common health problems were hypertension, diabetes, cardiovascular problems, and hyperlipidemia (Chuprapawan, as cited in Chaichana, 1997). In addition, Poungkeaw (1997) examined health behavior of 200 women with coronary heart disease in the Bangkok area and found that 78% of the participants had a number of chronic diseases, which included hypertension (70%) and diabetes (51%). These health problems were the health problems of people who engaged in sedentary activities (Chinuntuya, 2001).

The stages of readiness to adopt regular PA revealed that 12% reported no intention to adopt regular PA in the next 6 months (precontemplation stage); 22% considered participating in regular PA in the next 6 months (contemplation stage), and 35% performed irregular PA, but intended to participate in regular PA in the next 30 days

(preparation stage). Only 12% reported consistent PA for less than 6 months (action stage), and 19% of the sample had consistently engaged in regular PA for more than 6 months (maintenance stage; see Table 3).

According to the new recommendations for regular PA, individuals should be encouraged to increase habitual activity on most days of the week, at a moderate level of intensity, and at least 30 min a day (CDC and ACSM as cited in Pate et al., 1995; MPH, n.d.). In the current study, the average mean weekly MPA was 65.3 min (see Table 2); in contrast, over half of the participants (69%) from precontemplation, contemplation, and preparation stages performed weekly MPA less often than 90 min weekly. Only 31% of participants in the action and maintenance stages performed PA 90 min or more (see Table 4). This finding is consistent with the study by Kompayak and Naranong (as cited in Tammatisthan, 2000), which indicated that only 20% of people who live in Bangkok perform regular exercise behavior. Tammatisthan investigated regular exercise behavior among patients diagnosed with coronary heart disease. The study revealed that more than half of the subjects (56%) did not exercise before being diagnosed with coronary heart disease, and that their exercise behavior increased only 12% after diagnosis.

Similarly, Thitisak (1997) indicated that only 17% of hypertensive participants exercised 20 min a day and more than 3 times a week. The reasons most hypertensive participants in the Thitisak's study did not exercise was because 80% of subjects had complications from chronic illnesses, such as heart disease (44%), hyperlipidemia (29%), diabetes (24%), bone and joint problems (7%), and other diseases (17%). The participants perceived those diseases as the barriers that prevented them from exercising because they

were too tired, or afraid of fainting or injury. In addition, some participants perceived that regular housework was a type of regular exercise that they already achieved.

In another study related to physical activity, Kompayak (as cited in Thitisak, 1997) explored exercise and relaxation behaviors among people who lived in Bangkok and found that time limitation was the major reason people did not perform regular exercise. Only 7% of participants reported having enough time to relax after working because they spent most of the day working and commuting; thus when they arrived home, they only wanted to rest and relax. Moreover, the environment did not encourage them to perform regular exercise. Similarly, the study of Ruangtip (2000) explored preventive health behaviors on hypertension among bank officers in Bangkok. Most participants were female (60%), and all subjects were working age. The results showed the overall scores of preventive health behaviors were high; however, exercise behavior scores were the lowest. Some participants reported that they did not perform exercise activities because of lack of time due to many responsibilities, such as housework and taking care of their families.

In the current study, over half of participants (72%) were in the working-age group (less than 60 years) and worked outside home. In Bangkok, like other big cities, the lifestyles of individuals are very rushed. People have to wake up very early and leave home to work, then they go back home in the late evening because they spend most their time on the road due to traffic jams. In particular, when women arrive home, they have to perform housework and take care of their families. Results from the current study showed that participants in the maintenance stage were the oldest group and were retired from their full time jobs, and most of them were males. Thus, they tend to have more time to

participate in regular PA than do participants who are working-age females, most of whom were in the early stages (precontemplation, contemplation, and preparation). These findings are consistent with the study by Thitisak (1997), which revealed a significant relationship between working outside the home and poor health behaviors among women with hypertension in Bangkok.

In terms of the types of MPA and MPA behaviors (see Table 4), these findings revealed that the majority of subjects participated in more leisure-time PA (40%) than the other two types of PAs, which were both leisure-time and household PAs (18%), and occupational PA (15%). The typical MPA behaviors of participants in this study were housework (21%), walking (17%), and brisk walking (13%). An interesting finding in this study is that individuals in the action and maintenance stages tended to use more leisure-time PAs than individuals in the precontemplation, contemplation, and preparation stages. The reasons may be related to the fact that there were more males (54%) than females (46%) in the action and maintenance stages. These findings are consistent with other reports demonstrating that males were more likely to perform MPA than females. Moreover, previous studies (Ruangtip, 2000; Thitisak, 1997) indicated that females did not have time to perform exercise behavior because they not only did work outside the home to increase family income, but they also had many responsibilities inside the home, such as housework and childcare. Another potential explanation for increased exercise behavior among men may be related to educational level. These findings showed that most participants in the action and maintenance stages had the highest level of education; thus, they may have more opportunity to perform MPA than participants with lower education attainment who were in the precontemplation, contem-

plation, and preparation stages. However, Thitisak suggests that individuals who have higher education may not be able to perform exercise behavior due to lack of time.

Another interesting finding in this study is the type of MPA behaviors that the individuals in the three early stages usually performed. Most individuals in the precontemplation, contemplation, and preparation stages tended to perform more housework and walking than other types of MPA behavior that used more energy, such as brisk walking, stair walking, and jogging. The results from this study are similar to those of Marcus, et al. (1994), which indicated that women who reported participation in housework were significantly more likely to be in the precontemplation and contemplation stages. Additionally, the current finding is consistent with those of previous studies (Chinuntuya, 2000; Tammatisthan, 2000; Thitisak,1997) among patients with coronary heart disease and CVD risk, which concluded that most individuals tend to perform light-intensity PA, particularly housework and food preparation. The current finding showed that some individuals who performed housework and walking perceived that they would obtain the same health benefits, such as decreased blood pressure, blood sugar, or blood lipid from those activities as they would obtain from structured exercise activity. However, some of those participants reported that their blood pressure, blood sugar, or blood lipid did not change and they thought that the level of such activities that they currently performed were not enough to control their diseases.

In terms of MPA, the current study observed that more than one-half of participants knew that they should perform some kind of activity at least 3 days a week. Approximately 50% of participants mentioned the duration of physical activity as approximately 20-30 min a day; however, only a few participants knew the importance of intensity and

how much intensity is enough for gaining health benefits. This current finding is consistent with a previous study (Thitisak, 1997), which concluded that most participants performed PA behavior at light-intensity and that they perceived they would get health benefits from those behaviors. Similarly, the report of Tounwong (as cited in Chinuntuya, 2001) indicated that participants perceived the same benefits from daily work as from structured exercise.

Thirty four percent of all participants did not perform regular PA, with 12% of those being in the precontemplation stage and 22% in the contemplation stage. They were predominantly female, had low educational level, performed occupational and household PA types, and performed MPA fewer than 30 min weekly. They tended to perform more housework and walking than other types of PA behaviors, and they perceived that they would obtain the same health benefits from those activities as they would obtain from structured exercise activity. There were 35% of participants in the preparation stage who currently performed irregular MPA. Most of them commonly performed leisure-time PA and both leisure-time and household MPAs. They also tended to perform more housework and walking than other types of MPA behaviors, and they performed weekly MPA approximately 30-89 min. Moreover, only 31% of participants in the action and maintenance stages performed regular MPA at the recommended level. Most of them were male, had high educational levels, and were older ages. They tended to perform weekly MPA 90 min or more, and were more likely to perform more leisure-time PA, brisk walking, and jogging than individuals in the early stages, who performed MPA less than the recommendations.

In conclusion, the subjects were predominantly female, ranged in age from 21 to 81 with a mean age of 54.1, were married, and had finished a primary school education. The diseases commonly related to the risk of CVD were hypertension, diabetes, and hypertension combined with hyperlipidemia diseases.

### *Research Questions 2 and 3*

The second research question asked "What are the associations between the five stages of readiness to adopt regular PA and the ten processes of change, exercise self-efficacy, decisional balance, weekly MPA, and selected demographic variables among Thai adult patients who are at risk for CVD?" and the third question was "Are there differences in the means of those variables across five stages of readiness for adopting regular PA among adult Thai patients who are at risk for CVD?"

#### *Marital Status*

There was no significant relationship between marital status and stages of change (see Table 8). This finding is congruent with the finding reported by Sriaka (2000), which indicated that marriage in itself was the major barrier to engage in exercise behavior. Married people have to take responsibility for their job and family, so they did not have time to perform PA. This burden may be reflected in the exercise participation among females. However, the result of Sriaka's study was contrary to what was reported by Raglin, and Wallace (as cited in Pinto, et al., 1996), which indicated that individuals who exercise with their spouses have higher rates of exercise adherence than those who exercise alone.

One potential reason for the nonsignificant relationship between marital status and five stages of adoption of PA may be related to the possibility that individuals who were single, widowed, divorced, or separated did not live alone. They may have lived with their family, such as daughter, son or grandchildren, as is the traditional pattern of the Thai family, and they may also have received the same support from their families as those who are married. Similarly, Chinuntuya (2001) specified that elderly people commonly live with their children as an extended family. This is consistent with the study by Poungkeaw (1997), which indicated that most female participants usually lived with their children or husbands. In addition, participants may have received many types of support from their family. Thus, this type of extended-family pattern may provide the single, widowed, divorced, or separated groups the same or better support as married elderly people.

*Education*

Educational levels were significantly related to stage of readiness to adopt regular PA (see Table 9). This finding is in substantial agreement with many previous studies that conclude that education level had a significantly positive relationship with physical activity in healthy elderly (Pataravongsa, 1999), elderly with coronary heart disease (Inkoom, 1997), health promoting behavior (Borisut, 1997; Pornviriyasup, 1997; Totermsuk, 2000; Yamjunchai, 1995), and self-care behavior among diabetes patients (Kainil, 1994). In addition, King, et al. (1992) indicated that people with higher levels of education tend to participate in more leisure-time PA than do those with less education. Similarly, individuals with higher education tend to be more skilled at seeking informa-

tion, have more understanding about their disease and treatment, and have access to more resources than those with lower education (Suwan, as cited in Thitisak, 1997).

Moreover, the results of educational differences between the five stages showed that individuals who did not intend to participate in regular PA in the next 6 months (precontemplation) had the lowest education compared to those in other stages, but mean education was similar among the participants in the contemplation, preparation, action, and maintenance stages (see Table 9). This result can be interpreted as individuals who had high education level are more likely to participate in exercise activity. One possible reason for educational levels being similar among the participants in the contemplation, preparation, action, and maintenance stages is that it may be related to the time constraints in the middle-age group. People who attended secondary school or had a higher education levels should have better health behaviors than those with lower education, but those who had higher education levels were also in the working-age group, and may have been limited by time constraints.

This study found that the level of education was positively associated with leisure-time PA; however, it was negatively associated with work-related levels of PA (King, et al., 1992). In addition, Thitisak (1997) indicated that individuals, who had high educational level and had knowledge about disease and self-care behavior, may not be able to participate in exercise if they do not have available time. Particularly, individuals who are middle aged, have many responsibilities within their family. This report is consistent with the study of Kompayak and Naranong (as cited in Tammatisthan, 2000), which indicated that due to lack of time only 20% of people who live in Bangkok performed exercise behavior.

*Age*

Another finding from this study was that there was an association between age and stages of change (see Table 9), with older patients tending to perform more MPA than younger patients (see Table 7). Participants in the maintenance stage tended to be the oldest age group, 41 to 81 years. This finding is consistent with the report of King, et al. (1992), who proposed that the proportion of men performing regular and intense activity increases around retirement, approximately age 60-65, and remains relatively stable through age 80. Conversely, the proportion of women performing regular and intense activity continues to decline in older age groups.

When the differences in mean age across five stages were compared, the results showed that individuals in precontemplation, on average, were younger than those in contemplation, preparation, action, and maintenance stages; individuals in the latter four stages had similar means for age (See Table 9). An unexpected result in this study was that those in the youngest group performed less weekly MPA than those in the oldest group, who were in the action and preparation stages. This finding was opposite results from previous research which have indicated that PA consistently has been found to decrease with age after late adolescence or early adulthood. Chinuntuya (2001) indicated that elderly individuals with at least one chronic disease tended to participate less in exercise behavior because of health problems, such as lack of physical energy, joint problem, or soreness. Additionally, Prachapiphat (2000) contended that the deterioration in physiological function normally associated with aging is caused by a combination of reducing physical activity and the aging process itself.

However, the current finding is consistent with the national health behavior survey among the Thai population in 1995 which found that 60% of participants aged less than 60 years did not exercise (Chuprapawan, as cited in Chaichana, 1997). Similarly, the study of exercise behavior among healthy males and females aged between 20 to 40 showed a typical frequency of exercise activity of only 1-2 days weekly, with a duration of 5-15 min per session at moderate intensity (Nathvichai, as cited in Sriaka, 2000). The results of present study may have been a consequence of the fact that the older group had been diagnosed longer than those in the middle and younger groups; moreover, they had a higher educational level than those in the middle and younger groups. The longer the time since diagnosis, the greater will be the knowledge and opportunity to adjust health behaviors (James, 2001). Another reason may be related to the fact that retired participants who engaged in regular PA for more than 6 months had more time than those who currently worked a full time job. The current findings are consistent with Thitisak (1997), who indicated that high education can increase health behaviors and skills, but people with higher education must also have time to practice those skills.

*Gender*

The present study revealed that gender was associated with stage of change. Across the 5 stages, this study showed that most participants in later stages engaging in regular PA were male. In contrast, most physically inactive (precontemplation, contemplation), or irregular exercise participants (preparation) were women (see Table 8). Thus, males are more likely to perform MPA than females, which is congruent with reports from several previous studies. The studies of exercise activity among older Thai adults

have shown that male subjects were more physically active than female subjects (Vannarit 1999). It seems to be the habit of Thai women not to participate in exercise activity as much as men (Sriaka, 2000). Particularly in rural areas, traditional women usually wear "Pa-Thung," long skirts, in their daily life, which are not conducive to exercise (Tammatisthan, 2000). Moreover, elderly women commonly stay at home, perform housework, and look after their grand-children (Unipun, as cited in Thitisak, 1997), and they believe that housework is physical exercise and individuals are able to gain the same benefits from housework as from physical exercise (Tuanwong, as cited in Tammatisthan, 2000). However, performing housework, individuals are not able to control the consistency of intensity and duration of such activity; moreover, some types of housework, such as cooking and laundry, are light-intensity activities, which are not enough to gain the health benefits of exercise, particularly in terms of cardiovascular health benefit (Jumpa & Chusuwan, as cited in Tammatisthan, 2000).

Thitisak, (1997) examined a cross-sectional sample of health behaviors among 200 working-age women with hypertension in the Bangkok metropolitan area. In terms of exercise behavior, the results showed that only 17% of participants exercised more than 3 times a week, and at least 20 min per session. Working-age group women commonly work outside the home to increase family income; therefore, time constraints and having no place to exercise, may be perceived as barriers (Thitisak). Similarly, a study of exercise behavior among employees at the MPH in Thailand revealed that most subjects (58%) are physically inactive. Thirteen percent of men and 45% of women employees did not participate in exercise activity. In addition, individuals who perceived themselves as exercisers performed exercise activities only 1-2 times weekly (Tawichachat et al., as cited in Sriaka, 2000).

Likewise, Marcus, et al. (1994) examined exercise behavior among 431 employed women and found that 39% were sedentary, 34% were participating in irregular activity, and only 27% were active. Employed women who have one or more young children in the home are less likely to exercise than those who do not have children; time and money frequently have a greater impact on exercise among women and low-income individuals (Marcus, et al., 1994). Additionally, Nies, Vollman, and Cook (1998) indicated the barriers to exercise behaviors among European American women who failed to exercise or dropped out of an exercise program were time constraints due to the women's role demands, such as housework and being caregivers.

*Weekly Moderate-Intensity Physical Activity*

This study revealed that there was an association between weekly MPA and stages of readiness to adopt MPA. Individuals in the maintenance stage reported higher mean weekly MPA than did individuals in the precontemplation, contemplation, preparation, or action stages. In addition, there was a significant increase in mean weekly MPA from the contemplation to preparation, preparation to action, and action to maintenance stages; however, the differences in the mean scores for the precontemplation and contemplation stages were not statistically significant (see Table 9). This may have been influenced by the reality that increasing weekly MPA depends on a person's perception of the types of MPA and MPA behaviors. For example, women who performed household PA and considered participating in housework to be exercise tended to be at lower stages of exercise adoption than those participating in leisure-time PA and occupational PA.

This finding is similar to findings reported by some other studies. Hellman (1997) reported that engaging in more minutes of moderate to hard exercise is associated with each subsequent stage of exercise adherence from individuals who think about starting exercise (contemplation stage) to individuals who regularly engage in exercise (maintenance stage). Barrett (1997) examined the application of TTM in describing PA behavior and found that participants who engaged in more minutes of PA identified themselves in the advanced stages of PA readiness. Cooney (1996) examined the application of TTM in adolescent physical activity behavior. The results indicated that precontemplators participated in the least amount of minutes of PA, while maintainers participated in the most amount of minutes of PA.

*The Core Constructs from TTM*

The results of the present study revealed that there were associations between stages of change and all core constructs in the TTM. This finding is consistent with those of previous studies (Barrett, 1997; Marcus, Rakowski, et al., 1992; Prochaska, et al., 1994). Marcus, et al. (1996) indicated that stages of change in exercise behavior were associated with change in processes of change. Adopters tended to increase the use of the processes of change, whereas relapsers tended to decrease use of processes of change.

In the current study, moreover, the experiential and behavioral processes of change, self-efficacy, and decisional balance were significantly different for at least one of the stages of change. This finding is consistent with previous studies in the exercise activity domain that conclude that the processes of change, decisional balance, and self-efficacy appear to exhibit significant differences among groups of individuals in different

stages of change (Dunbar, 2000; Nigg & Courneya, 1998; Prochaska & Diclemente, 1998; Wallace & Buckworth, 2001).

Present study findings showed that the mean scores for experiential processes, behavioral processes, and self-efficacy variables significantly increased from precontemplation to contemplation, contemplation to preparation, and preparation to action. One possible explanation for increasing scores of experiential processes, behavioral processes, and self-efficacy from precontemplation to maintenance stages may be related to the fact that most individuals participating in light-intensity housework (i.e., prepared food, house cleaning, and washing clothes with machines, etc.) and walking tended to be in lower stages of PA adoption, to have lower confidence for performing regular PA and, to less often use processes of change. Moreover, individuals may perform such PAs as a part of their daily living rather than performing by intention to gain health benefits of action (Chinuntuya, 2001). Thus, individuals are not necessarily using processes of change or self-efficacy to motivate themselves to engage in household or walking PAs, but they are naturally performing these activities in their lifestyles.

The current study's finding is congruent with results that were reported from several studies. Marcus, et al. (1996) employed a longitudinal study with baseline and 6-month follow-up survey to examine the usefulness of using the stages and processes of change model to explore exercise adoption and maintenance over time. Results showed that processes of change use increased for those who adopted PA by shifting from precontemplation or contemplation to preparation, action, or maintenance stages, and decreased for those who relapsed from PA by shifting from preparation, action, or maintenance to precontemplation or contemplation stages. Additionally, Plotnikoff, Brez,

and Hotz (2000) indicated that the scores for self-efficacy and behavioral processes were significantly higher for individuals in the action stage than for those in the precontemplation, contemplation, and preparation stages.

Barrett (1997) indicated that use of the self-efficacy and behavioral processes were higher among individuals in the later stages. Moreover, most studies similarly conclude that self-efficacy increases from precontemplation to maintenance stages, which means that the precontemplators have the lowest scores, while those in the maintenance stages have the highest scores (Cooney, 1996; Marcus, et al., 1994; Wallace and Buckworth, 2001). Bandura (1986) indicated that the impact of self-efficacy on health behavior is generally the greatest during the early stages of behavior change. Other findings support this aspect of Bandura's theory, which hypothesizes that the level of confidence of an individual to engage in PA behavior is significantly related to actual behavior (Marcus, Selby, et al., 1992; Marcus, et al., 1994).

In terms of decisional balance, the current findings revealed that there were associations between decisional balance and stage of change, and there were statistically significant differences among pros and cons across five stages. These current findings are consistent with the study of Herrick, Stone, & Mettler (1997), who examined differences in decisional balance scores across the five stages of change and across four health behaviors (exercise, protection from sun exposure, smoking, and dietary fat consumption) among 393 employees. Results found significant differences for decisional balance scores across the five stages of change.

In the present study, the mean pros scores were similar between precontemplator and contemplator, and the mean pros scores for precontemplation and contemplation

stages were lower than the mean pros scores for preparation, action, and maintenance stages. In addition, the mean pros score for the preparation stage was lower than the mean pros score for maintenance stage. Moreover, the differences among the mean score for cons in the action stage were less than the differences among means in precontemplation, contemplation, and preparation stages, but there were no statistically significant differences for maintenance stage mean (see Table 9). These results for pros and cons may be explained by the facts that sedentary individuals (precontemplation and contemplation stages) may perceive fewer benefits (pros) of PA than those in preparation, action, and maintenance stages, and that they may also perceive more costs (cons) than do those in the later stages. These data suggest that as pros scores increase from precontemplation to contemplation and cons scores decrease from contemplation to action, performance of regular PA may become more likely. The findings that mean scores for cons slightly increased in the maintenance stage may be related to the fact that people in the maintenance stage tended to be older, so they may perceive greater physical barriers (such as fatigue, blurred vision, injuries, etc.) to engaging in regular PA than do people in the other four stages. Chinuntuya (2001) indicated that health problems including joint difficulties and/or fatigue have been reported as obstacles for elderly participants to engage in exercise behavior.

These findings for pros in this study are substantially supported by many previous studies of PA behavior in adolescents (Cooney, 1996), employed women (Marcus, et al., 1994), and healthy adults (Wallace and Buckworth, 2001). Those studies similarly concluded that pros increased from precontemplation to maintenance stages. Individuals in the precontemplation stage had the lowest scores of pros, while those in the main-

tenance stage had the highest scores. In contrast, this trend reversed for the con scale, which means the cons steadily decrease from contemplation stage to maintenance stage. Individuals in the contemplation stage had the highest scores of cons, whereas those in the maintenance stage had the lowest scores (Marcus, Rakowski, et al., 1992). However, the current findings for con scores are slightly different from the findings of Marcus, Rakowski, et al. The findings of the current study showed that the means for cons steadily decrease from action stage to precontemplation stage. Individuals in the precontemplation stage had the highest scores of cons, whereas those in the action stage had the lowest scores. The decisional balance (pros and cons) emphasizes the importance of perceiving high benefits (pros) and low costs or barriers (cons) before PA behavior change can occur (Marcus, et al., 1994). Moreover, knowing methods for changing perceptions of pros and cons could inform the design of interventions to facilitate individual progression from physical inactivity (precontemplation stage) to PA (action stage).

In conclusion, associations between education, age, gender, weekly MPA, and all of the core constructs in the TTM across five stages of change were identified. Additionally, there were differences in the means for those variables across the five stages. This study showed that older men and men with higher education who are in the action and maintenance stages tend to participate in more leisure-time PA and perform more weekly MPA behaviors, such as brisk walking and jogging, than do younger women and women with lower education. In contrast, those women who were in the precontemplation, contemplation, and preparation stages tended to participate in more household PA and perform fewer weekly MPA behaviors than men in action and maintenance stages. The current results for processes of change, self-efficacy, and decisional balance are supported

by several previous studies whose results are congruent with the explanation of core constructs in TTM. These findings revealed that scores for processes of change, self-efficacy, and pros significantly increased from the precontemplation to the preparation stages. Conversely, the cons continuously decreased from the action stage to the precontemplation stage.

*Research Question 4*

What are the mean differences between the mean T scores of experiential processes and the mean T scores of behavioral processes within the five stages, and what is the pattern of the mean T scores of each across the five stages of readiness for adopting regular PA among adult Thai patients at risk for CVD?

The results comparing the mean differences between experiential processes and behavioral processes and the five stages of change revealed that the experiential processes were used more than the behavioral processes by participants in the contemplation compared to preparation stages, whereas the experiential processes and behavioral processes were similarly used in the precontemplation and preparation stages. In the later stages, only participants in the maintenance stage used more behavioral processes than experiential processes, while participants in the action stage similarly used experiential processes and behavioral processes (see Table 10). The findings in this study are partially supported by previous studies that examined the stages related to the adoption of health behaviors and the reduction of unhealthy behaviors. Those studies concluded that experiential processes were commonly used in the early stages of change (contemplation and preparation; Marcus, et al., 1996), whereas behavioral processes were used much more

when people moved from action to maintenance stages (Prochaska, et al., 1997). Also, subjects in the maintenance stage more often used behavioral processes than they did experiential processes (Marcus, Rossi, et al., 1992). In smoking cessation, experiential processes tended to be used more frequently by smokers who were in the early stages (contemplation and preparation), whereas smokers in the later stages (action stage) tended to emphasize behavioral processes (Prochaska, Velicer, DiClemente, & Fava, 1988).

Moreover, the present study found that the pattern of using processes of change along the five stages showed that use of behavioral and experiential processes was lowest in the precontemplation stage and then slightly increased from the precontemplation to maintenance stages and were highest in the maintenance stage (see Table 11 and Figure 2). Additionally, the use of experiential processes was slightly higher than that of behavioral processes in the early stages (contemplation, and preparation), but slightly lower in the later stages (action and maintenance).

These results are partially consistent with the TTM and previous studies which concluded that participants in the maintenance stage had more frequent and higher level use of processes of change than subjects in the precontemplation stage. Additionally, participants in the precontemplation stage used the 10 processes of change substantially less frequently than did those in any other stage (Marcus, Rossi, et al., 1992; Ounpuu, et al., 2000; Wallace and Buckworth, 2001). Moreover, Marcus, Rossi and colleagues (Marcus et al., 1992 refs) indicated that the experiential processes tended to be used similarly among participants in the contemplation and preparation stages, whereas in progressing from the preparation stage to the action stage, individuals tended to use

behavioral processes more often than experiential processes. Once in the action stage, people used both the experiential and behavioral processes more often than those in the preparation stage, but individuals in the maintenance stage used fewer of the experiential processes than behavioral processes. Both the experiential and behavioral processes increased steadily from the precontemplation to action stages, peaked at the action stage, and then decreased at the maintenance stage (Marcus, Rossi, et al., 1992). Marcus, et al. (1996) employed a longitudinal study with a baseline and 6-month follow-up, and found that individuals who adopted PA by progressing from precontemplation or contemplation to preparation, action, or maintenance increased their use of the processes of change, whereas those who relapsed from PA by reversing from preparation, action, or maintenance to precontemplation or contemplation decreased their use of the processes of change.

However, some studies yielded contrasting results to those of the present study and the TTM. Cooney (1996) examined the application of TTM in adolescent PA. The results indicated that the use of the processes of change fluctuated across the stages, though clear differentiation was not as apparent in Cooney's study as within previous literature. Similarly, the findings of Gorely and Gordon (1995) indicated that the use of 10 processes of change fluctuated across the five stages. Jue and Cunningham (1998) described the processes of change used at the different stages by subjects following coronary artery bypass graft surgery. The participants in the precontemplation and preparation stages used the processes of change least frequently, while the contemplators and actors used the processes of change the most. Furthermore, there was a slight decline in the use of the processes of change by participants in the maintenance stage. In the TTM, processes of change are described as the strategies that facilitate people to progress

from early stages to later stages. Understanding the pattern of processes of change used across the five stages may enable health care providers to target some particular processes for inclusion in their intervention.

In contrast to cessation behaviors, acquisition behaviors require individuals to confront the barriers that impede them to engage in adopting behavior. For example, in adopting regular PA, individuals may not only use the processes of change, they may also have to address several potential barriers, such as time, money, and accessibility to becoming physically active (Marcus, King, et al., 1998). Another reason for inconsistent findings for processes of change may be the high complexity of integrating 10 processes of change across five stages; thus, this construct needs more supporting research for both longitudinal and qualitative research designs specifically (Gorely & Gordon, 1995; Prochaska, et al., 1997; Prochaska, et al.,1998).

In conclusion, previous empirical findings have indicated that the integration of the processes and stages of changing have not been consistent; not all 10 processes were always applicable, but occasionally a selected few processes of change were effective. Moreover, the pattern of processes of change use varied inconsistently across each stage along the progression from the early stages to the later stages. However, the literature did consistently conclude that experiential processes were commonly used in the early stages of change much more so than in the later stages, particularly when participants moved from the comtemplation to preparation stages. Also, individuals in the later stages more frequently used behavioral processes than experiential processes, particularly participants in the maintenance stage. Additionally, the use of behavioral and experiential processes was lowest in the precontemplation stage. Future research is needed to further the integra-

tion of the processes and stages of change for individuals adopting a variety of healthy behaviors or reducing different types of unhealthy behaviors.

*Research Question 5*

What are the patterns of the mean T scores for each of the pros, cons, and self-efficacy along the five stages of change among adult Thai patients at risk for CVD?

For decisional balance, the predicted pattern of the mean T scores was observed for the pros and cons across the 5 stages of change. The results revealed that the pros of changing consistently increased from the precontemplation to maintenance stages (see Table 12 and Figure 3). Interestingly, pros were higher in the contemplation stage than in the precontemplation stage. This may result from the fact that individuals who were considering participation in regular PA in the next 6 months (contemplation stage) may be more likely to perceive higher positive aspects from PA than those who do not intend to perform such behavior in the next 6 months (precontemplation stage).

Similarly, Prochaska, et al. (1994) indicated that in moving from the precontemplation stage to the contemplation stage, an individual's pros of changing must increase. Moreover, the pattern showed that the pros of PA outweigh the cons in later stages (action and maintenance). This supports the current finding that individuals in later stages perceived more benefits from regular PA than did those in early stages; thus, those in later stages are more likely to perform weekly regular MPA than those in early stages.

Conversely, the cons steadily decreased from precontemplation to action. The cons were also lower in the action stage than in the precomtemplation, contemplation, and preparation stages. One possible explanation for this pattern may be related to the

fact that individuals in the action stage were more likely to perceive fewer negative aspects to engaging in PA than those in the preparation, contemplation, and precontemplation stages. Thus, those in the action stage were more likely than those in the early stages to engage in MPA. Similarly, Prochaska, et al. (1994) indicated that in progressing from the contemplation stage to the action stage, the cons of changing must decrease. In addition, the cons must outweigh the pros in the early stages (precontemplation and contemplation stages). This illustrates that individuals in the early stages tend to perceive more barriers to engaging in PA than do those in the later stages and are, therefore, less likely to adopt regular MPA.

Another interesting finding in this study is the decrease in the cons during the action stage, and the slight increase in the maintenance stage. Participants in the maintenance stages tended to be older, so they may have tended to perceive physical barriers (such as fatigue, blurred vision, injuries, etc.) as cons to engaging in regular MPA. Chinuntuya (2001) indicated that health problems, including joint difficulties and fatigue, have been reported as obstacle factors to participation in exercise behavior. Moreover, complex health problems, such as arthritis, hypertension, or heart disease may be barriers to exercise adoption and maintenance (Marcus, King, et al., 1998). Congruent with these findings, the study by Booth, et al. (1997) found that among participants aged 60 to 78 years, the most frequent barriers to increased activity were injury or poor health. In addition, the advice of health professionals was the most preferred source of support and assistance for the oldest age group. Thus, encouragement and guidance from health care providers may be beneficial in providing problem-solving solutions to these barriers

In this study, the increasing pros scores and the decreasing cons scores reached a balance point at the preparation stage. These findings are consistent with findings from previous studies. Prochaska, et al. (1994) examined the relationship between stage of change and decisional balance for 12 problem behaviors. The investigators suggested that the equilibrium point generally occurred prior to the subject's taking action. In terms of exercise acquisition, the study by Marcus, Rossi, et al. (1992) revealed that the intersection between pros and cons occurred during the preparation stage. Nigg and Courneya (1998) found that the pros and cons intersected in the action stage. Gorely and Gordon (1995) found the decisional balance point to be between the preparation and action stages.

Prochaska, et al. (1998) suggested that before individuals progress to the action stage, the pros and cons would cross at the decisional balance point. At this point, Velicer, et al. (1998) suggested that the balance between the costs and benefits of changing can produce ambivalence that can keep people stuck in this stage. However, individuals whose pros scores are higher beyond the balance point are more prepared for participating in MPA. To progress from action to maintenance without relapsing, individuals must perceive pros that are sufficiently high and cons that are sufficiently low. Understanding this relationship between pros and cons would be useful for designing interventions to facilitate individual progression from the precontemplation stage to the action stage.

For Self-efficacy, the predicted pattern of means was observed, and the results revealed that the confidence in ability to perform regular PA increased from the precontemplation to maintenance stages (see Table 12 and Figure 4). These findings were congruent with previous studies. Gorely and Gordon (1995) indicated that self-efficacy increased from precontemplation to maintenance stages. Similarly, the studies by Marcus

and colleagues (Marcus, et al., 1994; Marcus, et al., 1996) revealed that higher scores on self-efficacy were significantly associated with higher stages of change

In conclusion, a clear pattern emerged that showed precontemplators scoring the lowest and those in maintenance scoring the highest on the pros, with a reversed pattern on the con scale. The increase in the pros and decrease in the cons reached a balance point at the preparation stage. Moreover, self-efficacy increased from the precontemplation to maintenance stages. These findings of this study are consistent with applications of the TTM in other areas of behavior change. These results can enhance the understanding of how patients weigh the pros and cons and how they perceived- confidence in their ability to perform regular PA at each stage of change.

*Research Question 6*

What are the determinants of the five stages of readiness to adopt regular exercise behavior among adult Thai patients who are at risk for CVD?

The set of the following variables level were entered into a discriminant function equation (predictive model) predicting stages of change: processes of change, self-efficacy, decisional balance, age and educational. The overall predictive model was able to correctly classify stages of change for 62.0% of the subjects (see Table 13). The model demonstrated the highest success rate for precontemplation (78%) and preparation stages (70%), while the action stage had the lowest percent of participants correctly classified (28%), with subjects tending to be incorrectly classified into the preparation stage (48%). This finding suggests that centroid of the set of variables for subjects in the action and the preparation stages were similar. This set of variables may not be sufficient to differentiate between

the stages; there may be other variables that, if added to the predictive model, may improve the ability to differentiate among the stages of change. Additional factors that may have contributed to the limited explanatory power of the discriminant analysis include low association between the set of variables and stages of change and limitations inherent in the use of self-report measures. The findings indicated that age, educational level, pros, and cons had the lowest associations with stages of change, ranging from .04 to .22. Use of self-report measures may produce a self-reporting bias, in that subjects may respond in a socially desirable manner.

In conclusion, the set of variables, including TTM constructs, age, and educational level, were statistically significant discriminators which were correctly classified into the five stages of change. The precontemplation and preparation stages had the highest percentage of participants that were correctly classified (62%), while the action stage had the lowest percentage of correct classification.

## Limitations

The following is a discussion of several limitations of the present study. First, regular MPA participation was based on self-reported information. This method tends to produce a self-reporting bias because subjects may respond in a socially desirable manner. Moreover, self-reports of weekly MPA may not correspond precisely with actual MPA because individuals may have exaggerated the weekly minutes of MPA due to that bias. Second, the interior environment of each hospital where data were collected may have affected the concentration of subjects completing the questionnaires; elements such as sound, light, and the interaction between patients and physicians may have influenced

their thoughts about engaging in PA. Third, this study employed a cross-sectional design. Thus, it was impossible to draw any cause-and-effect conclusion between the independent variables and stages of readiness to adopt PA.

Fourth, the generalizability of this study is limited to a similar patient population because it included a nonprobability sample of patients at risk of CVD who participated in follow-up at four hospitals in Bangkok, Thailand, and findings may not be generalizable to similar patients in other areas of Thailand. Finally, some variables that may predict stages of readiness to adopt regular PA are not included in the present study; thus the explanation of predictive factors of readiness to change may be limited.

## Conclusions

The following conclusions were derived from the findings of this study.

1. The subjects were predominantly female, with a mean age of 54.3. Most individuals were married and had a primary school education. The common diseases related to the risk of cardiovascular disease were hypertension, diabetes, and hypertension together with hyperlipidemia.

2. The majority of subjects were in the preparation stage. Most males were in the maintenance stage. Conversely, most females were in the precontemplation and contemplation stages. The weekly MPA was 65.3 min, and most of subjects participated in leisure-time PA. The typical MPA behaviors of participants in this study were housework, walking, brisk walking, and calisthenics.

3. In terms of type of MPAs and PA behaviors, most precontemplators performed occupational PA, where as most contemplators participated in household PA. The common

PA behaviors among individuals in both stages were housework and walking. The majority of individuals in the preparation stage participated in leisure-time PA and commonly performed housework and walking. Participants in the action and maintenance stages usually performed leisure-time PA, and the most common PA behaviors were brisk walking, aerobic dance, and jogging.

4. Hypothesis 1 was partially supported. There was no significant relationship between stage of change and marital status. However, statistically significant relationships were found between stage of change and age, gender, educational level, and weekly MPA. There were moderate relationships between stage of change and weekly MPA minutes ($\eta = .75$) as well as behavioral processes ($\eta = .61$); there were weak associations ($\eta = .04$-$.46$) among age, education level, experiential processes, self-efficacy, pros, and cons across five stages of change.

5. Hypothesis 2 was supported. Participants in the precontemplation stage were the youngest, had the lowest mean education level, and tended to perform fewer weekly MPAs (< 30 min) than did participants in other stages. Conversely, in the maintenance stage, participants were the oldest, had the highest mean education level, and tended to perform more weekly MPA ( 90 min) than did participants in any other stage. Individuals in the precontemplation stage tended to use experiential processes and behavioral processes less often than did individuals in the contemplation, preparation, action, and maintenance stages. Similarly, in self-efficacy, precontemplators tended to have lower confidence in their ability to perform regular PA than did individuals in the contemplation, preparation, action, and maintenance stages. In terms of decisional balance, individuals in the maintenance stage tended to score higher for pros than did individuals in

precontemplation, contemplation, preparation, or action stages. In contrast, individuals in action stage tended to score lower for cons than did individuals in the precontemplation, contemplation, or preparation stages.

6. Hypothesis 3 was supported. Subjects in the contemplation stage tended to use the experiential processes more often than the behavioral processes. In the later stages, only participants in the maintenance stage tended to use the behavioral processes more often than the experiential processes.

7. Hypothesis 4 was supported. The pattern of the mean T scores of the pros consistently increased from precontemplation to maintenance, whereas the mean T scores of cons steadily decreased from precontemplation to action. The mean T scores of pros outweighed the mean T scores of cons in the action and maintenance stages, whereas the mean T scores of cons outweighed the mean T scores of pros in the precontemplation and contemplation stages. Moreover, the increase in the mean T scores of pros followed by a decrease in the mean T scores of cons led to a crossover at the preparation stage.

8. Hypothesis 5 was supported. The mean T scores of self-efficacy consistently increased from the precontemplation stage to the maintenance stage. The mean T scores for self-efficacy in the precontemplation stage were lower than the mean T scores for self-efficacy in the contemplation, preparation, action, or maintenance stages.

9. The set of the determinant variables, including processes of change, self-efficacy, decisional balance, age, and educational level, were entered into a predictive model to predict the stages of readiness. The overall predictive model was able to classify stages of change correctly for 62.0% of the total subjects ($n = 436$).

## Implications

The empirical data from this study adds to the existing knowledge of MPA adoption in Thai patients at risk for CVD. Based on the findings of this study, the implications for nursing practice, nursing education, and nursing research are discussed as follows.

### *Implication for Nursing Practice*

#### *Providing Physical Activity Program Based on TTM*

One potential implication of this study is that it can guide health care providers in the design and implementation of strategies to encourage people to adopt regular PA behaviors. TTM can enhance the probability of successful PA behavior change by developing interventions matched to the specific stage of change that individuals presently occupy. Tailoring interventions to an individual's specific stage of change for PA behaviors may encourage an individual in the early stages (precontemplation, contemplation, or preparation) to seriously consider progression to the later stages (action or maintenance) of regular MPA adherence. Such intervention design will serve people's needs and help facilitate the achievement of a high participation rate. Most participants in this study were in the preparation stage, which is the most appropriate stage for recruitment into a PA program. Based on the findings of this study and the TTM constructs, a discussion of the characteristics of intervention follows.

*Processes of change.* This study did not investigate each process of change individually; however, 10 processes of change were grouped into two second-order

factors, the five experiential and five behavioral processes of change. Thus, the implications of intervention are described with regards to the experiential and behavioral processes of change.

A stage-matched PA promotion intervention (tailoring interventions) for individuals in the early stages focuses on the five experiential processes to increase awareness of costs and benefits of PA and encourages individuals to think about engaging in regular PA. The major content of experiential processes is composed of cognitive, affective, and evaluative processes, which should be a focus for intervention in the early stages of change. For individuals in the later stages, the focus should place more emphasis on the behavioral processes, including commitments, conditioning, reinforcement, environmental controls, and support to encourage individuals to begin PA and to initiate different strategies to maintain regular PA. For example, to help people progress from precontemplation to contemplation, health providers need to apply the experiential processes by focusing on increasing awareness of perceived costs and benefits of PA, such as consciousness-raising and dramatic relief. Conversely, applying the behavioral processes, such as reinforcement management, counter conditioning, and stimulus control to people in precontemplation can decrease the retention rate in the PA program.

*Self-efficacy.* Self-efficacy is an individual's confidence in being able to successfully performing regular PA. The self-efficacy scores increased constantly across five stages of change. The impact of self-efficacy on PA is generally the greatest during the early stages of behavior change. Thus, interventions for self-efficacy should be promptly emphasized in every stage from the precontemplation to maintenance stages, and particu-

larly for individuals in the early stages (precontemplation, contemplation, and preparation). The content of the intervention should assist individuals confronting difficult situations that increase resistance in individuals participating in regular PA and should guide them in dealing with such situations until the individual's confidence increases in his or her ability to engage in regular PA.

*Pros & cons.* Intervention should focus on increasing the pros of changing among pecontemplators, a strategy that may lead those precontemplators to progress to the contemplation stage. Once this progress has occurred, intervention should then focus on decreasing the cons of changing among individuals in the contemplation stage so that they can further progress to the preparation stage. Before regular PA is achieved, the pros and cons of changing intersect at the preparation stage; this cross-over can provide an indication to health care providers that an individual is ready to progress to the action stage.

In this study, the pros and cons of changing intersected during the preparation stage, meaning that individuals perceived the pros as being equal to the cons. Thus, intervention at the preparation stage should emphasize the benefits (pros) of engaging in regular PA as well as decreasing the costs (cons) to facilitate individual progression from the preparation stage to the action stage. This emphasis should continue throughout the transition to the maintenance stage because individuals in the maintenance stage can relapse if the cons become higher than the pros; therefore, the intervention in this stage should focus on how to assist people in keeping the cons at a low level related to pros.

*Increasing the Knowledge of New Recommendation of Regular PA*

In the present study, the most commonly cited PA behaviors by individuals in the early stages were housework, walking, and calisthenics; some of them perceived regularly performed housework as a type of regular exercise that provides health benefits. Moreover, most participants only emphasized or valued the frequency component of exercise participation, with less emphasis on other aspects of PA such as intensity, duration, and type. These misperceptions about PA should be clearly identified, and recommendations for regular MPA should be clearly conveyed.

Nurses must effectively explain the health benefits of engaging in MPA, the recommendation criteria, and dose-response for MPA including: types, frequency, duration, and intensity level. Using language that is more understandable for health providers and patients who have a low level of education is preferable, making certain to consistently distinguish between the terms exercise behavior and PA and clearly explain the difference in the meanings of these phrases. Interestingly, knowledge of the criteria for each intensity level has been typically ignored among health care providers and individuals although it is a necessary factor for optimizing health benefits. Moderate intensity PA is highly recommended for all individuals and should be emphasized.

In practice, moderate-intensity PA should be explained in the easiest manner for uneducated people to understand. Sing-Talk-Gasp is the simplest method to distinguish the three intensity levels. For example, if individuals are able to sing while they are exercising, the activity is defined as light-intensity. If they do not have enough breath to sing but they are still able to talk in sentences, moderate-intensity activity is being performed. Additionally, ACSM (2001) recommends an alternative method for those

whose goal of PA is improved health; under this method an adequate definition of moderate intensity might be hard enough to increase breathing, but not too hard to make you breathless or exhausted. In this study, the Sing-Talk-Gasp method was applied as the criteria for moderate-intensity PA.

*Initiating MPA at the community level*

Most female participants performed light-intensity PA such as housework and walking as part of their regular PA. Thus, nurses should help the patient to identify ways to engage in moderate-intensity activity using lifestyle PA as a form of exercise. Therefore, people can get health benefits without the need to find additional time to be active. A focus on shorter bouts of activity, such as three 10-min bouts throughout the day, is a more practical alternative method for women to achieve the duration criterion of at least 30 min daily. The criteria for accumulated short-bouts activity are at least two to three times per day, 10-15 min per sessions to achieve at least 30 min daily for a minimum of 5 days per week, at a moderate-intensity level. During the day, individuals may perform a variety of lifestyle PAs. Relevant examples include: 10 min of heavy house cleaning, a brisk 15-min walk to the market, 15 min of calisthenics. Moreover, individuals are able to apply occupational PA as accumulated short bouts of activity at moderate intensity. Relevant examples include: brisk walking around the work place building for 10 min, walk from the work place to the bus station or parking area for 10 min, using the stairs walk instead of using an elevator in the office building for 10 min. Interestingly, the finding of this study showed that brisk walking was the most common MPA behavior that individuals who met the recommendation performed. Therefore, brisk walking should be

recommended. Brisk walking does not require special equipment other than comfortable shoes. Furthermore, it can easily be scheduled because people can perform it individually, and it has less risk for injury than other types of PA.

These PAs demonstrate that individuals can perform various types of PAs in their daily lives without the need to find additional time. However, individuals have to follow the criteria for moderate intensity, duration, and frequency. Nurses who work at the community level should initiate several types of public health campaigns, such as media campaigns, that can encourage individuals in the early stages of change (precontemplation, contemplation, and preparation) to adopt regular MPA.

## *Implication for Nursing Education*

### *Increasing Knowledge of Moderate-intensity PA and TTM*

The benefits of engaging in regular PA as defined in this study are not commonly known in Thailand; however, most health care providers are familiar with traditional exercise routines. Thus, health care professionals and professional organizations need to increase public knowledge of the new recommendations of regular PA. Professional organizations need to continue to develop and evaluate methods for training health professionals to promote regular PA in the community, including (a) the development of standard curricula for training nurses and other health professionals in the promotion of regular PA among their clientele, (b) multidisciplinary collaborations for PA adoption by bringing together exercise scientists and instructors with behavioral and social scientists, and other health professionals, and (c) continuing education programs and ongoing development of certification for promoting lifestyle PAs.

The findings of this study demonstrated that TTM can be applicable for promoting regular PA in Thai patients at risk for CVD. Thus, TTM should be included in the health promotion theory curriculum in order to enhance knowledge for nurses' and nursing students' understanding of how to help people adopt new behavior. Nurses need to know how to assess the level of an individual's intention and how to provide information and methods that match their needs. Thus, the knowledge of TTM should be extended among nurses and nursing students. Stage-match intervention should be demonstrated appropriately to encourage nurses and nursing students to use stages of change and other concepts of TTM as a method to facilitate individuals' engaging in regular PA. Moreover, continuing training programs that integrate theoretical approaches to promote regular PA should be provided.

### *Implication for Nursing Research*

The findings showed that TTM can be applied in Thai population. However, the results are not able to clearly identify how individuals use processes of change, perceive self-efficacy, and perceive pros and cons while they progress from an earlier stage to a later stage or relapse to an earlier stage. Thus, a longitudinal design, with at least a 6-month follow-up should be employed in order to demonstrate the pattern of the processes of change, self-efficacy, and the pros and cons as the individual moves back and forth through the five stages of change. Knowing the pattern of those constructs in the Thai population can enhance the applicability and validity of TTM. Additionally, social factors and physical environment factors can provide a number of barriers to and facilitators of

regular PA, and can determine the success or failure of regular PA interventions; thus, they should be added in the predictive model.

## Recommendations for Future Research

Recommendations for Future Research are as follows:

1. Gaining a true picture of the current PA levels at which individuals are receiving cardiovascular health benefits is complicated. Thus, researchers need to develop and utilize a more sensitive instrument that measures formal and informal PAs related to the recommendation for cardiovascular health benefits.

2. More research is needed to test the applicability of TTM across a broad range of health behaviors with a variety of population groups, such as workplace populations, adolescents, working-age groups, older persons, and groups with differing levels of health status.

3. An exploration of the causal relationships between the TTM core constructs, including processes of change, self-efficacy, and decisional balance across the five stages of change is highly recommended. Future studies need to use longitudinal and experimental research designs that follow individuals through the five stages so that the patterns of the processes of change, self-efficacy, and the pros and cons can be evaluated as individuals progress through the five stages of change.

4. Future studies should test the effectiveness of various interventions conducted in clinical settings, worksite settings, and various community settings to provide behaviorally tailored interventions that match individuals' motivational readiness for physical-activity adoption based on TTM.

5. In determining the effectiveness of PA interventions, few studies follow adoption behavior among participants longer than one year, and many studies intervene with participants for only 3 to 6 months; moreover, many follow-up investigations of PA indicate that the adopted PA behavior ends shortly after the program is terminated. Thus, strategies that enable health care teams to promote the long-term maintenance of PA need to be developed through research on both short-term and long-term effects of interventions.

6. Future research should also investigate the social factors (e.g., family environment and structure, social support, and social roles) and physical environment factors (e.g., type and accessibility of recreational facilities, availability and safety of walking and cycling paths) that may influence the adoption and main-tenance of PA in a variety of population groups. Those factors can provide a number of barriers to and facilitators of regular PA which can determine the success or failure of interventions.

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# APPENDIX A

# INSTITUTION REVIEW BOARD APPROVAL

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

*Institutional Review Board for Human Use*

Form 4: IRB Approval Form
Identification and Certification of Research
Projects Involving Human Subjects

The Institutional Review Board for Human Use (IRB) has an approved Multiple Project Assurance with the Department of Health and Human Services and is in compliance with 21 CFR Parts 50 and 56 and ICH GCP Guidelines. The Assurance became effective on January 1, 1999 and the approval period is for five years. The Assurance number is M-1149.

| | |
|---|---|
| Principal Investigator: | PANIDCHAKUL, KULTIDA |
| Co-Investigator(s): | |
| Protocol Number: | **X020314003** |
| Protocol Title: | *Determinants of Readiness to Adopt Regular Physical Activity among Thai Patients at Risk of Cardiovascular Disease: A Transtheoretical Model* |

The IRB reviewed and approved the above named project on 04/10/02. The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services. This Project will be subject to Annual continuing review as provided in that Assurance.

This project received EXPEDITED review.

IRB Approval Date: 4-10-02

Date IRB Approval Issued: 04/11/02

Marilyn Doss

Marilyn Doss, M.A.
Vice Chair of the Institutional Review
Board for Human Use (IRB)

Investigators please note:

The IRB approved consent form used in the study must contain the IRB approval date and expiration date.

IRB approval is given for one year unless otherwise noted. For projects subject to annual review research activities may not continue past the one year anniversary of the IRB approval date.

Any modifications in the study methodology, protocol and/or consent form must be submitted for review and approval to the IRB prior to implementation.

Adverse Events and/or unanticipated risks to subjects or others at UAB or other participating institutions must be reported promptly to the IRB.

470 Administration Building
701 20th Street South
205.934.3789
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irb@uab.edu

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Mailing Address:
AB 470
1530 3RD AVE S
BIRMINGHAM AL 35294-0104

# APPENDIX B

## SUBJECT CONSENT FORM

# CONSENT FORM

**Title of Research:** Determinants of Readiness to Adopt Regular Physical Activity among Thai Patients at risk of Cardiovascular Disease: A Transtheoretical Model

**Investigator:** Ms. Kultida Panidchakul

**Faculty Advisor:** Dr. Michael Weaver

**Sponsor:** Self-funded

## Explanation of Procedures

You are being asked to participate in a research study because you have hypertension, diabetes and/or hyperlipidemia. The purposes of the project are to describe the stages of readiness to adopt regular physical activity and to explain the determinant factors related to regular physical activity adoption. The study is being conducted by Ms. Kultida Panidchakul, who lives in Thailand and is currently a doctoral student in nursing at the University of Alabama at Birmingham, the United States of America.

If you decide to participate in this study, you will be asked to complete a questionnaire while waiting for clinic services. It will take about 20 to 30 minutes to finish the questionnaire. When you complete the questionnaire, please return it to the investigator. Then, the investigator will briefly review your questionnaire to see all questionnaires were answered, unless you did not want to respond to that item. After reviewing questionnaire, the investigator will keep the completed questionnaire in an envelope. Please be assured that all of your responses will remain confidential. The interpretations and reports will be presented as a whole group; therefore, your identity will not be revealed.

## Risks and Discomforts

The only risk associated with participating in this study is that answering questions about your regular physical activity behavior may cause you to feel briefly uncomfortable. If you feel uncomfortable responding to any of the items, you are free, to not respond to that item or to withdraw your consent and discontinue participation in this study. There are no other known risks or discomforts associated with participation in this study.

## Benefits

You may not personally benefit from your participation in this study. However, your responses on the questionnaire may provide valuable information about the determinants of readiness to adopt regular physical activity in Thai adults at risk of CVD. The information will be used to develop and implement appropriate health promotion programs for Thai adults at risk of CVD aimed at promoting exercise behavior and well-being to you and others.

 RB Version date April 10, 2002 Participant's Initials.....

ed 04/10/02

Expiration 04/10/03

Confidentiality

The information gathered from the study will be kept confidential. The questionnaire will be coded with numbers. No names or any identifying information will be used; only group data will be reported. For auditing purposes, the University of Alabama at Birmingham Institutional Review Board for Human Use, Birmingham, Alabama, USA, may review the research records and have access to confidential information which identify you by code number. Although the results of this project may be published for scientific purposes, your identity will not be revealed.

Withdrawal without Prejudice

You are free to withdraw your consent and to discontinue participation in this study at any time without penalty. The care you receive from this clinic is not associated with this study.

Costs from Participation in Research

There will be no cost to you to participate in this research.

Payment for Participation in the Research

You will not be paid for responding to the questionnaire.

Payment for Research-Related Injuries

The University of Alabama at Birmingham (UAB) has made no provisions for monetary compensation in the event of injury resulting from the research.

Questions

If you have any questions about this research, Ms. Kultida Panidchakul will be glad to answer your questions. Ms. Kultida can be reached at number 510-1413. She will be living in Thailand from April 26 to October 20, 2002. You may also contact Dr. Michael Weaver, the investigator's advisor, at the School of Nursing, the University of Alabama at Birmingham, 1701 University Boulevard, Birmingham, Alabama 35294-1210, the United States of America. His e-mail address is weaverm@uab.edu. If you have any questions about your rights as a research participant, Ms. Sheila Moore, Director of the UAB Institutional Review Board for Human Use (IRB), will be glad to answer them. Her address is the University of Alabama at Birmingham, 470 Administration Building, 701 20th Street South, Birmingham, Alabama 35294-0104. Ms. Moore's e-mail address is smoore@uab.edu

Legal Rights

You are not waiving any of your legal rights by signing this consent form.

Signatures

You will receive a copy of this informed consent. Your signature below indicates that you agree to participate in this study.

| | |
|---|---|
| Signature of Participant or Legally Authorized Representative | Date |
| Signature of Investigator | Date |
| Signature of Witness | Date |

# APPENDIX C

# BATTERY OF INSTRUMENTS

## Personal Data

Direction: The following questions are to obtain additional information about yourself. For each question, please answer by writing and checking " "only one the number that best describes your personal information.

1. What is your age?

   ------ years

2. What is your gender?

   (1) ------ Male

   (2) ------ Female

3. What is your marital status?

   (1) ------- Single (never married)

   (2) ------ Married

   (3) ------ Widowed

   (4) ------ Divorced/ Separated

   (5) ------ Other, please specify ----------

4. What is the highest level of education you have completed?

   (1) ------ Primary level (1-6 years)

   (2) ------ Lower secondary level (7-10 years)

   (3) ------Upper secondary level (11-12 years)

   (4) ------ Vocational education (Certificate level)

   (5) ------ College or University

   (6) ------Other, please specify ----------

## Regular Physical Activity Questionnaire

Direction: Please indicate the level of intensity, duration, frequency, and type of PA according to the meaning of **the level of intensity** behind by checking " "more than one statement that best describe your current physical activity.

**Intensity:** **Light-intensity (able to sing while performing physical Activity)**

**Type:** leisure-time PA Occupational PA

Household PA Other, please specify.....

Please lists the types of physical activity behavior that you usually perform.

---

---

**Intensity:** **Moderate-intensity** ( a level that increases your breathing rate until you do not have enough breath to sing, but you are still able to talk in sentences)

**Duration:** How long do you usually perform physical activity per session?

**Frequency**: How often do you usually perform physical activity per day?

: How many days do you usually perform physical activity per week?

**Type:** leisure-time PA Occupational PA

Household PA Other, please specify.....

Please lists the types of physical activity behavior that you usually perform.

---

---

**Intensity** **Vigorous Intensity (unable to talk in sentences while performing physical activity, and are gasping for breathe)**

**Duration:** How long do you usually perform physical activity per session?

**Frequency**: How often do you usually perform physical activity per day?

: How many days do you usually perform physical activity per week?

**Type:** leisure-time PA Occupational PA

Household PA Other, please specify.....

Please lists the types of physical activity behavior that you usually perform.

---

---

## Part 1: Stages of Change

Regular Physical Activity is any physical activities or exercise (e.g., stair walking, gardening, brisk walking, aerobics, jogging, bicycling, swimming, rowing, etc.) performed to increase physical fitness. Such activity should be performed at least 3 to 5 times per week, at moderate intensity for 30-60 minutes per session, it is also possible to accumulate three short-bouts of activity at least 10-15 minutes per session 5 days per week or preferably everyday.

Physical Activity does not have to be painful to be effective but should be done at a level that increases your breathing rate until you do not have enough breath to sing, but you are still able to talk in sentences.

Direction: Please indicate your readiness to perform regular exercise according to the meaning of **regular physical activity** above by checking " " only one statement that best describe your current exercise activity.

1. ------ I currently do not exercise, and I **do not intend to start** exercising in the next six months.

2. ------ I currently do not exercise, but I am **thinking about starting** to exercise in the next 6 months.

3. ------ I currently exercise some, but I **plan to start in next 30 days.**

4. ------ I am currently exercising regularly, but I have only begun **doing so within the last 6 months.**

5. ------ I currently exercise regularly and **have done so for longer than 6 months.**

## Part 2: Process of Change

The following experiences can affect the exercise habits of some people. Think of similar experiences you may be **currently having or have had during the past month.**

Direction: Please indicates how frequently each of the following experience occurs by circling the one number that best describes your experience.

| Statements | Never<br>1 | Seldom<br>2 | Occasionally<br>3 | Often<br>4 | Repeatedly<br>5 |
|---|---|---|---|---|---|
| 1. I read articles about how exercise would lower my risks for heart disease. | 1 | 2 | 3 | 4 | 5 |
| 2. I believe that regular exercise will make me a healthier and happier person. | 1 | 2 | 3 | 4 | 5 |
| 3. I have someone who helps me with my job, so that I have free time to exercise. | 1 | 2 | 3 | 4 | 5 |
| 4. I look for information about exercise in an attempt to learn more about it. | 1 | 2 | 3 | 4 | 5 |
| 5. I feel better about myself when I exercise regularly. | 1 | 2 | 3 | 4 | 5 |
| 6. One of the rewards of regular exercise is that it could improve my blood pressure levels, blood sugar and/or blood lipid levels. | 1 | 2 | 3 | 4 | 5 |
| 7. I find out about new methods of exercising that fit me. | 1 | 2 | 3 | 4 | 5 |
| 8. I have noticed that more people are exercise regularly. | 1 | 2 | 3 | 4 | 5 |
| 9. Performing exercise is a time to relax my mind as well as doing something good for my body. | 1 | 2 | 3 | 4 | 5 |
| 10. I get upset when I think about my lack of regular exercise. | 1 | 2 | 3 | 4 | 5 |
| 11. I am aware of more and more people who are making exercise a part of their daily lives. | 1 | 2 | 3 | 4 | 5 |

| Statements | Never 1 | Seldom 2 | Occasionally 3 | Often 4 | Repeatedly 5 |
|---|---|---|---|---|---|
| 12. If I engage in regular exercise, I find that I get the benefit of having more energy. | 1 | 2 | 3 | 4 | 5 |
| 13. I am afraid of the consequences to my health if I do not exercise. | 1 | 2 | 3 | 4 | 5 |
| 14. I have noticed that famous people often advertise the fact that they exercise regularly. | 1 | 2 | 3 | 4 | 5 |
| 15. I tell myself that I can keep exercising if I try hard enough. | 1 | 2 | 3 | 4 | 5 |
| 16. I get upset when I realize that I would have better health if I exercised. | 1 | 2 | 3 | 4 | 5 |
| 17. I make commitments to exercise. | 1 | 2 | 3 | 4 | 5 |
| 18. When I feel tired, I exercise anyway because I will feel better afterwards. | 1 | 2 | 3 | 4 | 5 |
| 19. I realize that if I don't exercise regularly, my blood pressure levels, blood sugar and/or blood lipid levels may not be controlled and I may become a burden to others. | 1 | 2 | 3 | 4 | 5 |
| 20. Instead of taking a nap, relaxing by eating or watching TV, I take a walk or exercise. | 1 | 2 | 3 | 4 | 5 |
| 21. I believe that I can exercise regularly. | 1 | 2 | 3 | 4 | 5 |
| 22. I realize that I might be able to influence others to be healthier if I exercise regularly. | 1 | 2 | 3 | 4 | 5 |
| 23. When I'm feeling stressed, I find exercise is a great way to relieve my tension. | 1 | 2 | 3 | 4 | 5 |
| 24. I keep a set of exercise clothes and shoes conveniently located so I can exercise whenever I get the time. | 1 | 2 | 3 | 4 | 5 |
| 25. I think that regular exercise plays a role in reducing my health care costs. | 1 | 2 | 3 | 4 | 5 |

| Statements | Never 1 | Seldom 2 | Occasionally 3 | Often 4 | Repeatedly 5 |
|---|---|---|---|---|---|
| 26. I have someone who encourages me to exercise when I don't feel up to it. | 1 | 2 | 3 | 4 | 5 |
| 27. I schedule my exercise time to make sure that I always have time available to exercise regularly. | 1 | 2 | 3 | 4 | 5 |
| 28. I feel better when I can keep up with my exercise. | 1 | 2 | 3 | 4 | 5 |
| 29. I have someone who provides useful information about my exercising. | 1 | 2 | 3 | 4 | 5 |
| 30. I post notes to remind me to exercise regularly at home. | 1 | 2 | 3 | 4 | 5 |

## Part 3: Self-Efficacy

This part asks about how confident you are to perform exercise when other things get in the way.

Direction: Please indicate how confident you are to perform exercise in each of the following situations by circling the one number that best expresses your confidence level.

How **confident** are you that you could participate in regular exercise when:

| Statements | Not at all confident 1 | Somewhat confident 2 | Moderately confident 3 | Very confident 4 | Extremely confident 5 |
|---|---|---|---|---|---|
| 1. I am under a lot of stress. | 1 | 2 | 3 | 4 | 5 |
| 2. I am tired. | 1 | 2 | 3 | 4 | 5 |
| 3. I feel I don't have the time. | 1 | 2 | 3 | 4 | 5 |
| 4. I am busy. | 1 | 2 | 3 | 4 | 5 |
| 5. My exercise partner decides not to exercise that day. | 1 | 2 | 3 | 4 | 5 |
| 6. I have to exercise alone. | 1 | 2 | 3 | 4 | 5 |
| 7. I do not have access to exercise equipment. | 1 | 2 | 3 | 4 | 5 |

| Statements | Not at all Confident 1 | Somewhat Confident 2 | Moderately Confident 3 | Very Confident 4 | Extremely Confident 5 |
|---|---|---|---|---|---|
| 8. I do not feel safe. | 1 | 2 | 3 | 4 | 5 |
| 9. I am spending time with friends or family who do not exercise | 1 | 2 | 3 | 4 | 5 |
| 10. The weather is too hot, cold, or wet outside. | 1 | 2 | 3 | 4 | 5 |

## Part 4: Decisional Balance

The following statements below describe pro and con aspects of exercise.

Directions: Please circle the one numbers that best indicates how important each of the following statements is to your decision to exercise or not to exercise in your leisure time. If you disagree with a statement below and are unsure how to answer, the statement is probably not important to you.

| Statements | Not important 1 | Somewhat important 2 | Moderately important 3 | Important 4 | Extremely important 5 |
|---|---|---|---|---|---|
| 1. I would have more energy for my family and friends if I exercised regularly. | 1 | 2 | 3 | 4 | 5 |
| 2. Regular exercise would help me relieve tension. | 1 | 2 | 3 | 4 | 5 |
| 3. I think I would be too tired to do my daily work after exercising. | 1 | 2 | 3 | 4 | 5 |
| 4. I would have more energy to perform routine physical tasks if I exercised regularly. | 1 | 2 | 3 | 4 | 5 |
| 5. I would sleep better if I exercised regularly. | 1 | 2 | 3 | 4 | 5 |
| 6. I feel uncomfortable when I exercise because I got out of breath and my heart beats very fast. | 1 | 2 | 3 | 4 | 5 |

| Statements | Not important 1 | Somewhat important 2 | Moderately important 3 | Important 4 | Extremely important 5 |
|---|---|---|---|---|---|
| 7. I would feel good about myself if I kept my commitment to exercise regularly. | 1 | 2 | 3 | 4 | 5 |
| 8. I would like my body better if I exercise regularly. | 1 | 2 | 3 | 4 | 5 |
| 9. I think it would be difficult to find an exercise activity that I enjoy. | 1 | 2 | 3 | 4 | 5 |
| 10. Regular exercise would take too much of my time. | 1 | 2 | 3 | 4 | 5 |
| 11. I could control blood sugar level, lipid levels, and/or blood pressure levels if I exercised regularly. | 1 | 2 | 3 | 4 | 5 |
| 12. My heart and lungs would Strengthen if I exercised regularly. | 1 | 2 | 3 | 4 | 5 |
| 13. I would have less time for my family and friends if I exercised regularly. | 1 | 2 | 3 | 4 | 5 |
| 14. I could control appropriate weight when I exercised regularly. | 1 | 2 | 3 | 4 | 5 |
| 15. At the end of day, I am too exhausted to exercise. | 1 | 2 | 3 | 4 | 5 |
| 16. Regular exercise would help me have a more positive outlook on life. | 1 | 2 | 3 | 4 | 5 |

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**Graduate Program** Nursing

**Title of Dissertation** Determinants of Readiness to Adopt Regular Physical Activity Among Thai Patients at Risk of Cardiovascular Diseases: A Transtheoretical Model

**I certify that I have read this document and examined the student regarding its content. In my opinion, this dissertation conforms to acceptable standards of scholarly presentation and is adequate in scope and quality, and the attainments of this student are such that she may be recommended for the degree of Doctor of Philosophy.**

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