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A CAUSAL MODEL OF PHYSICAL ACTIVITY IN HEALTHY OLDER THAI PEOPLE

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มยุรี ลี่ทองอิน: โมเดลเชิงสาเหตุของการมีกิจกรรมทางกายของผู้สูงอายุไทย (A CAUSAL MODEL OF PHYSICAL ACTIVITY IN HEALTHY OLDER THAI PEOPLE): อ.ที่ปรึกษาวิทยานิพนธ์หลัก: รศ.ดร. จินตนา ยูนิพันธุ์, อ.ที่ปรึกษาวิทยานิพนธ์ร่วม: รศ. ร.ต.อ. หญิง ดร. ยุพิน อังสุโรจน์, 303 หน้า.

การวิจัยครั้งนี้มีวัตถุประสงค์เพื่อพัฒนา และทดสอบโมเดลที่ใช้ในการอธิบายการมีกิจกรรมทางกายของผู้สูงอายุไทย ซึ่งประกอบด้วย ความเชื่อมั่นในความสามารถของตนเอง ความคาดหวังผลลัพธ์ด้านบวก ความคาดหวังผลลัพธ์ด้านลบ อายุ การสนับสนุนทางสังคม และสิ่งแวดล้อมทางกายภาพ กลุ่มตัวอย่างได้แก่ผู้สูงอายุไทยจำนวน 320 คน ที่ได้มาโดยการสุ่มตัวอย่างแบบหลายขั้นตอน จาก 12 ชุมชน ใน 6 ภาคของประเทศไทย เก็บรวบรวมข้อมูลโดยใช้แบบบันทึกข้อมูลส่วนบุคคล แบบทดสอบสภาพจิตจุฬา แบบสอบถามความเชื่อมั่นในความสามารถของตนเองต่อการมีกิจกรรมทางกาย แบบสอบถามความคาดหวังผลลัพธ์ด้านบวกจากการมีกิจกรรมทางกาย แบบสอบถามความคาดหวังผลลัพธ์ด้านลบจากการมีกิจกรรมทางกาย แบบสอบถามแรงสนับสนุนทางสังคมเพื่อการมีกิจกรรมทางกาย แบบสอบถามการสนับสนุนสิ่งแวดล้อมทางกายภาพเพื่อการมีกิจกรรมทางกาย และแบบสอบถามการมีกิจกรรมทางกายของผู้สูงอายุไทย วิเคราะห์ข้อมูลโดยใช้สถิติเชิงพรรณนา และสมการโครงสร้าง

ผลการศึกษาพบว่า โมเดลมีความกลมกลืนกับข้อมูลเชิงประจักษ์ และตัวแปรที่อยู่ในโมเดลสามารถร่วมกันอธิบายความผันแปรของการมีกิจกรรมทางกายของผู้สูงอายุไทยได้ร้อยละ 65 ทั้งนี้ปัจจัยที่มีอิทธิพลต่อการมีกิจกรรมทางกายมากที่สุดคือ ความเชื่อมั่นในความสามารถของตนเองมีอิทธิพลทั้งทางตรงและทางอ้อมผ่านความคาดหวังผลลัพธ์ด้านลบจากการมีกิจกรรมทางกาย ความคาดหวังผลลัพธ์ด้านบวกไม่มีอิทธิพลต่อการมีกิจกรรมทางกาย ความคาดหวังผลลัพธ์ด้านลบ สิ่งแวดล้อมทางกายภาพ และอายุมีอิทธิพลทางตรงต่อกิจกรรมทางกาย และการสนับสนุนทางสังคมมีอิทธิพลทางอ้อมต่อการมีกิจกรรมทางกายผ่านความเชื่อมั่นในความสามารถของตนเอง อย่างไรก็ตามความคาดหวังผลลัพธ์ด้านบวกทำหน้าที่ตัวแปรส่งผ่านระหว่างความเชื่อมั่นในความสามารถของตนเองกับการมีกิจกรรมทางกาย แต่ไม่มีนัยสำคัญ

ผลการวิจัยบ่งชี้ว่าโมเดลการมีกิจกรรมทางกายสามารถอธิบายและทำนายการมีกิจกรรมทางกายของผู้สูงอายุไทยได้ การจัดกิจกรรมการพยาบาลที่ครอบคลุมการเพิ่มความเชื่อมั่นในความสามารถของตนเอง การลดความคาดหวังผลลัพธ์ด้านลบจากการมีกิจกรรมทางกาย การส่งเสริมการสนับสนุนทางสังคมและสิ่งแวดล้อมทางกายภาพ ควรส่งเสริมผู้สูงอายุไทยให้มีกิจกรรมทางกาย

สาขาวิชา : พยาบาลศาสตร์.......... ลายมือชื่อนิสิต ....

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MAYUREE LEETHONG-IN: A CAUSAL MODEL OF PHYSICAL ACTIVITY IN HEALTHY OLDER THAI PEOPLE. THESIS ADVISOR: ASSOC.PROF. JINTANA YUNIBHAND, Ph.D., THESIS CO-ADVISOR: ASSOC.PROF. POL. CAPT. YUPIN ANGSUROCH, Ph.D., 303 pp.

The purposes of this descriptive research were to develop and examine the causal relationships among self-efficacy, positive outcome expectation, negative outcome expectation, age, social support, physical environment, and physical activity among older Thai people. The sample, 320 Thai older people aged 60 years and over who resided in twelve communities within 6 sub-districts of Thailand was obtained by multi-stage random sampling. Research instruments were a personal data sheet, the Chula Mental Test, the Positive Outcome Expectations for Physical Activity, the Negative Outcome Expectations for Physical Activity, the Self-efficacy for Physical Activity, the Social Support for Physical Activity, the Environment Supports for Physical Activity, and the Physical Activity questionnaires. Data were analyzed using descriptive statistics and structural equation modeling.

The goodness of fit indices illustrated that the physical activity model fit with the empirical data, and explained 65% of the variance of physical activity in healthy older Thai people. Self-efficacy was the most influential factor affecting physical activity both direct and indirect effects through negative outcome expectations. Positive outcome expectation, age, and physical environment had a significant direct effect on physical activity. Social support had a significant indirect effect on physical activity through self-efficacy. However, the positive outcome expectation was no significant to perform as directed effect from self-efficacy to physical activity.

The study suggested that the physical activity model can explain physical activity in healthy older Thai people. The further interventions should be concerned about enhancing self-efficacy reducing negative outcome expectation reducing negative outcome expectation reducing negative outcome expectation, motivating social support, and providing physical environment to increase the physical activity of healthy older Thai people.

Field of Study : Nursing Science　　Student's Signature Mayuree Leethong-in
Academic Year : 2009　　Advisor's Signature Jintana Yunibhand
Co-Advisor's Signature Yupin Angsuroch

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CHAPTER I

INTRODUCTION

Background and significance of the study:

Physical activity is necessary for older adults to maintain health into their seniority (the U.S. Department of Health and Human Services [USDHHS], 1996; World Health Organization [WHO], 2006: online). Physical activity can be defined as "bodily movement that produces the contraction of skeletal muscles and increases energy expenditure" (p126) (Caspersen, Powell, and Christenson, 1985). A physical activity is the act of moving, as exhibited while performing for example, four types of activities, including household chores, occupational activities, transportation, and leisure activities (Caspersen et al., 1985; WHO, 2002). These activities are graded on a scale of light, moderate, or vigorous intensity (USDHHS, 1996).

Health related benefits can be obtained by following certain recommendations for participation in physical activity including doing regular, moderately intense physical activities for at least 30 minutes per day, at least 4 or 5 days of the week, for short periods of 10 minutes of activity, 3 times a day, or vigorously intense physical activities for at least 20 minutes per session, 3 or more days a week (USDHHS, 1996). A substantial amount of empirical evidence has demonstrated that the health benefits associated with participation in physical activity can maintain functional independence and ultimately improve quality of life (Bonnefoy et al., 2001; Varin Binhosen, 2003; Elavsky et al., 2005). In addition, participation in physical activity improves self-esteem, mental alertness and social interaction, as well as decreasing levels of depression (Koltyn, 2001; Houde and Melillo, 2002; WHO, 2002). Moreover, physical activity is a major independent modifiable risk factor that has a protective effect against the onset of cardiovascular disease, ischemic stroke, type 2 diabetes, and cancer (USDHHS, 1996; WHO, 1999b; Heikkinen, 2006: online; WHO, 2007: online).

However, although researchers have investigated and conducted effective programs to promote engagement in physical activity by older Thai people using a number of significant variables (Kamolporn Chathakuembong, 2008), the results from many studies indicate that elderly Thais aged 60 years and over engage in physical activity less than is recommended for good health. The amount of participation in physical activity decreased 6% among older people from 2004 to 2005 (the National Commission of the Elderly study, 2005). In addition, a survey estimated that 86.3% of the aged population perform physical activity at minimum recommended levels (ABAC Poll Research Center, 2005). Finally, in 2007 a preliminary report by the Thai National Statistical Office [NSO] (2007) showed that more than 58% of elderly Thais do not perform physical activity at a sufficient level to achieve health benefits. At the present, Thailand has one of the most rapidly aging populations among developing countries (NSO, 2005). As they grow older, Thai people experience a continuous decline in biological function, with an increase in the risk of chronic diseases and disability (Sutthichai Jitapunkul, 2001; Sutthichai Jitapunkul et al., 2003: online). Hence, when a demographic trend changes in this way, it is imperative that physical activity among the aged population is evaluated.

A review of studies on physical activity in populations reveals statistically significant determinants for engagement in physical activity, including self-efficacy, positive outcome expectation, negative outcome expectation, age, social support, and physical environment. These determinants can be organized into two categories: 1) personal variables known to be associated with physical activity including; self-efficacy, positive outcome expectation, negative outcome expectation and age; and 2) environmental variables, namely, social support and physical environment.

Numerous studies have confirmed that self-efficacy not only forms association with the physical activity of the aged but predicts the amount of the activity engaged in by the aged (Allison and Keller, 2000; Laffrey, 2000; Prapaporn Chinuntuya, 2001; McAuley et al., 2003a; Wilcox et al., 2003; Sharma, Sargent, and Stacy, 2005; Lee and Laffrey, 2006; McNeill et al., 2006b; Umstattd et al., 2006; McAuley et al., 2007). Furthermore, self-efficacy is a significant predictor of adherence to physical activity up to 6-18 months (McAuley et al., 2003a) and 2- 5 years (McAuley et al., 2007) after the older person has completed a physical activity instruction program. Regardless of the results from these studies, a strong relationship between self-efficacy and physical activity evidently exists. Thus, it is important to integrate self-efficacy into the conceptual model to examine its influence on engagement in physical activity by the elderly.

In the literature on physical activity, positive outcome expectation, which reflects a positive attitude towards physical activity has been acknowledged (Pitakpong Punta, 2004; Wannipa Asawachaisuwikrom, 2004; Anderson et al., 2006). Meanwhile, many studies have found that negative outcome expectation negatively influences older people's inclination to engage in physical activity (Prapaporn Chinuntuya, 2001; Wannipa Asawachaisuwikrom, 2001; 2004; Rovniak et al., 2002). Although the magnitude of the link between perceived positive and negative outcome expectation and physical activity has been shown, there is evidence demonstrating that positive outcome expectation is a less consistent predictor of likelihood to undertake physical activity in the elderly than negative expectation. To illustrate, Wannipa Asawachaisuwikrom (2001) examined the psychological factors associated with physical activity in elderly Thais. The researcher randomly selected participants from two sub-districts in a province of Thailand. The study confirmed that the perceived benefits of physical activity were not significantly related with engagement in physical activity (Wannipa Asawachaisuwikrom, 2001). In addition to the effect of self-efficacy, a predominant variable in the cognitive factors affecting activity levels is outcome expectation (Bandura, 1997). That is, both positive and negative outcome expectations have a mediating role on the performance of physical activity. However, few studies have confirmed this influence; for instance, a study of people aged 18-92 supported only the mediating role of positive outcome expectation (Anderson et al., 2006), while Rovniak and associates (2002) demonstrated the mediating role of negative outcome expectation in a group of university students. This study may have limited applicability to older people due to the difference in age of the subjects. Thus, a number of studies on the influence or mediating role of positive outcome expectation and negative outcome expectation on physical activity in the elderly are inconclusive.

Age has been reported to be another determinant of physical activity in older adults. Physical activity is directly impacted by the decline of physical competence resulting from the aging process (Craig, 1999). As indicated in a substantial amount of the literature on the elderly, age has a strongly negative correlation with physical activity (Booth et al., 2000; Laffrey, 2000; Wilcox et al., 2003; Pitakpong Punta, 2004; Anderson et al., 2006; Umstattd et al., 2006). Hence, age is consistently reported to be a significant determinant of physical activity in the elderly.

Not only do personal factors strongly impact physical activity among older persons but environmental determinants such as social support and physical environment have also played an important role in predicting levels of engagement in physical activity. Social support for physical activity typically is related to older peoples' perception of family and friend support in terms of participation, rewards, or punishment for pursuing physical activity (Sallis et al., 1987). Several substantial studies demonstrate that social support is confirmed to be a determinant in encouraging in and reinforcing physical activity behavior in older adults through self-efficacy (McAuley et al., 2003a; Anderson et al., 2006; McNeill et al., 2006b). Furthermore, sedentary older persons with higher social support increase their physical activity via self-efficacy at 6 months and 18 months (McAuley et al., 2003a). Additionally, participants aged 18 years or older reported that social support from friends and family influenced their interest and participation in physical activity (Wilcox et al., 2003; McNeill et al., 2006b; Umstattd et al., 2006). Thus, people with greater social support tend to show greater self-efficacy in terms of increasing their participation in physical activity. However, the mediator role of self-efficacy in older people is still inconclusive. Therefore, an indirect effect for social support on physical activity via self-efficacy in older people has not been determined conclusively.

Physical environment, such as the neighborhood, community, or home, has been investigated in relation to elderly Thais engagement in physical activity. Physical environment has been shown to play either a facilitating or an obstacular role in human motivation (Bandura, 1997). A review of relevant research indicates that the physical environment has an influence on physical activity, and the principle purpose of this study is to examine how neighborhood and community environment factors for instance, safety, traffic volume, streetlighting, unattended dogs, presence of sidewalks, and accessibility to public recreation facilities are related to older Thais engagement in physical activities (Wannipa Asawachaisuwikrom, 2001, 2004; Humpel, Owen, and Leslie, 2002; Wilcox et al., 2003; McNeil et al., 2006b). In addition, the home environment is where most older people’s daily activities take place (Dahlin-Ivanoff et al., 2007), but this environmental factor is the least studied potential determinant of participation in physical activity (Sallis et al., 1997; Booth et al., 2000). Given that older Thai people are familiar with their home surroundings, it is justified to study the home environment as a supplemental determining factor to engagement in physical activity. Studies focusing on the contribution to the physical activity of the elderly made by their physical environment including the home, neighborhood, and community, are still rare. As a consequence, findings have remained inconclusive regarding the influence of the physical environment on the physical activity habits of older Thai people.

In view of the effects of intervention on physical activity behavior among older people, the findings are inconclusive. According to a number of experimental studies and an integrative review, approximately 41-42 % of intervention studies resulted in insignificant findings (Bank-Wallace and Conn, 2002; Eden et al., 2002; Hirvensalo et al., 2003; Pomeroy, 2003; Allison and Keller, 2004; Peterson et al., 2005; van Sluijs et al., 2005; Costanzo et al., 2006; Leinonen et al., 2006; Young and Stewart, 2006). Furthermore, several studies illustrated that similar intervention as conducted by Conn and colleagues were both successful and unsuccessful in changing activity behavior results (Conn et al., 2003). As a result, the effectiveness of intervention studies has not impacted the promotion of physical activity in older adults. It is considered that the prevalence of insufficient physical activity in older adults has therefore increased. Thus, the existing knowledge of intervention reflected the need to explore what and how the determinants affect physical activity.

Although prior physical activity researches have been designed to test descriptive to prescriptive levels, it is unclear on whether the direct and indirect influences of important determinant have been consistent. A considerable number of studies have supported the existence of an association between physical activity and significant variables including self-efficacy, positive outcome expectation, negative outcome expectation, age, social support and physical environment with different levels of support for each variable. However, a model incorporating the total effect of these determinants has not been applied in studies on older people. Subsequently, understanding the causality of these variables and their effect on physical activity in the entire model is also required. Additionally, the previous physical activity model could be explained a low strength of the structural relationships by multiple theoretical frameworks such as social cognitive theory (SCT) (Dergance et al., 2003; Netz and Raviv, 2004; Gee, 2005), Social support (Banks-Wallace and Conn, 2002; Peterson et al., 2005), Health Promotion Model (HPM) (Wannipa Asawachaisuwikrom, 2001; 2004; Prapaporn Chinuntuya, 2001; Pitakpong Punta, 2004), and The Neuman Systems Model (Varin Binhosen, 2003). Consequently, it is wondering if there any other determinants including in the new model with based on a theory that can appropriate explain the variance of physical activity for older people.

A central concept in the nursing paradigm is the interrelationship between person and environment. So, the causal relationships of these variables in any account of physical activity behaviors may be explained and understood by using a multidimensional framework, as afforded by Social Cognitive Theory (SCT). SCT explains how people attain and maintain their behavior with a model which attempts to account for the interaction between behavior, personal, and environmental factors (Bandura, 1986). That is, personal and environmental factors can have both a direct and indirect influence on engagement in certain behaviours. Moreover, the chronological ordering of these variables reveals confidence in the effect of the variables on participation in physical activity by the elderly that can be used in structural equation modeling (SEM) which permits the analysis of a variable's direct, indirect, and total effects (Kline, 2005). Therefore, the existing gap in knowledge regarding older people's participation in physical activity can be filled by developing a purposeful model integrating these variables following SCT criteria and using an analysis in accordance with SEM principles.

For these reasons, the physical activity model in the present study has been developed based on the relevant literature and is guided by the principles of SCT. This model consists of 6 variables: self-efficacy, positive outcome expectation, negative outcome expectation, age, social support, and physical environment which are examined to explain participation in physical activity. The proposed model of physical activity, therefore, will provide an understanding of the effect of the various determinants on the physical activity of elderly Thais so that nurses, other health-care providers, and researchers may develop effective intervention approaches by enhancing significant variables that will help the older person to perform and maintain physical activity as a regular part of their life. The findings will provide useful recommendations for the allocation of resources for health-promotion programs for the aged. Moreover, the knowledge derived from theory and research will more effectively explain nursing phenomena and provide a valuable tool to nursing science.

Research questions

1. Do self-efficacy, positive outcome expectation, negative outcome expectation, age, and physical environment have a direct effect on physical activity of the elderly?

2. Does social support have an indirect effect on physical activity through self-efficacy?

3. Does self-efficacy have an indirect effect on physical activity through positive outcome expectation and negative outcome expectation?

4. Does the hypothesized causal model explaining physical activity among older Thai people in view of their self-efficacy, positive outcome expectation, negative outcome expectation, age, social support, and physical environment adequately fit the data?

Purpose of the study

1. To develop a causal model to explain physical activity of elderly Thais taking into consideration the significance of self-efficacy, positive outcome expectation, negative outcome expectation, age, social support, and physical environment.

2. To examine the causal relationships between variables including self-efficacy, positive outcome expectation, negative outcome expectation, age, social support, and physical environment on physical activity among older Thai people.

Conceptual framework

The theoretical framework of the present study is guided by SCT (Bandura, 1986; 1997) in order to explain and predict the physical activity among older Thai people within a nursing perspective. The research model was developed by integrating SCT with significant variables from empirical knowledge including age, self-efficacy, positive outcome expectation, negative outcome expectation, social support, and physical environment. The interrelationships among these variables in the model are detailed as follows**:**

Based on the proposed conceptual model in the present study, it is claimed that self-efficacy influences older people's physical activity performance through its cognitive function. An individual with high self-efficacy is more likely to attempt to perform physical activity and to continue their efforts in the face of barriers. Most empirical research has supported that self-efficacy is strongly correlated with physical activity for older people (Allison and Keller, 2000; Booth et al., 2000; Laffrey, 2000; McAuley et al., 2003a; Wilcox et al., 2003; Anderson et al., 2006; Lee and Laffrey, 2006; McNeill et al., 2006b; Umstattd et al., 2006). Therefore, older people increasingly perform and maintain a higher performance of physical activity if they have a greater sense of self-efficacy.

In addition, SCT posits that self-efficacy is a major determinant of outcome expectations (Bandura, 1986; 1997). Bandura (2001) postulates that expectations of benefit outcomes depend on people's belief in their capabilities which thus affects their behavior. This is because highly self-efficacious individuals tend to visualize and dwell on their successes more than their failures. They also tend to process the positive affective aspects of their performance more than the negative aspects

(Bandura, 1997). A great deal of evidence demonstrates that self-efficacy is positively associated with positive outcome expectation (Wannipa Asawachaisuwikrom, 2001; Anderson et al., 2006). Conversely, older persons regulate their physical activity by outcome expectations; they generally reject behaviors that they perceive will bring negative outcomes. According to a significant amount of evidence, self-efficacy negatively influences negative outcome expectation (Wannipa Asawachaisuwikrom, 2001; Anderson et al., 2006).

In addition, the tendency to engage in physical activity is influenced by a person's forethought (Bandura, 2001). Bandura (2001) hypothesizes that people regulate their behavior by outcome expectations; they adopt performance that is likely to produce positive outcomes and discard that which will bring undesired outcomes. Therefore, initial and continued physical activity efforts are more likely to occur when an individual has greater positive outcome expectations than negative. Accordingly, a number of studies demonstrate that older persons who believe in positive outcome expectation increasingly perform physical activity (Pitakpong Punta, 2004; Wannipa Asawachaisuwikrom, 2004; Anderson et al., 2006). Several studies also show that those with higher perceived negative outcome expectations engaged less often in physical activity (Rovniak et al., 2002). Therefore, the hypothesized model proposes that positive outcome expectation has a positive direct effect on participation in physical activity. In turn, negative outcome expectation has a negative direct influence on physical activity.

Increasing age is accompanied by declines in both physiological and psychosocial functions (Stewart, 2005). Signs of physical decline, such as, muscle weakness, muscle wasting, and decreased endurance capacity are accompanied by declines in participation in physical activity (Stewart, 2005). Older people with advancing age will engage less in physical activity (Booth et al., 2000; Laffrey, 2000; Wilcox et al., 2003; Pitakpong Punta, 2004; Anderson et al., 2006; Umstattd et al., 2006), therefore, age has a negative direct effect on physical activity.

Older people's self-efficacy arises from interaction with their social environment through observation, learning, and motivation processes (Bandura, 1997). Social support serves as a source of efficacy information through vicarious experience and social persuasion (Bandura, 1997). Numerous studies have illustrated that social support strongly correlates with self-efficacy (Wannipa Asawachaisuwikrom, 2001; McAuley et al., 2003a; Wilcox et al., 2003; Anderson et al., 2006; Umstattd et al., 2006). Additionally, self-efficacy has a mediating role for social support in participation in physical activity. According to previous studies, social support indirectly influences physical activity through self-efficacy (McAuley et al., 2003a; Anderson et al., 2006; McNeill et al., 2006b). It is hypothesized that older persons who perceive greater social support are more likely to have an increased level of self-efficacy which greatly enhances physical activity. Thus, the model proposes that social support has an indirect effect on physical activity through self-efficacy.

Physical environments affect participation in physical activity behavior through the interaction between cognitive functions and the environment (Bandura, 1986; 1997). A significant number of studies show that physical environment positively influences physical activity (Booth et al., 2000; Wannipa Asawachaisuwikrom, 2001; 2004; Humpel et al., 2002; Wilcox et al., 2003; McNeill, Kreuter, and Subramanian, 2006). Thus, older people with a more positive perception of their physical environment will have an increased performance of physical activity. As a result, in this model, physical environment is proposed to have a positive direct effect on physical activity.

In short, personal factors and environmental variables are the essential determinants for physical activity among the aged. This research model proposes that participants with greater social support will have a stronger belief in their capabilities and better participation in physical activity. At the same time, individuals with a stronger sense of belief in their ability to perform physical activity have expected higher positive outcomes, lower negative outcomes and greater physical activity. Furthermore, participants with advancing age will tend to have a lower participation in physical activity, whereas those benefitting from a perceived positive physical environment are more likely to participate. Finally, individuals with greater physical activity will perceive greater social support, higher self-efficacy, better positive outcome expectation, better physical environment, lower negative outcome expectation, and have a relatively younger age.

The proposed relationships among the tested variables and concepts are depicted in Figure 1.1

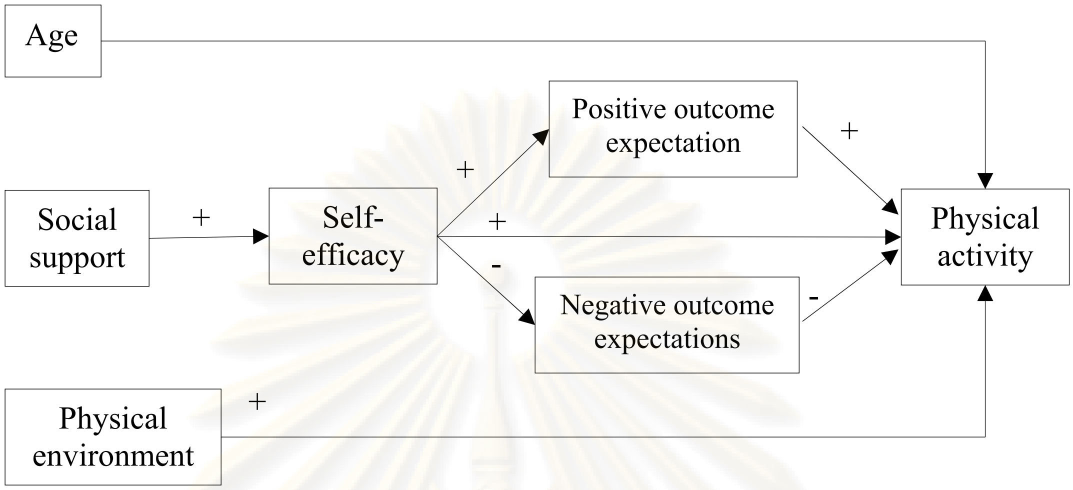

Figure 1.1 Hypothesized causal model of physical activity in older Thai people

Research hypotheses and rationale:

The research hypotheses are listed in the following seven statements:

1. Self-efficacy has a positive direct influence on physical activity, and it has an indirect effect on physical activity through both positive outcome expectation and negative outcome expectation.

Self-efficacy beliefs enable the individual to perform behavior through four processes; choice behavior, effort expenditure and persistence, thought patterns, and emotional reactions (Bandura, 1986). Older people will perform and maintain physical activity only if they believe in their ability to perform it. A substantial amount of evidence has confirmed that older people with greater self-efficacy demonstrate higher physical activity (Allison and Keller, 2004; Booth et al., 2000; Laffrey, 2000; McAuley et al., 2003a; Wilcox et al., 2003; Anderson et al., 2006; Lee and Laffrey, 2006; McNeill et al., 2006b; Umstattd et al., 2006).

Within SCT, despite confidence in their ability to perform an activity, old people may not do so unless they have the necessary motivation or incentive (Bandura, 1997). Self-efficacy is a major determinant of outcome expectations when outcomes are significantly dependent on performance competence (Bandura, 1997). That is, outcome expectations have a mediating role on performance. According to numerous studies, self-efficacy is positively related to positive outcome expectation of physical activity (Wannipa Asawachaisuwikrom, 2001; Rovniak et al., 2002; Anderson et al., 2006). In turn, Bandura (1986; 1997) postulated that people who lower their level of confidence would anticipate unsuccessful outcomes. That is, if believing that their actions can produce undesired outcomes, older people do not have the incentive to act or to persist in the face of obstacles. Congruent with the findings of prior studies, older persons with a lower level of self-efficacy would expect greater negative outcomes (Wannipa Asawachaisuwikrom, 2001; Anderson et al., 2006). Furthermore, based on a SCT perspective, outcome expectation is considered to have a mediating role between self-efficacy and behavior (Bandura, 1997). However, a few causal studies have supported self-efficacy having an indirect influence on physical activity through positive outcome expectation in participants aged 18-92 (Anderson et al., 2006) and via negative outcome expectation in university students (Rovniak et al., 2002)

Therefore, self-efficacy has a positive direct influence on physical activity and it has an indirect effect on physical activity through positive outcome expectation and negative outcome expectation.

2. Positive outcome expectation exerts a positive direct influence on physical activity

When older people feel confident in their ability to perform a certain activity, they may do it only if they have sufficient motivation or incentive (Bandura, 1997). Within SCT, outcome expectations directly impact behavior, with positive outcome expectation increasing the desired behavior (Bandura, 1997). Most evidence has indicated that positive outcome expectations are positively correlated with physical activity (Nices and Kershaw, 2002; Rovniak et al., 2002; Pitakpong Punta, 2004; Wannipa Asawachaisuwikrom, 2004; Anderson et al., 2006). Therefore, positive outcome expectation has a positive direct effect on physical activity.

3. Negative outcome expectation has a negative direct influence on physical activity.

Based on SCT, behavior is directly influenced by outcome expectations with decreasing behavior being the result of negative outcome expectations. That is, if a person predicts negative outcomes from physical activity participation, they will not motivate themselves to do the activity (Bandura, 1997). The negative outcome expectation of the physical activity will discourage older persons from participating in that activity. According to previous evidence, older people who expect greater negative outcomes are more likely to decrease their engagement in physical activity (Prapaporn Chinuntuya, 2001; Wannipa Asawachaisuwikrom, 2001; 2004; Rovniak et al., 2002). Thus, negative outcome expectation has a negative direct effect on physical activity.

4. Age has a negative direct influence on physical activity.

Most people of advanced age have lower participation in physical activity as a result of the decline of biological functions such as muscle weakness, muscle wasting and decreasing endurance capacity (Stewart, 2005). As demonstated in a significant amount of evidence, older people with advancing age are negatively associated with physical activity (Booth et al., 2000; Laffrey, 2000; Wilcox et al., 2003; Pitakpong Punta, 2004; Anderson et al., 2006; Umstattd et al., 2006). Thus, age has a negative effect on physical activity.

5. Social support has an indirect effect on physical activity through self-efficacy.

Under a SCT perspective, modeling by family members and friends indirectly influences behaviors since the developed model can strengthen self-efficacy related to a particular activity through observation, learning, and motivational processes (Bandura, 1997). With support from others, older people will have a stronger belief in their capabilities and will have greater participation in physical activity. Considerable evidence demonstrates that a greater level of social support increases self-efficacy (Wannipa Asawachaisuwikrom, 2001; McAuley et al., 2003a; McAuley et al., 2003b; Wilcox et al., 2003; Anderson et al., 2006; Umstattd et al., 2006). Benight and Bandura (2004) state that self-efficacy is a mediator of social support. In addition, social support exerts an indirect influence on physical activities through self-efficacy (McAuley et al., 2003a; Anderson et al., 2006; McNeill et al., 2006b). Therefore, it is proposed that social support has an indirect influence on physical activity through self-efficacy.

6. Physical environment has a positive direct influence on physical activity.

Physical environment factors provide motivation to act by the creation of a psychological mechanism (Bandura, 1986, 1997). Older persons will engage more in physical activity if they perceive a positive physical environment to do so. Much evidence sustains that the physical environment positively influences physical activity by older people (Booth et al., 2000; Wannipa Asawachaisuwikrom , 2001, 2004; Humpel et al., 2002; Wilcox et al, 2003; McNeill et al., 2006a). Physical environment, therefore, has a positive direct influence on physical activity in the elderly.

Scope of the study

The study is cross-sectional, intending to develop and examine the causal model of physical activity in older Thai people.

Operational definitions

1. **Physical activity** is defined as older people's participation in moderate to vigorous intensity activity through a daily accumulation of self-selected activities lasting at least 10 minutes per instance. The activities should fall within each of the four types: job related physical activity, household, transportation, and leisure time activities (WHO, 2002). The performance will be measured over the previous 7 days using the total scores of the summation of the duration and frequency of all four types of activities, according to the International Physical Activity Questionnaire-Long version (IPAQ-L) (Craig et al., 2003). A higher score indicates a higher physical activity.

1.1 **Job-related physical activity** refers to older people's participation in occupational activities such as paid jobs, farming, volunteer work, course work, and any other unpaid work that they did outside their home.

1.2 **Household activity** refers to older people's participation in unpaid work or activities which they might do in and around their home like housework, gardening, yard work, general maintenance work, and caring for family members.

1.3 **Transportation activity** refers to older people's participation in traveling from place to place such as from home to work, stores, and neighborhoods, using motor vehicles, bicycles, and walking.

1.4 **Leisure-time physical activity** refers to older people's participation in activities such as recreation, sports, and physical exercises.

2. **Self-efficacy** is defined as older people's perception on the level of confidence or belief in their ability to perform physical activity for at least 10 minutes per time, 3 times a day under different conditions of obstacles within a given activity domain including low, moderate, and high obstacle. Their level of confidence will be measured using the Self-efficacy for Physical Activity scale (SEPA) modified from the Self-efficacy for Exercise scale (Resnick and Jenkins, 2000). Higher scores mean that self-efficacy for physical activity is higher. In this study, self-efficacy is measured by 3 categories of obstacles as follows

2.1 **Self-efficacy for low obstacles** means older people's perceived confidence in their abilities to engage in physical activity at least 10 minutes per time, 3 times a day when faced with inconvenient weather, boredom with the program or activity, loneliness during exercise , and depression.

2.2 **Self-efficacy for moderate obstacles** means older people's perception of the level of confidence or belief in their ability to perform physical activity at least 10 minutes per time, 3 times a day; they maintain participation in physical activity in spite of these barriers: lack of enjoyment, too busy with other activities, feeling tired, and feeling stressed.

2.3 **Self-efficacy for high obstacle** means older people perceive their capabilities to perform physical activity at least 10 minutes per time, 3 times a day when faced with pain upon performance.

3. **Positive outcome expectation** refers to older people's perception of the positive physical and psychological outcomes from performing physical activities at least 10 minutes per time, 3 times a day. This perception will be measured using the Positive Outcome Expectation for Physical Activity (POEPA), modified from the positive outcomes subscale of the Outcome Expectations for Exercise-2 (OEE-2) (Resnick, 2005). High scores indicate high positive outcome expectation for the physical activity.

3.1 **Positive physical outcome expectation** means older people's perception of the benefits of physical outcomes from performing physical activities at least 10 minutes per time, 3 times a day. These include physical improvement, decreased fatigue, increased muscle strength, increased endurance, and improved bone strength/density.

3.2 **Positive psychological outcome expectation** means older people's perception of benefits of psychological outcomes from performing physical activity at least 10 minutes per time, 3 times a day. These include providing a better mood, general enjoyment, an increased sense of personal accomplishment, and enhancing mental alertness.

4. **Negative outcome expectation** refers to older people's perception of the negative physical and psychological outcomes from performing physical activity at least 10 minutes per time, 3 times a day. This perception will be measured using the Negative Outcome Expectation for Physical Activity (NOEPA), modified from the negative outcomes subscale of the OEE-2 (Resnick, 2005). High scores indicate higher negative outcome expectation for physical activity.

4.1 **Negative physical outcome expectation** refers to older people's perception of the negative physical outcomes including physical discomfort and pain from performing physical activities at least 10 minutes per time, 3 times a day.

4.2 **Negative psychological outcome expectation** refers to older people's perception of negative psychological outcomes including fear of falling or being hurt and stress on their heart from performing the physical activity at least 10 minutes per time, 3 times a day.

5. **Social support** is defined as older people's perception of family support given to them during the last month in terms of participation, rewards and punishments for engaging in physical activity, as well as support from friends for participating in activities (Sallis et al., 1987). Social support will be determined using the Social Support for Physical Activity (SSPA) modified from the Social Support for Exercise (SSE) (Sallis et al., 1987). Higher scores depict good social support for physical activity

5.1 **Family support** refers to older people's perception of what family members living in their household said to them during the last month in terms of participation, rewards and punishments towards their participation in physical activities.

5.2 **Friend support** refers to older people's perception of what friends or acquaintances or coworkers said to them during the last month regarding participation and rewards for participation in physical activity.

6. **Physical environment** is defined as older people's perception of characteristics, availability, safety, barriers, and accessibility in their home environment, neighborhood environment, and community environment such as to facilitate or hinder their ability to participate in physical activities (SIP 4-99 Research Group, 2002). The physical environment is measured using the Thai Environment Supports for Physical Activity scale (TESPA) modified from the Environmental Support for Physical Activity questionnaire (SIP 4-99 Research Group, 2002). A high score indicates a good physical environment.

6.1 **Home environment** refers to participants' perceptions regarding convenience and safety of the environment both in and around their home in relation to their participation in physical activities. The perceptions on environment questions are developed by asking older Thai people about availability, convenience and safety of their home for physical activity. It is then included as a part of the TESPA.

6.2 **Neighborhood environment** refers to older people's perceptions of supports (including access and characteristics) and barriers to physical activities in their neighborhood. Neighborhood is defined as the area around their home that they could walk to within 10 minutes (Addy et al., 2004). Supports for physical activities include streetlights, public recreation facilities, a pleasant neighborhood for walking, and the condition of the public recreation facilities. Barriers to physical activities include traffic volume crime and unattended dogs (Addy et al., 2004).

6.3 **Community environment** refers to older people's perceptions of supports and barriers to physical activities in their community where community is defined as a 20 minute drive from their residence. Supports for physical activity include public recreation centers, parks, schools, and places of worship. A barrier for physical activity is the safety concern associated with recreation facilities (Addy et al., 2004).

7. **Age** is defined as the chronological age of the older Thai person reported in the year of the study.

8. **Older Thai people** are defined as Thai people 60 years of age and older.

Expected usefulness of the study

1.The current study provides additional knowledge to understand, explain and predict the phenomena of physical activity in older Thai people.

2. The utility of the causal model provides significant information for nursing and health care providers to implement programs to motivate and empower elderly Thais to maintain their belief in their capabilities for the initiation and maintenance of participation in physical activity as a regular part of their life.

3. This study is related to the body of knowledge of the SCT. The results enhance the validity of the SCT in particular the causality of the relevant concepts of the SCT with respect to the phenomena of physical activity in older Thai people.

4. The modified measurement of the current study, in particular the TESPA, will be utilized to assess physical environment as an appropriate environment for elderly Thais within Thai culture.

5. The findings will encourage nurses and researchers to develop further investigations to enhance the engagement in physical activity of older Thai people.

CHAPTER II

LITERATURE REVIEW

The present study is aimed at examining the model of causal relationship as it relates to 6 factors associated with physical activity among older Thai people. A critical review of the existing literature includes theories and empirical studies. The review describes related to physical activity the phenomena and concepts of interest, the interrelationships among the determinants, and identifies those gaps. The review was divided into six parts:

1. Physical activity
   1.1 Definition of physical activity
   1.2 Levels of physical activity
   1.3 Physical activity recommendations for older adults
   1.4 Measurements of physical activity in older adults
   1.5 Benefits of physical activity in older adults
2. Physical activity in healthy older Thai people
   2.1 Overview of Thailand and Thai elderly
   2.2 Physical activity in healthy older Thai people
3. The social cognitive theory
4. Factors associated with physical activity in older people
5. The conceptual model in previous studies
6. Structural equation modeling for analysis

1. Physical activity

1.1 Definition of physical activity

Physical activity can be defined from a physiological and/or behavioral perspective. From a physiological perspective, physical activity is a component of total energy expenditure, which includes resting metabolism and thermic effect of food (Bouchard, Shephard, and Stephens, 1994). As pointed by Caspersen and colleagues (1985), "Physical activity" is broadly defined as "any bodily movement produced by the contraction of skeletal muscles that substantially increases energy expenditure above the basal level." Similarly, other studies defined physical activity as energy expended by one's body (Mouton et al., 2000; Koltyn, 2001; Houde and Melillo, 2002; Netz and Raviv, 2004; Bailey and McLaren, 2005; Riebe et al., 2005; Pettee et al., 2006). Physical activity is considered by many as moderate intensity activities (Brownson et al., 2000; Kaplan et al., 2001; King, 2001; Brawley, Rejeski, and King, 2003; Speck and Harrell, 2003) or a combination between moderate and vigorous intensity activities (Booth et al., 2000; Kultida Panidchakul, 2003; Powell, Martin, and Chowdhury, 2003).

From a behavioral perspective, physical activity is defined as body movement with intention through space, or exertion of an intended strength (Bouchard et al., 1994). Otherwise, the various types of daily activities, such as exercise (Allison and Keller, 2000; Dergance et al., 2003; Lim and Taylor, 2005), daily activity (Lawlor et al., 2002), the continuum activity (Kaysorn Sumpowthong, 2002; Leinonen et al., 2007) and lifestyle and leisure time exercise activities (Prapaporn Chinuntuya, 2001) have been included in its definition. In particular, qualitative studies on older people have considered physical activity to encompass a broader range of activities such as participation in regular and intentional activities (Tudor-Locke et al., 2003). Moreover, some participants widely defined physical activity as health promotion (Belza et al., 2004).

The combination of the two perspectives can found in numerous studies. WHO (2002) defined physical activity as the act of moving as exhibited while performing in one of the four types of activities including occupational, transportation, household and leisure time activities. A similar definition is used by the Department of Health, Thailand (2007). Similary, the Pan American Health Organization's (2006) definition not only includes energy expenditure but also all movements in everyday life including occupational, recreational, exercises and sporting activities. Physical activity can be incorporated into one's daily routine in many different ways. According to Warburton, Nicol, and Bredin (2006:809), who reviewed the health benefits of physical activity, defined it as "all leisure and non leisure body movements resulting in an increased energy output from the resting condition". The combination of physiological and behavioral perspective may reflect the overview of physical activity's definition more clearly.

The USDHHS (1996) reports that the principle for a physical activity generally includes type, intensity, duration and frequency.

1) Types of physical activity.

Types of physical activity may be classified as setting or physiological changing. According to setting, Yawarat Porapakkham, and Pornpan Boonratpan's (2006) identified three types of physical activities including work-related physical activity, transport-related physical activity and leisure-time activity. Other studies also included household chores as a form of physical activity (WHO, 2002; the

Department of Health, 2007). Craig and colleagues (2003) additional defined types of occupation related activity including job-related physical activity such as paid jobs, farming, course work, and any other unpaid work that an individual did outside his home. Types of household activities included housework, gardening, yard work, general maintenance work, and caring for the family. Transportation related represent the activities done on the relocation between one place and another such as from home to work, stores, temples and so on. Whereas, leisure-time physical activities included recreational, sport, and exercise related activities.

Based on physiological changing, the American College of Sport Medicine (2004) and the National Institute on Aging (2009: online) stated that physical activity in older adults generally fall into four main categories: endurance, strength, balance, and flexibility. Endurance or aerobic refer to activities that increase breathing and heart rate. It includes brisk walking, yard work, dancing, jogging, swimming, biking, climbing stairs, playing sport, and grocery shopping. Strength activities increase muscle strength, and consequently assist older adults remain strong to carry out everyday tasks. Strength activities include climbing stairs, carrying groceries, lifting weights and using a resistance band. Balance activities which include standing on one foot, heel-to-toe walk, or Tai chi, assist in the prevention of falls, which is a common problem in the elderly. Flexibility activities improve cardiac and muscular-skeletal function, and include shoulder and upper arm stretch, calf stretch, and Yoga. Some activities may fall into several categories. For instance, many endurance activities also help build strength, and strength activities can help improve balance.

2) Intensity of physical activity.

Intensity reflects the rate of energy expenditure during such activity (the Center of Disease Control and Prevention and the American College of Sports Medicine [CDC–ACSM], 2006) and is usually expressed in metabolic equivalent (METs) (Ainsworth et al., 2000), perceived exertion, or maximum heart rate. MET and perceived exertions are mentioned in the current study. One MET is equal to the energy used sitting quietly for an hour, which is approximately 1 kilocalorie (kcal) per kilogram (kg.) of body weight per hour or 3.5 ml of oxygen uptake per kg of body weight per minute in an adult (Ainsworth et al., 2000). The intensity of physical activity is classified in 3 levels. *Vigorous physical activity* refers to activity that leads to an energy expenditure greater than 6.0 METs or more than 7 kcal/min. It highly increases the breathing rate, heart rate and result in high sweat for at least 10 minutes. Vigorous activities may include heavy lifting, digging, aerobics, or fast bicycling (Craig et al., 2003; CDC, 2006). *Moderate physical activity* refers to activity that leads to an energy expenditure of between 3-6 METs or 3.5 to 7 kcal/min and a moderate increase in breathing rate, heart rate and moderate sweat for at least 10 min duration. It may include carrying light loads, bicycling at a regular pace, or playing double tennis (Craig et al., 2003; CDC, 2006). *Light physical activity* refers to activity requiring less than 3 METs or less than 10 minutes in total per week of moderately or vigorously intense activities such as walking with velocity less than 1-2 miles/hr., and fishing.

3) Duration of physical activity.

The duration refers to how long the physical activity is performed at a time. The physiological changes associated with health benefits from physical activity require a minimum duration that is at least ten minutes at a time (Craig et al., 2003).

4) Frequency of physical activity.

Frequency refers to how often the physical activity is done in a day or a week.

In summary, various studies have proposed that the definition of physical activity involves movement, energy expenditure, type, intensity, duration, and frequency. According to the way of life among Thai elders, the current study focused on a combination of prior definitions (Caspersen et al., 1985), along with the principle of physical activity and defines "physical activity" as any bodily movements produced by skeletal muscle that results in energy expenditure above the resting level and performed at a moderate to vigorous intensity level. The activities performed must be related to their lifestyles and of at least 10 minutes duration each time. It includes four types: job related physical activity, housework, transportation, and leisure-time physical activity.

1.2 Levels of physical activity

The level of physical activity may be categorized using METs-min, through intensity, duration, and frequency for estimating energy expenditure (Craig et al., 2003). A MET-minute is computed by multiplying the energy consumption in each activity by the minutes performed (Craig et al., 2003). Regarding to MET in each activity, Ainsworth and colleagues (2000) developed a list with 19 of the most common physical activities and measured the energy expended using indirect calorimetry expressed in METs. The list included additional occupational, household, religious, volunteer, and leisure-time activities (Ainsworth et al., 2000). Physical activity can be categorized into three levels which are associated with health benefits (Craig et al., 2003). A high level physical activity is reported as seven days of any combination of walking and moderate intensity activity or vigorous intensity activity accumulating at least 3000 MET-minute/week. Moderate level physical activity is reported as five or more days of any combination of walking and moderate or vigorous intensity activities achieving at least 600 MET-minute /week. A low level physical activity, on the other hand, is reported as no activity or insufficient to meet categories of moderate and high level physical activity (Craig et al., 2003).The level of physical activity in previous studies conducted in Thailand had been categorized into 3-4 groups, dependent on the objectives of the study (Table 2). The Division of Exercise in Thailand’s (2004) and Health Systems Research Institute’s (2006) for example, categorized physical activity using intensity, duration, frequency and a slightly modified version of Craig's (2003) recommended MET values. In addition, the Division of Exercise in Thailand’s (2004) also included inactive group as another category, similar to Yawarat Porapakkham, and Pornpan Boonratpan’s study (2006).

Table 2.1 Comparison of the criteria used in Thai studies.

Level of physical activity	Thai's study		
	Division of Exercise in Thailand's report (2004)	Porapakkhamn and Boonratpan's study (2006)	Health Systems Research Institute's study (2006)
High	1. vigorous intense activity at least 3 days/wk with an energy expenditure of at least 1,500 MET-min/wk; or 2. combination of moderate or vigorous intensity activities and walking, at least 7 days/wk, with an energy expenditure of at least 1500 MET-min/ wk	-	1. vigorous intense occupation and leisure time activity at least 3 days/wk with an energy expenditure of at least 1500 MET-min/wk; or 2. combination of vigorous intense occupation and leisure time activity and moderately intense occupation, leisure time and transportation activity at least 7 days/wk with an energy expenditure of at least 3000 MET-min/wk
Sufficient physical activity	1.moderate-intensity activity or walking for at least 150 min/ wk. or 2. vigorous intensity activity for at least 60 min/ wk. or 3. a combination of moderate or vigorous intensity and walking at least 5 days/wk, with an energy expenditure of at least 600 MET-min/wk .	1.moderate-intensity activity for more than 150 min/wk or 2. vigorous intensity activity for more than 60 min/wk	1. moderate intensity occupation, leisure time and transportation related activity for at least 150 min/wk. or 2. vigorous intensity occupation and leisure time activity for at least 60 min/wk; 3. a combination of vigorous intensity occupation and leisure time activity and moderate intensity occupation, leisure time and transportation related activity at least 5 days/wk with an energy expenditure of at least 600 MET-min/wk
Insufficient physical activity	where vigorous , moderate activity or walking does not meet the criteria of high level or sufficient physical activity level	1. moderate intensity activity for less than 150 min/wk. or 2. vigorous physical activity for less than 60 min/wk.	1. where vigorous or moderate activity or walking does not meet the criteria of high level or sufficient physical activity level or 2.no physical activity
Inactive	no physical activity	no physical activity	-

In summary, the physical activity level of an individual can be based on frequency, duration, intensity of participation, or energy expenditure in a range of occupational, transportation related, household, and leisure time activities. Within Thai society, the elder have participated in moderate and vigorous intensity activity, and walking. Consideration of intensity, duration, frequency, type, and MET will clearly reveal the overview of physical activity because a bout activity is combined by more than one component. Based on the table above and taking into consideration that the study will only recruit participants who can engage in physical activity, a modified version of the criteria used by the Health Systems Research Institute (2006) will be applied.

1.3 Physical activity recommendations for older adults

The U.S. Department of Health and Human Services (USDHH, 1996) recommends performing regular physical activity, indicating that it is an important component of a healthy lifestyle. Generally, the ‘FITT' recommendation focuses on frequency (mostly, preferably all days of the week), intensity (moderate), duration of time (30 minutes accumulated over the course of the day), and type of physical activities (USDHH, 1996). To benefit from physical activity, it is recommended performing enough moderate intensity physical activity to expend approximately 150-200 calories per day (USDHH, 1996). The guidelines further acknowledge the health benefits of experiencing intermittent, short bouts of physical activity such as 10 minutes intervals that occur in the context of one’s lifestyle rather than one continuous engagement session. According to the WHO (2006: online) the accumulation of at least 30 minutes of moderate intensity physical activity per day, five or more days per week is preferable. Likewise, Somchai Leethongin (2005) recommends Thai elders to participate in moderate-intensity physical activity for a minimum of 30 minutes per day, five days a week.

Additionally the American College of Sports Medicine and the American Heart Association (2007) has recommended physical activity for all adults aged 65 years and over and those aged 50-64 with chronic conditions or functional limitations (Nelson et al., 2007, p1442).To promote and maintain good health they recommend older adults to perform moderate-intensity aerobics (endurance) for a minimum of 30 minutes, five days a week or vigorous-intensity aerobic activity for a minimum of 20 minutes, three days a week. On a 10-point scale, where sitting is 0 and all-out effort is 10, moderate-intensity activity is a 5 or 6 and produces noticeable increases in heart rate and breathing. On the same scale, vigorous-intensity activity is a 7 or 8 and produces large increases in heart rate and breathing. On the other hand, combinations of moderate-and vigorous-intensity activity can also be performed to meet the recommendation. These moderate or vigorous intensity activities are in addition to the light intensity activities frequently performed during everyday life or moderate-intensity activities lasting 10 minutes or less.

1.4 Measurements of physical activity in older adults

In this literature review, the researcher focused on measurements related to older adults, in particular Thai elderly. Physical activity can be assessed using accurate, precise, and reproducible measures (USDHHS, 1996). Measuring physical activity however, represents a complex challenge since it occurs in a variety of social domains such as occupational, transportation related, household, and leisure-time activities. Compared to other age groups, the type and intensity of activities which older adults engage are different, older adults tend to participate in light to moderate intensity activities rather than vigorous ones (Westerterp, 2008). Furthermore, basal metabolic rate and fat free mass decrease with physiological changes, this influence energy expenditure estimation (Rikli, 2000). Physical activity may be assessed using objective and subjective measures. These methods have their own benefits and limitations under normal daily conditions and focus on physical activity from different views.

1.4.1 Objective measures

Objective measurement can be done by direct observation or/and physiological measures. Double Labeled Water (DLW) and indirect calorimetry are the gold standard methods for assessing energy expenditure (Welk, 2002). The DLW method involves administration of stable isotopes of oxygen and hydrogen and measuring urine samples for hydrogen and oxygen, which is reported by the authors to be an accurate measure of energy expenditure with physical activity (Welk, 2002), however the method is expensive. .

Other several techniques, including heart rate monitors and motion sensors are available to measure indirect calorimetry. Using a heart rate monitor is the most convenient way, the outcome however, depends on other parameters such as body temperature, state of hydration, fatigue, and state of emotion. Motion sensors, on the other hand, are small machines that attached to one's body can record the amount of movement over time (Welk, 2002). There are several different types of motion sensors that range in complexity and cost, from pedometers to accelerometers. The pedometer is a simple device movement counter, which counts steps. The pedometer responds to vertical acceleration of the body during walking or running and causes a lever arm to move vertically and a ratchet to rotate a dial that displays distance covered (Berlin, Storti, and Brach, 2006). Pedometers tend to underestimate distance walked at slower speeds and overestimate distances during fast walking or running (Berlin et al., 2006). Additionally, pedometer may not accurately count seated activity, upper-extremity activity or indoor and outdoor household chores such as pushing, lifting, or carrying objects because of ambulatory behavior measurement (Berlin et al., 2006).

In contrast, accelerometer is an instrument that is worn at the waist, or ankle, and uses information obtained to calculate kilocalories expended of the intensity, frequency, pattern, and duration of activity (Washburn, 2000). This device measures bodily movement by evaluating movement in one or three directions (Washburn, 2000). Although accelerometers can assess most type of physical activity that involves lower-extremity such as walking and stair climbing, the activities including upper-extremity movement or seated activity such as indoor and outdoor household chores may be rarely measured (Berlin et al., 2006) and the record counts are rarely interpreted (Murphy, 2009). Likewise, concerns on the accuracy of accelerometers when applied to older adults exist due to discomfort or practicability. Moreover, the use of accelerometers in older adults requires a basic understanding of the type being used, rationale for their placement, and attention to calibration when needed (Murphy, 2009).

Objective measurement can provide accurate measures of ambulatory behaviors and capture intermittent or continuous physical activity engagement throughout the assessment period, however the cost per device is still high which limits its use in large-scale studies with inadequate financial support. In older adults in particular, memory recollection and convenience in using the device might impact on accurate data collection (Murphy, 2009). The feasibility of a physical activity measurement for older adults is also influenced by expenditure, time to administer, process of measurement, acceptability, compatibility with usual daily activities, reliability and validity of data (Washburn, 2000; Berlin et al., 2006).

1.4.2 Subjective measures

Self-report is a commonly used scale for subjective measurement. Self-reported physical activity questionnaires have become an invaluable and feasible tool for use in the elderly studies because their minimal expense and scoring flexibility (Washburn, 2000; Matthews, 2002). Self-report scales such as diaries, logs, recall questionnaires and history questionnaires can be used to record intensity, duration, frequency, and type of physical activity over a specified time period.

Based on the literature review six physical activity questionnaires developed specifically for the older adult population exists: the Modified Baecke Questionnaire for Older Adults (Voorrips et al., 1993), the Zutphen Physical Activity Questionnaire (ZPAQ) (Caspersen et al., 1991), the Yale Physical Activity Survey (YPAS) (DiPietro et al., 1993), the Physical Activity Survey for the Elderly (PASE) (Washburn et al., 1993), the Community Healthy Activities Model Program for Seniors (CHAMPS) (Stewart et al., 2001) and the International Physical Activity Questionnaire long version (IPAQ-L) (Craig et al., 2003). All questionnaires were published and studied during the1990s, except for the CHAMPS and the IPAQ-L which were developed in the 2000s. Some instruments were modified from preexisting ones, such as the Modified Baecke Questionnaire for Older Adults (the

Modified Baecke Questionnaire) in Holland. The ZPAQ was modified in the Netherlands, whereas the YPAS, the PASE, and the CHAMPS were originally constructed in the United States. As the IPAQ-L was originally developed by WHO and has been translated into more than 12 languages in western and eastern countries, though it's to suit adults 15-69 years of age (Craig et al., 2003). Regardless of the questionnaire used, all differentiate in the characteristic of respondents, timeframe, administration process, type of activities, reliability and validity, and scoring of physical activity data.

The previous researcher also identified initial version of the characteristic of respondent whom the instrument was designed to collect data: healthy elderly (the Modified Baecke Questionnaire, the IPAQ-L, YPAS) (DiPietro et al.,1993; Voorips et al.,1993; Craig et al.,2003; Timperio et al., 2004; Yazigi and Armada-da-Silva, 2007), elderly community dwelling (PASE) (Washburn et al., 1993), retried men (the ZPAQ) (Caspersen et al., 1991), members of a Medical HMO recruited into cohort study (CHAMPS) (Stewart et al., 2001). Furthermore, according to Harada and colleague (2001), the PASE, YPAS, and CHAMPS questionnaires were revealed acceptable only for certain segments, such as old adult males, 65-74 years old and living in retirement homes.

Regarding timeframe, some questionnaires assessed physical activity within the previous 7 days (the IPAQ-L, the PASE), while others one month (the YPAS, the CHAMPS), 1 year (the Modified Baecke Questionnaire), or usual activity (the ZPAQ). Harada and colleagues (2001) proposed that the elders may have trouble with memory and cognition, which interfere with their ability to recall past physical activities, particularly over long periods of time. Questionnaires using a short recall timeframe therefore are more practical for older adults (Winters-Hart et al., 2004). In addition, self-administration and interviews are frequently used in senior citizens' studies. Porntip Malathum (2002) proposed that Thai elders may be unfamiliar with self-administration questionnaires, whereas the interview approach may be better accepted, particularly for those who are illiterate or has limitation in reading. On the other hand, interviews may lead the subject to under or over estimate their behavior (Polit and Hungler, 1999).

Types of physical activity are composed of occupational, transportation related, household, and leisure time activity. Leisure time and household activities are included in all scales. Transport related activity is stated in the Modified Baecke Questionnaire, the ZPAQ, and the IPAQ-L only. Occupational activity is mentioned in the PASE, the CHAMPS, and the IPAQ-L. The YPAS has subsections representing 5 specific activity dimensions such as vigorous activity, leisurely walking, moving, standing, and sitting. While, sedentary activity is only included in the YPAS and the IPAQ-L (Table 2.2). Based on the information provided above, the IPAQ-L therefore is the only measurement that assesses all 5 types of activities (work-related, transport-related, household, leisure time physical activity, and time spent sitting). In addition, number of items have been established for each scale: the Modified Baecke Questionnaire (12 items) (Voorips et al., 1993), the ZPAQ (15 items) (Caspersen et al., 1991), the YPAS (36 items) (DiPietro et al., 1993), the PASE (10 items) (Washburn et al., 1993), the CHAMPS (41 items) (Stewart et al., 2001) and the IPAQ-L (25 items) (Craig et al., 2003). Furthermore, the validity and reliability of each questionnaire have been accepted (Bijnen et al., 1996; Harada et al., 2001; Prapaporn Chinuntuya, 2001; Varin Binhosen, 2003; Wannipa Asawachaisuwikrom, 2003; Craig et al., 2003)

In addition, questionnaire outcomes can be categorized into two groups: unit less activity score (the Modified Baecke Questionnaire, and the PASE) and caloric expenditure (the YPAS, the ZPAQ, the CHAMPS, the IPAQ-L) such as METs-min, or kilocalories. The energy expenditure of these measurements had been generally calculated by type, frequency, and duration with the intensity of each activity, with the exception of the Modified Baecke Questionnaire. Intensity codes for expended energy calculation of each questionnaire were set in different ways. For example, the intensity codes of the ZPAQ were modified to reflect activity of Dutch men between the ages of 65 and 84 years (Caspersen et al., 1991). Meanwhile the Modified Baecke Questionnaire used intensity code based on the work of Bink and colleague (Voorips et al., 1993). Some questionnaires were set specific weight for their measurement such as the PASE and the CHAMPS (Washburn et al., 1993; Stewart et al., 2001). The IPAQ-L intensity code was based on a compendium of physical activity of 19 major types (Ainsworth et al., 2000).

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Table 2.2 Component of physical activity questionnaire for older adults

Types of activity	Measurement					
	Modified Baecke questionnaire	PASE	YPAS	CHAMPS	IPAQ_L	ZPAQ
Sedentary			/		/	
Moderate	/ /		/	/	/	/
Vigorous	/ /		/	/	/	/
Leisure-time	/ /		/	/	/	/
Occupational	/		/	/	/	
Household	/ /		/	/	/	/
Transportation	/				/	/

Note / = available item
YPAS = The Yale Physical Activity Scale
PASE = The Physical Activity Scale for Elderly
ZPAQ = The Zutphen Physical Activity Questionnaire
CHAMPS = The Community Healthy Activities Model Program for Seniors
IPAQ-L = International Physical Activity Questionnaire_long version

Although subjective assessments are suitable and convenient for obtaining data, the respondent's physical activity participation may not be accurately estimated due to memory recollection bias (Baranowski, 1988) and social desirability (Polit and Hungler, 1999). Cognitive impairments are common in older adults and often threatened the validity of self-report method. Indeed, subjective measures among older adults may also be influenced by fluctuations of health status, mood, depression, anxiety, or cognitive ability (Rikli, 2000). Underestimation on the engagement of light and moderate intensity activities may frequently occur in older adults (Washburn, 2000). However, Polit and Hungler (1999) suggested that creation of open-minded and indirect questions may decrease response bias. Thus subjective measurement is better suited for large populations where convenience, applicability, and accuracy are required.

The IPAQ-L instrument was selected because it was the only that could measure the physiological and behavioral aspects to be investigated in the current study. The psychometric properties reported an acceptable value. Furthermore, the instrument was considered adequately reliable and valid by numerous experts in the physical activity field. Another important reason for the selection of is that this tool is congruent within the Thai context in particularly the characteristics of the older population and time constrains.

1.5 Benefits of physical activity in older adults

The demographic trend indicates declining mortality rates and an increase in life expectancy (Institute for Population and Social Research, 2002; NSO, 2005) however the extra years has not necessarily been in good health or free from illnesses and disability. In other words, the average age at the onset of a disability in relation to the average age at death is due to a longer life expectancy rather than a better health expectancy (Sutthichai Jitapunkul, 2001; Sutthichai Jitapunkul et al., 2003: online). Previous studies suggested that almost 70 % of Thai elderly live with at least two chronic diseases in their lifetimes (WHO, 2004; NSO, 2005). Furthermore, Suwit Wibulpolprasert (2007) indicated that the 85.4 % of non communicable disease is the leading cause of disability–adjusted life years (DALYs) lost. Therefore, maintenance of health becomes important for all elderly.

Physical activity is a significant health promotion activity which helps to improve and maintain the health of older people (WHO, 2006: online) and it is one of the most important factors influencing the physical and psychological benefits of older people (Bonnefoy et al., 2001).

1.5.1 Physical benefits of physical activity

Several empirical evidences have demonstrated that the health benefits of physical activity can prevent a number of chronic diseases (Erlichman, Kerbey, and James, 2002; WHO, 2002; Warburton et al., 2006), decrease mortality rate (Hu et al., 2005), and promote long life expectancy (Franco et al., 2005). Moderate to vigorous physical activity prevents or delay the onset of chronic diseases and dependence of others (WHO, 2002; Warburton et al., 2006). Physical activity participation is known to prevent cardiovascular diseases, hypertension, and stroke by strengthening heart muscle, decreasing blood pressure, raising high-density lipoprotein (HDL) levels, reducing low-density lipoprotein (LDL) levels, raising blood flow, and enhancing one's heart capacity (Warburton et al., 2006). It also assists in raising left ventricular mass on the risk of ischemic stroke (Rodriguez et al., 2002). Reducing cardiac output and peripheral vascular resistance at rest, decreasing of serum catecholamines, and plasma rennin activity are also known to be positively influenced by physical activity (Thompson et al., 2003).

A prospective study as follow-up of 18.4 years (Hu et al., 2004), has shown that occupational and leisure-time physical activity reduced the risk of total and cardiovascular mortality among Finnish subjects, 25 to 74 years of age with type II diabetes. The multivariate-adjusted (age, gender, study year, body mass index, systolic blood pressure, cholesterol, smoking, and the two other types of physical activity) hazard ratios associated with light, moderate, and active work were 1.00, 0.86, and 0.60 ($p< 0.001$) for total mortality and 1.00, 0.91, and 0.60 ($p< 0.001$) for cardiovascular disease mortality, respectively. Additionally, the multivariate adjusted hazard ratios associated with low, moderate, and high leisure-time physical activity were 1.00, 0.82, and 0.71 ($p < 0.001$) for total mortality and 1.00, 0.83, and 0.67 ($p < 0.005$) for cardiovascular disease mortality. Franco and colleagues (2005) demonstrated that adults aged 50 years and over with a moderate or high physical activity level were likely to increase their total life expectancy by 1.3 and 3.7 years respectively. Furthermore they lived without cardiovascular disease, 1.3 and 3.3 years longer than adults without physical activity. According to Hu, Jousilahti, and colleagues (2005) moderate or high physical activity levels were associated with lower total and cardiovascular mortality in diabetic patients.

In addition, physical activity has not only improved glucose tolerance and insulin sensitivity, but also reduced body composition (Warburton et al., 2006). A study revealed that concentrations of both insulin and adrenaline were reduced in active people. Furthermore, insulin sensitivity had improved by 25% in diabetics patients (Parliamentary Office of Science and Technology, 2001). Another study (Engberg et al., 2010) investigated the incidence of diabetes in 4,031 individuals without diabetes at baseline and at 5 years follow-up; the findings confirmed that physically active individuals had a low progression to diabetes. In addition, healthy people with higher physical activity were more likely to improve their glycaemic control, insulin resistance, and reduced cardiovascular risk than diabetes patients (Lazarevic et al., 2006). Furthermore, a case-control study revealed a positive correlation between high levels of physical activity with lower non-insulin dependent diabetes mellitus in ages 20-74 years (Fulton-Kehoe et al., 2001). Moreover, Kyle and colleagues reported (2004) the extent to which the physical activity was correlated with body composition in Caucasian persons between 18 and 98 years; the results demonstrated that physically active persons was significantly less likely to have a low body fat mass index than sedentary subjects.

During physical activity participation, bone mass is rapidly stimulated and the length of the bone changes (Vuori, 2004; Warburton et al., 2006). In addition, physical activity may result in greater bone mass increases than bone strength (Vuori, 2004). For instance, a non-randomized prospective studies with 8 years duration (Kaptoge et al., 2006) was conducted in adults aged 65-74 years within the European Prospective Investigation of Cancer (EPIC) study in Norfolk, UK. The findings indicated that physical activities such as daily living, walking or cycling positively assisted the redistribution of bone loss, particularly lateral distance of hip structure. Walking/cycling for more than one hour per day was correlated with greater lateral distance of hip structure. Furthermore, few epidemiological evidence depicted healthy person with low physical activity level to be correlated with slightly lower bone mass and osteoporosis (Jakes et al., 2001; Pescatello et al., 2002).

1.5.2 Psychological benefits of physical activity

In addition to the physical benefits, numerous studies have demonstrated that moderate physical activity improve psychological performances on depressive symptom, psychological well-being, and health-related quality of life (Lampinen, Heikkinen, and Ruoppila, 2000; Koltyn, 2001; Houde and Melillo, 2002; Panitnun Chotikacharoensuk, 2002; Penninx et al., 2002; Varin Binhosen, 2003; Garatachea et al., 2009).

Similarly, longitudinal studies have documented significant improvement in depressive symptoms (Lampinen et al., 2000; Penninx et al., 2002). Furthermore physical activity training also lowered depression in healthy older adults (Lampinen et al., 2000) and in elder persons with high or low depressive symptomatology (Penninx et al., 2002). Moderate physical activity with longer duration also improved psychological well-being (Panitnun Chotikacharoensuk, 2002; Penninx et al., 2002; Garatachea et al., 2009). Likewise, a cross sectional study in older Australian women (Lee and Russell, 2003) revealed that women aged 70 years and over with a high physical activity level had a higher emotional well-being.

Additionally, elderly who attained recommended physical activity guidelines were more likely to perceive better health related quality of life (Koltyn, 2001; Brown et al., 2003; Varin Binhosen, 2003). Several studies demonstrated that physical activity is also associated with healthier quality of life among older women living either independently in the community or in assisted-care facilities (Koltyn, 2001). This was also confirmed for Thai elderly living in urban areas (Varin Binhosen, 2003). In a randomized controlled trial study using the Thai Wand Exercise program, 40 minutes per day, 3-5 days per week, for 15 weeks saw an improvement on the mental health dimension of health related quality of life in sedentary Thai older adults (Punnee Puengsuwan et al., 2008).

In brief, several evidences have supported the health benefits of physical activity in the prevention of several chronic diseases, while maintaining functional independence, improving psychological health and health related quality of life for the elderly.

2. Physical activity in healthy older Thai people

2.1 Overview of Thailand and Thai elderly

Thailand is situated in Southeast Asia and is divided into six regions: North, South, Northeast, West, East, and Central (The Royal Institute, 2005 : online). The Northern region is mountainous with lush valleys fed by numerous rivers and streams. The Northeast has a semi-arid plateau with relatively infertile soil. Agriculture is predominant in both North and Northeast regions. The Southern and the Western regions are surrounded by the Gulf of Thailand on the east and the Indian Ocean on the west. They are influenced by rain for several months and relies mostly on fisheries. The Eastern region is bounded by a short Gulf of Thailand coastline and industries and fisheries are predominant. The central plains rely mostly on agriculture. Thailand is administered by appointed governors and divided into provinces, districts, sub-districts, and villages (Suwit Wibulpolprasert, 2007). From a sociology perspective, Thais choose to live in an urban or a rural area due to different occupations, income, social differences, population density, community size, and the environment.

Due to modernization, the rate of aging population is rapidly increasing (NSO, 2005). In 2007, 10.7% of the total population in Thailand was considered senior citizens (NSO, 2008). Knodel and Napaporn Chayovan (2008b) defined urban population as persons living within officially designated municipal areas (testsabaan, inThai) while rural population residing outside municipal areas. A national survey revealed that most senior citizens lived in a non-municipal area (NSO, 2008). In addition, the proportion of elderly female was higher than elderly male (NSO, 2008). Shared living, with or very near family members such as their spouse, and/or their children or grandchildren was the most frequently stated (NSO, 2008). Their children, acted as the principal caregivers (Knodel and Napaporn Chayovan, 2008a: online; 2008b). However, the trend of the skipped generation households with grandparents and grandchildren living together without middle generation married adults will gradually increase (Somsak Chunharas, 2008; Knodel and Chayovan, 2008a: online; 2008b). Just over three-fourth of Thais aged 60 and over had resided in their own homes , whereas a quarter of them stayed in institutions or the Social Welfare Development Center for Older Person (Churnrurtai Kanchanachitra et al., 2007; NSO, 2007).

Additionally, most elders who lived in a non-municipal area were more attached to their home and community. There were familiar with their nearby temple, primary care unit, marketplace, and office government center (Vitul Lieorungruang et al., 2009). Based on the way of life of the elderly as to their physical environment, the location of habitation between the elderly who lived in the municipality and non-municipality was different: those who lived in municipality live in a house closing to the others, whereas those who lived in non-municipality live in a house which located in a large area. If the house belonged to the elderly, the house was old, big, and deteriorated; if the house belonged to urban area, the house was new and modern and was in the area closed to the work place of the municipal area (Sompoch Anegasukha and Kochgorn Sungkchad, 2005).

Given the traditional hierarchy of Thai society, a sense of gratitude (katanyu katavedi, inThai) and obligation, and a sense of respect strongly relate to the lifestyle of the senior citizens (Jiraporn Kespichayawattana, 1999). Most Thai people are Buddhists, in most cases this leads them to live with their parents in order to repay their gratitude (Tassana Choowattanapakorn, 1999). Thai people respect the elderly and accept to take care of their parents when old (Tassana Choowattanapakorn, Nay, and Fetherstonhaugh, 2004). For example, assistance in daily activities was seen as one of the responsibilities that family members engaged to support their aging relatives (Tassana Choowattanapakorn et al., 2004). In addition, within the doctrine of Buddhism, Thais believe that good performances lead to a good return. Consequently, most elders have adhered to religious belief at the temple to accumulate merit for a better life in the future (Kanokporn Nateetanasombat, 2003). As a consequently, social activities can be generally found every day in Thai society (Pranom Othaganont, Chownpis Sinthuvorakan, and Pongsai Jensupakarn, 2002; Wichuda Intaramanwong, 2003). Participation in solving community problems, communication with neighbors, willingness to help others and to sacrifice for community benefits were common practice in all Thai elderly (Pranom Othaganont et al., 2002).

2.2 Physical activity in healthy older Thai people

Older Thai people have engaged in 4 types of physical activity: occupational, household chores, transportation, and leisure time activities. Firstly, occupational activities are generally found in the Thai context. Changing society leads the elderly to work for daily living expenses, provide for their family, improve health conditions and increase self-value (the National Commission on the Elderly, 2005). According to a survey by the NSO (2007), 36.4 % of the older people in all parts of the country continue to work in paid and unpaid labour. Particularly, most of them (34.8 %) still work in agriculture (the National Commission on the Elderly, 2005) or the informal sector of economy (Knodel and Napaporn Chayovan, 2008b).

The majority of work status was own account worker and unpaid family worker (NSO, 2008). In addition, most worked on average 39 hours per week with male workers in urban areas working around 46 hours and in rural areas 38 hours a week (Churnrurtai Kanchanachitra et al., 2007). Similar to Nareerat Jitramontee's study (2003), for those who still worked, the average working hours was 30.61 per week in Bangkok. The activities however, depended on the area of residence; for instance, older persons in urban areas were mostly laborers, self employed, and shop employers/employees, whereas those in non-municipal area have generally engaged in farming (Wichuda Intaramanwong, 2003).

Secondly, most elderly spend most of their day in household chores, family care activities, mowing the lawn, raking leave, gardening, as well as participating in community groups activities (Waraporn Sirisawang, Chamaiporn Tawichasri, and Jayanton Patumanond, 2000; Wannipa Asawachaisuwikrom, 2001; Kaysorn Sumpowthong, 2002). Kaysorn Sumpowthong (2002) conducted a focus group study on older Thai people and found that looking after family members and gardening were favorite activities. It is interesting that different types of activities are gender dependent and area of living. In Nareerat Jitramontee's (2003) and Wichuda Intaramanwong's (2003) studies for example, elderly females were responsible for household chores such as home cleaning, washing/ironing clothes, cooking, and looking after the grandchildren whereas most elderly males had an occupation, conducted wickerwork, and/or were responsible for work outside the home such as gardening. Within the Thai society norm male does not participate in household chores (Wichuda Intaramanwong, 2003). Compared to other activities, household chores have been less studies in previous researches. Regarding to area of living, the elderly who lived in the municipality frequently participates in light to moderate intensity activities such as housework, dish washing, food preparation, grocery shopping, laundry, cleaning walkway/driveway, and childcare (Prapaporn Chinuntuya, 2001; Varin Binhosen, 2003). Meanwhile those who lived in non-municipality mostly participated in household activities, child care, religious and community activities (Waraporn Sirisawang et al., 2000), in particular some of them have also contributed to society by participating in voluntary activities (Sutthichai Jitapunkul, Napaporn Chayovan, and Jiraporn Kespichayawattana, 2002).

Thirdly, traveling is also regarded as a type of physical activity. Generally, older people travel from their home to other places by walking, bicycling, or using a motor vehicle, such as trains, buses, cars, and motorcycles (Prapaporn Chinuntuya, 2001; Wichuda Intaramanwong, 2003).

Lastly, leisure time activities of older people include recreational activities and exercises. The recreational activities are mainly; resting, listening to the radio, watching television, reading, and praying (Somsanit Waengwon et al., 2000). Regarding exercise activities, the survey of four regions in Thailand by the Institute of Geriatrics (2004) found that 62.3 % of older people performed walking as exercise. According to Kaysorn Sumpowthong's study (2002), walking was emphasized as the most fashionable exercise. Moreover, many senior citizens participated in jogging, aerobics activity (The Institute of Geriatrics, 2004; the National Commission on the Elderly, 2005), and light calisthenics (Wannipa Asawachaisuwikrom, 2001).

To strengthen the well-being of Thai elderly, many plans and legislations have continually been enacted to provide assistance to the elders for a period of nearly 30 years ago (Knodel and Napaporn Chayovan, 2008b). In 2002, the second National

Long-Term Plan for Older Person, 2002-2012 was established; the aim of this plan is to provide knowledge to encourage exercise behavior through various types of exercise, exercise facilities and equipment (Committee policies and Strategies for elders, 2002). Meanwhile the Ministry of Public Health, the Department of Public Welfare, and Subdistrict Administration Organization have promoted the establishment of senior citizen clubs in every subdistrict of all provinces of the country (Somsak Chunharas, 2008). A survey in 2008 identified about 19,475 elderly clubs all over Thailand, most of them located in the northeast region (45.6%) (Somsak Chunharas, 2008). To keep the elderly motivated and healthy, these senior citizens club conduct monthly exercise activies for its members.

Studies however, have found that older Thai people have participated in less physical activity than that recommended. Based on a survey of physical activity on 1833 older people, it was found that 30.3% did not participate in physical activity at the adequate level (ABAC Poll Research Center, 2005). Additionally, the engagement on physical activity has decreased 6 per cent between 2004 and 2005 (the National Commission of the Elderly, 2005). In 2007, the NSO (2008) reported that 58 % of older people did not perform physical activity. In particular, the trend of inadequate physical activity engagement in the group aged 70 years and older will increase (Yawarat Porapakkham and Pornpan Boonratpan, 2006). In addition, 69% of the participants did not perform sufficient household activities or leisure time activities (Wannipa Asawachaisuwikrom, 2001) and 78.73% of Thai elders did not participate in exercise at all (the National Commission on the Elderly, 2005).

In summary, the number of aging population has been constantly increasing. With increased age, there is greater concern on the health of aging population. The patterns of physical activity performed among Thai elders including occupational, transportation, household chores, and leisure time activities differed in three dimensions; across duration, frequency, and the level of intensity. Although the Thai government enacted acts, established a plan, and set up elderly clubs to promote healthy living, participation in physical activity has been less than that recommended for good health. Further studies should therefore concentrate on the factors influencing the lack of physical activity. Moreover, since the way of life of Thai elderly differs from other countries and studies, the knowledge obtained from this research should be used to develop intervention applicable for the Thai elderly.

3. The social cognitive theory

Physical activity among older people has been influenced by a variety of factors and has been understood using a multidimensional framework. Social cognitive theory (SCT) is a comprehensive theory of human behavior that has proven useful in the studies of health behavior since it combines the concept of cognitive processes with the concept of performance-based procedures (Bandura, 1997; 2001). Thus, the explicit theory can explain the physical activity of older people and point the significant variables of the present study.

The foundation of SCT includes the view of personal factors, behavior, and environment (Bandura, 1986). Based on the conception of triadic reciprocality, these factors operate as interacting determinants that influence one another bidirectionally (Bandura, 1986). From this theoretical perspective, human behavior is proposed as the product of a dynamic interplay of personal, behavioral, and environmental influences. Although these relationships are viewed as reciprocal determinants, the effect of these personal or cognition behaviors, and environment determinants are not equal (Bandura, 1997). In other words, behavior is not simply the result of the environment and the person, just as the environment is not simply the result of the person and behavior (Glanz, Rimer, and Lewis, 2002). The SCT is showed in Figure 2.1. Moreover, the influence of one factor may vary over time depending on the situation (Bandura, 1997).

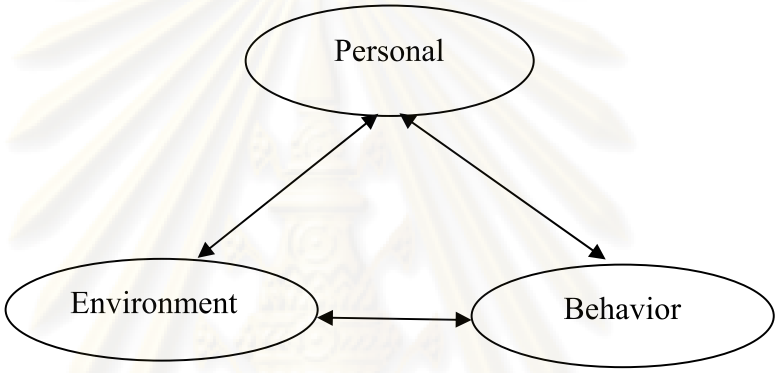

Figure 2.1 Social cognitive theory

SCT have been broadly applied to a range of older adults including hypertensive patients (Gee, 2005), elders with cardiac problems (Allison and Keller, 2000), sedentary adults (McAuley et al., 2003a) and non-institutionalized women (Laffrey, 2000). It has also been applied in a variety of settings such as rural areas (Wilcox et al., 2003) and churches (Anderson et al., 2006), Furthermore, SCT as a framework has been applied in inactive and active elderly (Wilcox et al., 2003; Anderson et al., 2006; Umstattd et al., 2006).

Generally, SCT posts that personal contribution is influential in determining behavior that includes the form of cognitive, affective, and biological events (Bandura, 1986). Among the vital personal factors are the individual's capabilities to symbolize behavior, to anticipate the outcomes of behavior, to learn through observing others, to self-regulate, and to reflect on experiences (Bandura, 1986;

1997). These capabilities provide a person with the cognitive development which is important in determining their future (Bandura, 1997). However, even if an affective state was found to be predictive of physical activity, it consistently had less influence on physical activity in older adults. Longitudinal and randomized control trial studies revealed that affect has been shown to be predictive and explanatory in relation to physical activity, but these studies had been only conducted in sedentary older adults (Bock et al., 2001; Salmon et al., 2003). Older adult population with physically inactive to active was not represented. In addition, it is rather speculative to attempt to explain the reasons underlying the relationship; it could be caused by different definitions of affect; for instance enjoyment (Salmon et al., 2003; Steven et al., 2003), and depressive, positive and negative affect (Bock et al., 2001). Moreover, previous examinations of the direct and indirect effects of physical activity engagement on older adults are less known, therefore, stated the association of affect and physical activity was less stable. As mentioned above, the present study focuses only on cognitive and biological variable within personal factors.

Of particular relevance to cognition functioning, efficacy beliefs affect the types of activity people choose to engage in, the level of effort they expend, their perseverance in the face of difficulties, and the thought patterns and emotional reactions they experience (Bandura, 1986). Bandura (1997) postulated that the two interrelated personal cognitive constructs that explain the motivation in older people to participate in physical activity are self-efficacy and outcome expectations. In the first assumption, self-efficacy is defined as "*belief in one's ability to organize and execute the courses of action required to produce given attainments*" (Bandura, 1997: 3). Self-efficacy beliefs can develop human functioning through four processes:

choice behavior, effort expenditure and persistence, thought patterns, and emotional reactions (Bandura, 1986). The first two reflects the behavioral domain; the last two are mainly cognitive in nature (Bandura, 1997). With respect to cognitive functioning, low self-efficacy beliefs could lead to less participation in challenging cognitive activities as well as less effort or persistency in such activities. In turn, people with a high self-efficacy level will adopt and maintain their behaviors (Bandura, 1997).

Self-efficacy is influenced by four sources: a) previous experience, b) verbal persuasions, c) vicarious experience, and d) physiological and affective states (Bandura, 1986; 1997). Bandura (1997) considers previous experience as the most important source. The achievement in a significant task encourages an individual to perform the similar task, whereas a failure discourages one's belief (Bandura, 1994). Verbal persuasion influences an individual to adopt and maintain an activity (Bandura, 1997). However, it is more difficult to increase self-efficacy through positive persuasion than it is to decrease self-efficacy via negative persuasion (Bandura, 1997).

Furthermore, vicarious experience is a way of influencing self-efficacy. People's belief can be enhanced by observing the success of others (Bandura, 1997). Particularly, similar attributes in both the role model and an individual will help to increase one's confidence (Bandura, 1994). Moreover, Bandura (1997) stated that people with positive emotion would increase their level of self-efficacy.

The second assumption of cognitive construct, outcome expectations, are the expectation of positive and negative outcomes as the results of a specific behavior that can influence human's motivation and action through forethought (Bandura, 1986;

1997). People construct outcome expectations from observed conditional relations between environmental events, and the outcomes that the action produced (Bandura, 1986). Outcome expectations include physical, social, and self-evaluation (Bandura, 1997). Particularly, the physical effects comprise of two forms; 1) pleasant sensory experience and physical pleasures in positive form, and 2) aversive sensory experience and physical discomfort in negative form (Bandura, 1997). Moreover, Bandura (1997) postulated that people who increase their level of confidence will anticipate successful outcomes. Therefore, outcome expectations depend on self-efficacy related judgments.

For biological factors, Dzewaltowski (1994) postulated that age is a significant determinant in personal construct. Generally, most human beings begin to slowly decline in biological functions in the mid-20s, followed by a decline in physical and cognitive functions (Stewart, 2005). The gradual decline of the biological functions in advanced age leads to increase susceptibility of diseases and disabilities, where as physical strength is required for engaging in activity (Bandura, 1997). Additionally, changing of physical capabilities such as increasing fatigueability, muscle weakness, decreasing endurance capacity, muscle wasting, causes an individual to decrease physical activity participation (Stewart, 2005).

In one foundation of the SCT conception, environmental factors refer to all physically external structures that affect behavior by the interaction of internal factors with people's perceptions (Bandura, 1986). Additionally, the environment influences can be constructed from the psychological mechanism of self-system such as motivation (Bandura, 1986; 1997). Bandura (1997) further expanded the concept of environment to include social systems and physical environment. Furthermore, individual's beliefs of his or her capabilities can influence thoughts and emotions during interaction with his/her environment (Bandura, 1986). As a reason, the relationship between cognitive factors and environmental factors shapes people's action or behavior (Bandura, 1997). Thus, senior citizens determine the aspects of their environment to which they are exposed, and in turn, that environment modifies their behavior.

4. Factors associated with physical activity in older people

Several personal and environmental factors influencing physical activity have been studied. Based on the conceptual framework and empirical research regarding physical activity applied to guide the present study, correlations among self-efficacy, positive outcome expectation, negative outcome expectation, age, physical environment, social support, and physical activity were reviewed and are presented as follows.

4.1 Self-efficacy and physical activity

Self-efficacy beliefs can develop human functioning through psychosocial function (Bandura, 1986). Perceived self-efficacy provides the foundation for personal motivation, well-being, and accomplishment (Bandura, 1997). The rate of confidence in capability for solving specific problems may vary due to different situations. As argued by Bandura (1996), the stronger the level of self-efficacy, the greater the chance a person will select more challenging tasks, be persistent and perform them successfully. Therefore, in this study, self-efficacy refers to one's perceptions on the level of confidence or belief in their ability to perform physical activity at least 10 minutes a time, 3 times a day, under low, moderate, and high levels of difficulties within a given activity domain (Resnick and Jenkins, 2000). Low obstacles for physical activity included the weather, being uninterested, exercising alone, and feeling depressed. Moderate obstacles for physical activity included no enjoyment, busy with other activities, tiredness, and stress. Pain associated with participation was considered as a high obstacle for physical activity.

The direct effect of self-efficacy on physical activity

A number of empirical evidence have supported Bandura's argument that older people with higher levels of self-efficacy have higher levels of physical activity (Allison and Keller, 2004; Laffrey, 2000; Resnick, 2001c; McAuley et al., 2003a; Wilcox et al., 2003; Anderson et al., 2006; Lee and Laffrey, 2006; McNeill et al., 2006a; Umstattd et al., 2006). For example, Resnick (2001c) tested a model of overall activity in older adults who lived in a retirement community using a cross-sectional design. The study findings demonstrated that self-efficacy as a predictor in the model directly influenced physical activity and accounted for 29 % of the variance in physical activity. Unfortunately, the study was conducted in only 175 older adults and most of the respondents were women, well educated with generally low levels of physical activity.

Several longitudinal studies have confirmed the affects of self-efficacy on physical activity among older adults (McAuley et al., 2003a; McAuley et al., 2007). For instance, McAuley and colleagues (2003a) conducted a six-month randomized controlled trial with an 18- month follow-up to examine the long term continuance in physical activity among older adults. Structural equation modeling was applied to analyze several models of physical activity prediction. The findings from assessments made at the 6 and 18 month points showed that self-efficacy predicted the participation and continuation in physical activity. The fitted model accounted for 40% of the variance in the 18-months follow-up. In addition, McAuley and associates (2007) determined the contribution of self-efficacy and the effects in predicting long-term physical activity in 174 sedentary older adults. Participants were randomized to one of two treatment conditions at baseline: a walking program or stretching and toning program. The program was conducted in six months. All participants were assessed for physical activity over a 1–week period at both Year 2 and Year 5 follow-up. The findings revealed that self-efficacy is positively associated with physical activity. At Year 2, self-efficacy more positively correlated with higher level of physical activity at both Year 2 and Year 5 ($r=.32, .34, p<.05$). Although the mean score of self-efficacy decreased from 70.37 to 60.23 from Year 1 to Year 2, self-efficacy did predict physical activity in older adults. However, these two studies have a number of limitations: most of the participants were sedentary older females and the sample sizes were small to be using SEM analysis.

In contrast with the above studies, the association of the self-efficacy and physical activity is ambiguous from findings in other evidences (Gee, 2005), in particular Thai elderly (Prapaporn Chinuntuya, 2001; Wannipa Asawachaisuwikrom, 2001). For instance, Prapaporn Chinuntuya (2001) conducted a cross-sectional study with 300 elder persons living in a metropolitan area. The purpose of the study was to develop two causal models including leisure-time and lifestyle exercise based on Pender's Health Promotion model. The majority of the participants were female with a mean age of 68.01 years (SD.= 6.04). The results revealed that self-efficacy had a positive direct effect on physical activity in the leisure-time exercise model, although were not significantly correlated in lifestyle exercise model. Conspicuously, most of the respondents perceived self-efficacy for lifestyle exercise at high level (62%), whereas only 39.70 % of the participants perceived self-efficacy for leisure-time exercise at high level. Furthermore, only 41% of the elders participated in leisure-time exercise. The results of the study shall be difficult to generalize to older people living in other areas.

In a related study, Wannipa Asawachaisuwikrom (2001) examined the effects of self-efficacy on physical activity among 112 non-institutionalized older Thai adults aged 60 years and older. Path analysis was used to estimate the effects. The results revealed that self-efficacy did not significantly predict physical activity. Notably, the participants were chosen based on random sampling from only one district of a particular province and most had a low level of school education. Likewise, the sample sizes were small.

Although restricted, previous evidence with older people suggested that self-efficacy influences physical activity, however the causality of self-efficacy in older Thai people is needed for confirmation. Therefore, it is important for additional studies to determine this association in older Thai people.

The indirect effect of self-efficacy on physical activity through positive outcome expectation and negative outcome expectation

Individuals with a higher level of confidence will forethought the desired outcomes (Bandura, 1986; 1997). Older people will perform physical activity based on their perceived outcomes and capability beliefs (Bandura, 2001). Furthermore, the outcome expectations flow from self-efficacy, directly influence behavior (Bandura, 1997), that is, the outcome expectations act as the mediating role for performance. The results of empirical research regarding physical activity among older people support the notion that self-efficacy, positively influences positive outcome expectation (Wannipa Asawachaisuwikrom, 2001; Anderson et al., 2006) and negatively influences negative outcome expectation (Wannipa Asawachaisuwikrom, 2001; Anderson et al., 2006). As well, few studies confirmed this role; for instance, a study of people aged 18 to 92 years supported the mediating role of positive outcome expectation (Anderson et al., 2006) and a research on university students confirmed the mediating role of negative outcome expectation (Rovniak et al., 2002).

It is presumed that the effect of self-efficacy on both positive and negative outcome expectation among older people is still being supported. Regarding mediating roles of both positive and negative outcome expectation, none of the studies were conducted with only older people. It is critically assumed that the mediating roles of both outcome expectations are needed for confirmation on physical activity participation in further researches.

4.2 Positive outcome expectation and physical activity

Positive outcome expectations focus on individuals' beliefs that certain benefits will occur following participation in a specific behavior (Bandura, 1986). Based on the SCT, for people who believe that their actions can produce the outcomes they desire, they require the incentive to act or to persist on the face of obstacles (Bandura, 1997). Correspondingly, as defined by Resnick (2005), positive outcome expectations refer to older adults' perception of positive outcomes of physical and psychological effects from performing physical activity. Therefore, the current study defines positive outcome expectation as older people's perception of the benefit outcomes of physical and psychological effects from performing physical activity at least 10 minutes a time, 3 times a day. Positive physical outcome expectation is perceived as a form of improving physically, decreasing tiredness, building stronger muscles, raising endurance, and improving bone strength. Positive psychological outcome expectations is perceived as a form of providing better feeling, enjoyment, increasing sense of personal accomplishment, and enhancing mental alertness (Resnick et al., 2000).

The direct effect of positive outcome expectation on physical activity

A number of evidences supported the relationship between positive outcome expectations and physical activity, however, on the other hand an inconsistent association between the two was also noted. Many studies indicated that people who understands that physical activity is very important are more likely to be actually involved in the participation in physical activity (Pitakpong Punta, 2004; Wannipa Asawachaisuwikrom, 2004). For example, Wannipa Asawachaisuwikrom (2004) examined the prediction of personal factors and the behavior-specific cognition on physical activity in 259 older Thai people in a sub-district in Thailand. The variables included income, education, perceived benefits, perceived barriers, and perceived environment. The data was analysis by Hierarchical regression; the results showed that all the variables accounted for 68% of the variance in physical activity. Moreover, perceived positive outcome expectations significantly predicted physical activity.

To examine the relationship of the selected factors and physical activity, Wee Poolsawat (2007) assessed 315 Thai elders, aged 70 years and over, living in Bangkok, Thailand. The respondents were voluntary recruits from two communities who were interviewed by the researcher. Data was analyzed using Pearson's product moment correlation coefficient and stepwise regression. The study findings revealed that the elders who perceive the benefits of physical activity were better able to sustain physical activity levels than those who did not (r=.16, p<.05). Also, there were only seven factors including self-efficacy, perceived interpersonal influence, perceived barriers, being a member of senior citizen clubs, perceived health status, age, and adequate income that explained 40% of variance of physical activity. Nevertheless, most of participants were female with an average age of 76 years and living in their own house in a municipal area.

Similarly, a cross-sectional study of 389 Hmong people aged over 15 years and older in Phayao province, Thailand was conducted by Pitakpong Punta (2004). The study proposed to determine the relationship between personal factor, perceived benefits, and physical activity. The findings illustrated that the participants with greater positive outcome expectation were more likely to take part in physical activity. Although there was a positive correlation between perceived positive outcome expectation and physical activity, the majority of participants were younger and middle aged. It is therefore difficult to induce the results to older adults, in particular Thai elders living in the other areas.

Additionally, a number of qualitative studies on the elder's perception have also strongly supported the importance of positive outcome expectations on physical activity (Devereaux et al., 2001; Melillo et al., 2001; Kaysorn Sumpowthong, 2002; Belza et al., 2003: online; Henderson and Ainsworth, 2003; O'Brien Cousins, 2003; Kolt, Paterson, and Cheung, 2006; Lin et al., 2007). For instance, Melillo and associates (2001) examined the perception of older Latino adults toward physical fitness, physical activity, and exercise. Three focus groups were conducted in participants aged 59 to 76 years, the majority females, living in the United Stated for an average of 25.6 years. The findings demonstrated that all focus groups engaged in physical activity after learning the physical and psychological benefits of physical activity. Alike, Kaysorn Sumpowthong's (2002) set to explore physical activity levels and the determinants for developing a model in older Thai people in Bangkok, Thailand. Four focus groups and twenty-three individual face to face interviews were conducted. All participants described that the psychological and social health benefits lead them to participate in physical activity.

In contrast, a path analysis study demonstrated that the positive outcomes expectation was not significantly correlated with physical activity among the Thai elderly (Wannipa Asawachaisuwikrom, 2001). Wannipa Asawachaisuwikrom (2001) examined the psychosocial factors associated with physical activity in Thai elderly, randomly selected samples, 60 years and over from two sub-districts in a district in Thailand. Path analysis demonstrated that the elderly with greater positive outcome expectations were not more likely to participate in physical activity. Unfortunately, the participants were randomly selected from only one district in a province and the majority of the samples had a low school education level.

Similarly, Nices and Kershaw (2002) developed a model of psychosocial and environmental influences on physical activity and psychophysiological health outcomes in sedentary women aged 30-60 years. Perceived benefits of physical activity was a predictor in the model. This cross-sectional study using structural equation modeling revealed that the model strongly predicted the program which was designed to increase physical activity; however perceived benefits of physical activity did not significantly influence physical activity. Although most studies revealed a positive correlation between positive outcome expectation and physical activity, other studies suggested a negative correlation. A cross-sectional study by Anderson and colleagues (2006) reported that positive outcome expectation negatively influence physical activity among the participants with different age groups between 18 to 92 years.

In short, the clarification on the magnitude of linking positive outcome expectation and physical activity has been described, however the inconsistency of the relationship between positive outcome expectation and physical activity, especially in older people have been inconclusive explained. Therefore, it is critical that this association be examined in older people.

4.3 Negative outcome expectation and physical activity

Identifying negative outcome expectations for physical activity that prevent or hinder older adults from participating in physical activity has become a concern for gerontologists and health care providers. People with negative outcome expectations will lower their behavior (Bandura, 1997), that is, if older person expect an unachievable physical activity behavior, they will reduce the participation in physical activity. The negative outcome expectations may be flown from performance non-achievement activity (Bandura, 1997). Negative outcome expectation of physical activity is defined as an individual' beliefs that certain negative outcomes will occur following participation in physical activity (Resnick, 2005). The negative outcome involves physical and psychological outcomes. Therefore, the present study defines negative outcome expectations as older people's perception of the negative outcomes of physical and psychological effects from performing physical activity at least 10 minutes a time, 3 times a day. Negative physical outcome expectations include physical discomfort and pain, whereas negative psychological outcome expectations include fear of falling or getting hurt, and stress on the heart (Resnick, 2005).

The direct effect of negative outcome expectations on physical activity

A number of evidences depicted the person who perceived greater negative outcome expectations of physical activity to have engaged less in physical activity (Crombie et al., 2004; Rovniak et al., 2002). A cross-sectional survey by Crombie and colleagues (2004), determined the elder's intentions to participate in leisure time physical activity and identified strategies to promote physical activity. A total of 409 older Scottish people, aged 65-84 years who lived in their home were randomly recruited. Regression modeling was used to identify 11 factors that exerted significant independent effect on levels of leisure time physical activity. The final model revealed that leisure time physical activity was affected by the lack of energy, shortness of breath, and painful joints (OR= 3.3, 3.2, 2.5 respectively). The results revealed that physical problem as a part of negative outcome correlated with physical activity engagement in the elderly.

Rovniak and colleagues (2002) conducted a study to examine a model of the relation between social cognitive variables and physical activity in 227 undergraduate students. The model included social support, self-efficacy, outcome expectations and self-regulation. The social cognitive measurement was assessed at baseline and physical activity measured at 8 weeks follow-up. The outcome expectation was measured with positive outcome expectations, negative outcome expectations, and enjoyment scale. Results of structural equation modeling demonstrated that a good model fit accounted for 55% of the variance of physical activity at 8 weeks follow-up.

Within the model, outcome expectation did not have a direct effect on physical activity, however the negative outcome expectations exerted a significant effect on physical activity. Since the study sample consisted of university students, it may not suit other groups of population, in particularly older people.

Although the relation between negative outcome expectations and physical activity has been less studied as descriptive studies, numerous qualitative researches have shown that the expectation of negative outcomes such as fear of physical activity causing injuring or pain cause the elderly to cease physical activity (Devereaux et al., 2001; O'Brien Cousins, 2003; Wilcox et al., 2003; Kolt et al., 2006; Lin et al., 2007). Furthermore, some Thai elderly described that the fear of illnesses, injuries, and disabilities were the negative reasons for not engaging in physical activity (Kaysorn Sumpowthong, 2002).

Another qualitative study, Lin and associates (2007) identified and compared the beliefs on physical activity by older Chinese immigrant adults in Seattle and Chinese elderly in Taipei through focus groups. Participants aged 65 years and over, mostly women and living in the community were recruited into groups by purposive convenience sampling. One group was formed by 10 elderly from Washington and the other group 14 elderly from Taipei, Taiwan. The information was analyzed by deductive content analysis. The three chronic diseases most commonly reported by participants were hypertension, diabetes mellitus, and arthritis. Many of the participants mentioned fear of injury, fatigue, and increasing painful symptoms as disadvantages associated with physical activity. Additionally, an exploring perception study by Jancey and colleague (2007), investigated perceptions of physical activity in elders aged 65-74 years in Western Australia. A total of 16 participants with insufficient physical activity levels were convenience sampled. Using a thematic analysis approach, the study findings illustrated that older adults reduced physical activity engagement associated with pain. Findings of these qualitative studies raised issues that warrant further investigations, perceived pain and fear of falling also acted as a significant determinant. It is claimed that the tendency for persons with high perceived negative outcome expectations to engage in physical activity becomes stronger in older adults.

It is presumed that negative outcome expectations have a direct influence on physical activity, but the causality of the negative outcome expectations and physical activity is still inconclusive in the elderly. Thus, the association of negative outcome expectations and physical activity needs to be investigated in the elderly.

4.4 Age and physical activity

The ageing processing and attitudes among older adults may result in activity restriction. As people grow older, they experience a gradual decline in the large biological reserve, which increases susceptibility to diseases and debility (Bandura, 1997). With advancing age, declining in the size, elasticity, and strength of all muscle tissues (Stewart, 2005) the muscular activity become less efficient and require more effort to accomplish a given activity.

The direct effect of age on physical activity

According to Westerterp and Meijer's investigation (2008), distributions of physical activity levels and total energy expenditure values under daily living conditions were shifted downward for participants aged over 60 years in comparison to the 20 to 49 aged group, as demonstrated using the doubly labeled water technique.

Also, there is qualitative evidence that some older people view physical activity as irrelevant to their own lifestyle even though they believed that physical activity participation may be beneficial to health (Kaysorn Sumpowthong, 2002). Meanwhile, older adults may believe themselves to be old or weak for engaging in physical activity (Schutzer and Graves, 2004). Others may be concerned that many physical activities to be inappropriate for them because of strenuous and injuries (O'Brien Cousins, 2000; Alexandris et al., 2003; Witcher, 2005).

Several literature review identified that age factor has been noted to have a direct effect on physical activity, with advancing age being associated with decreased levels of physical activity (Booth et al., 2000; Laffrey, 2000; Wilcox et al., 2003; Pitakpong Punta, 2004; Anderson et al., 2006; Umstattd et al., 2006). For instance, Anderson and colleagues' causal study (2006) revealed that physical activity was different between the participants with different age groups between 18 to 92 years. Similarly, related to older people's perspective, increasing age is considered as a great barrier for physical activity participation (Devereaux et al., 2001; Kaysorn Sumpowthong, 2002; Wilcox et al., 2006).

The clarification of the magnitude of linking of age and physical activity has been extensively shown however, the relationship has been less studied in older Thai people. It is therefore essential to investigate this association within the proposed model in older Thai people.

4.5 Social support and physical activity

Based on a review of concepts and evidences related to social support and physical activity, social support are interpersonal relationships and interactions which occurs both interpersonally and at community level (McNeill et al., 2006a). Social support enables or constrains the adoption of health promoting behaviors by providing access to resources and material goods, enhancing individual and community coping responses, and buffering negative outcomes (McNeill et al., 2006a). In addition, social support for physical activity is typically related to tasks that are jointly conducted with family members and friends to facilitate physical activity (Sallis et al., 1987). Hence, in the present study, social support is defined as older people's perception of family and friends support provided to them in terms of participation towards physical activity. Family support refers to older people's perception on the frequency of physical activity support by family members during the last month. Friend support refers to older people's perception on the frequency of physical activity support by friends, acquaintances, or coworkers during the last month in terms of participation and rewards towards physical activity.

Many cross-sectional studies illustrated that the elderly who had greater social support were more likely to take part in physical activity (Prapaporn Chinuntuya, 2001; McAuley et al., 2003a; Wilcox et al., 2003), however, this particular association was not supported by others (Wannipa Asawachaisuwikrom, 2001; Gee, 2005; Umstattd et al., 2006). It may be reflected that there are inconsistencies on the direct effect of social support on physical activity. However, a number of evidences demonstrated that family and friend support have provided the motivation to increase physical activity level through self-efficacy as cognitive process. Congruent with the social support view of SCT, family members and friends indirectly influences behavior by strengthening self-efficacy through observation learning and motivation process (Bandura, 1997). Observing the physical activity of others can assist individuals to learn about physical activity, its benefits, and also persuade one to take part in physical activity. Therefore, social support may have an indirectly influence physical activity via self-efficacy rather than being directly associated with physical activity in the elderly.

The indirect effect of social support on physical activity through self-efficacy

Various researches have consistently found a correlation of social support with self-efficacy (Wannipa Asawachaisuwikrom, 2001; McAuley et al., 2003a; Wilcox et al., 2003; Anderson et al., 2006; Umstattd et al., 2006). Additionally, a number of evidences have significantly determined the influence of support received from both family and friends on self-efficacy (Wilcox et al., 2003; Umstattd et al., 2006; McNeill et al., 2006b), whereas a study found that only the support of family members encouraged participation in physical activity (Anderson et al., 2006). Furthermore, Benight, and Bandura (2004) stated that self-efficacy played a mediating role for social support in health behavior. Numerous studies confirm that the support of either family or friends are positively associated with increased levels of participation in physical activity through self-efficacy (Resnick et al., 2002; McAuley et al., 2003b; Anderson et al., 2006; McNeill et al., 2006b).

For example, a social-cognitive model of physical activity composed of age, race, social support, self-efficacy, outcome expectations and self-regulation was examined by Anderson and colleagues (2006). The participants were recruited from 999 adults who participated in Southwestern Virginia churches. Social support was measured using a questionnaire that included support from family and friends for physical activity. Structural equation modeling was used to analyze the model; the findings illustrated that family support indirectly influenced physical activity through self-efficacy and self-regulation however; friends' support had a non significant influence. The indirect and total effect of family support on physical activity had a significant standardized value (β=.20, β=.16, $p<.01$), meanwhile the direct effect was non significant. Additionally, the model accounted for 46% of the variance in physical activity among the diverse group of adults and supported the indirect effect of family support on physical activity via self-efficacy. The participants aged 18-92 years regularly attended the church that included younger and older adults, subsequently the findings may be difficulty to represent only the elder persons.

In another study among 174 sedentary older adults by McAuley and colleagues (2003) found that social support by friends had a direct effect on physical activity and an indirect effect on physical activity via self-efficacy both after 6 or 18 months post survey. Consistent with SCT, for some health behaviors social support influences behavior through self-efficacy rather than directly (Bandura, 1997). In addition, in a qualitative study which determined the elderly perspective on physical activity from multiple cultures, Belza and colleagues (2004) cited that the child and other family members helped their parents or grandparents to participate in physical activity by accompanying and encouraging them. Also previous studies in Thailand revealed that family and friend support were important sources that acted as catalysts, reinforcement, and encouragement for engaging in physical activity (Kaysorn Sumpowthong, 2001).

In spite of the fact that few studies did not support the direct relationship between social support and physical activity, many studies have still provided the indirect influence of social support on physical activity through self-efficacy. Nevertheless, integrating social support in a model and taking self-efficacy as a mediator between social support and physical activity has not been identified in the elderly. As a consequence, additional studies are needed to clarify this effect in the old age group.

4.6 Physical environment and physical activity

Physical environment refers to a part of the external factors, which affect behavior (Bandura, 1997). Particularly, physical environments can either be facilitators or obstacles for the participation in physical activity (Humpel et al., 2002; Spence and Lee, 2003). In the current study, physical environment is defined as older people's perception of home environment, neighborhood environment, and community environment as they relate to their ability to participate in physical activity (SIP 4-99 Research Group, 2002: online). Home environment refers to participants' perceptions regarding their home environment both in and around their home in relation to their participation in physical activity. Neighborhood environment refers to older people's perceptions of supports (including access and characteristics) and barriers of physical activity in their neighborhood. Neighborhood is defined as the area around their home that they could walk to within 10 minutes (Addy et al., 2004). Supports for physical activity in neighborhood environment include streetlights, unattended dogs, public recreation facilities, a pleasant neighborhood for walking, and the condition of the public recreation facilities. Barriers to physical activity include traffic volume and crime (Addy et al., 2004). Community environment refers to older people's perceptions of supports and barriers of physical activity in their community, and is defined as the area within 20 minutes drive from their residence. Supports for physical activity in community environment include public recreation centers, parks, schools, and places of worship. Barrier for physical activity in community environment is the safety concern associated with recreational facilities (Addy et al., 2004).

The direct effect of physical environment on physical activity

Previous researches have supported direct relationship between physical environment and physical activity among older people (Booth et al., 2000; Wannipa Asawachaisuwikrom, 2001; 2004; Humpel et al., 2002; Wilcox et al, 2003; McNeill et al., 2006; McNeill, Wyrwich et al., 2006). For example, Wannipa Asawachaisuwikrom (2001) determined the environmental factors on physical activity among 112 older Thai people. The researcher defined environmental factors as neighborhood environment and convenient facilities. Neighborhood environment consisted of three items: neighborhood features (e.g., sidewalk, heavy traffic, hills, street lights, unattended dog, enjoyable scenery, frequently see people walking, and crime), perceived safety, and neighborhood characteristics. While, convenient facilities included places where participants could use for physical activity engagement in their neighborhood or community, such as aerobic dance studios, beaches or lakes, bike lanes or trails, golf courses, health clubs, playing fields, public parks, public recreation centers, running tracks, sport stores, and swimming pools. As predicted, neighborhood environment had a significant direct effect on physical activity (β=.20, p<.05) and an indirect effect on physical activity through convenient facilities (β=.09, p<.05). Meanwhile, convenient facilities had a positive direct effect on physical activity (β=.26, p<.05). The researcher however suggested that the samples were randomly selected from only one district and all with similar characteristics. As a consequence, further studies should focus on participants with different socioeconomic backgrounds and geographical area.

In a latter study, Wannipa Asawachaisuwikrom (2004) examined the predictor of physical activity in 259 older Thai adults in a sub-district, in Thailand. Random sampling was applied to the study, while hierarchical regression was used to analyze data. Perceived environment was measured by combining neighborhood environment and convenient facilities into one scale. The model included income, education, perceived benefits, perceived barriers, and perceived environment and accounted for 68 % of the variance in physical activity; perceived environment significantly positive predicted physical activity with a beta value of .36. The findings concluded that the elderly who lived in neighborhoods with sidewalks, street lights, enjoyable scenery, no unattended dogs, traffic lights, and low crime were more likely to participate in physical activity rather than those with an unsafe neighborhood, heavy traffic and no place to exercise. Furthermore, the study indicated that neighborhood environment and convenient facilities were significant determinants of physical activity in the elderly. Considerably, perceived environment scale was obtained by summing both, 5-point Likert scale for safety item and dichotomous response (yes/no). Moreover, the frequency of using was presented more than perception. For this point, the researcher suggested that environmental measurements be modified by using interval or ratio scale.

In a related study, Wilcox and associates (2003) examined the correlation of physical activity in 102 older African American and white women who lived in rural settings. The conceptual framework of the study was guided by Social Cognitive

Theory. Perceived physical environment was defined as participants' scores on physical environment for physical activity including safety of their neighborhood, motorized traffic, street lighting, unattended dogs, living within walking distance of a park, and with sidewalks in their immediate neighborhood. The results depicted that elders with perceived greater safety and light motorized traffic were more likely to engage in physical activity, whereas those with perceived no sidewalks in their neighborhood were less likely to participate in physical activity. Furthermore, the researchers suggested that the results should not be generalized to older rural woman living outside the Southern United States.

A longitudinal randomized controlled trial study by McNeill and associates (2006), studied the social ecological model of physical activity and examined the direct and indirect effect of motivation, self-efficacy, social support, and physical environment on physical activity. Physical environment included neighborhood quality and availability of facilities. The proposed conceptual model was developed into 3 separate models including walking, moderate-intensity activity, and vigorous-intensity activity. The findings illustrated that physical environment had a significantly positive direct effect on physical activity. Availability of facilities had positive direct effect on walking (β=.26, p<.05) and moderate-intensity activity (β=.14, p<.05), whereas neighborhood quality had significantly direct effect on moderate-intensity (β=.14, p<.05) and vigorous-intensity activity (β=.10, p<.05). Although, these correlations are marginal, it is concluded that neighborhood quality had a slightly greater influence on moderate-intensity activity than either walking or vigorous-intensity activity; availability of facilities had a greater affect on walking than other activities. The study however, was conducted in 910 community adults aged 18-65 years (Mean age = 33 years), mainly African American female. Accordingly, perceptions related to physical environment may be different between young, middle-age and old age since older people's physical activity may be affected by physical environment more than younger adults (Sallis et al., 2007).

On the contrary, a cross-sectional study (Nices and Kershaw, 2002) revealed that disturbing of walking and community did not significantly influence physical activity in sedentary women aged between 30-60 years. Likewise, perception of neighborhood safety was not significantly associated with physical activity among 8,881community-dwelling adults aged 65 years and older (Lim and Taylor, 2005).

According to senior citizen's perceptions, physical environments take either an impeded or an enhanced physical activity role (Kaysorn Sumpowthong, 2002; Aronson and Oman, 2004; Kolt et al., 2006).With advancing age, the home environment and close surroundings become the major living space where senior citizens perform their everyday activities and spend most of their time (Dahlin-Ivanoff et al., 2007). Unfortunately, only home equipment as a part of home environment was correlated with physical activity (Sallis et al., 1997; Booth et al., 2000). To date, moreover, explanatory models of physical activity have focused primarily on neighborhood and community environment attributes and less on home environment. Though, the evidence on the relationship between home environment and physical activity in older adults has been less studied, it is assumed to be useful to study home environment as a supplement to physical environment.

In short, previous evidences show that safety and convenience in neighborhood and community are important factors for older adult's engaging in physical activity. Nevertheless, the association of physical environment and physical activity has been less supported. It is possible that home environment may influence physical activity by combining neighborhood and community environments. To enhance understanding and explanation of variance of physical activity in older people, physical environment including home, neighborhood, and community environment should also be considered in further studies.

5. The conceptual model in the previous studies

The conceptual model in this study was derived from Social Cognitive Theory (Bandura, 1997). The SCT has been continuously determined by great deal of studies. Regarding to explaining and predicting physical activity behavior, a substantial amount of evidence had adopted only the SCT as a conceptual framework (Rovinak et al., 2002; McAuley et al., 2003a: Gee, 2005; Anderson et al., 2006; Umstattd et al., 2008), whereas the others combined this theory with the others such as ecological model (McNeil et al., 2006b). Nonetheless, these studies conducted in an array population such as adults group (Rovinak et al., 2002), older group (McAuley et al., 2003a; Gee, 2005; Umstattd et al., 2008), and adults and older group (Anderson et al., 2006; McNeil et al., 2006b). Two studies mentioned on specified sample; one focused on the elderly with hypertension (Gee, 05), the other one conducted on inactive senior people (Umstattd et al., 2008). Three studies were conducted by prospective design (Rovinak et al., 2002; McAuley et al., 2003a ; McNeil et al., 2006b), while the others did cross-sectional design (Gee, 2005; Anderson et al., 2006; Umstattd et al., 2008). Moreover, all of these investigations conducted in the United Stated and Australia.

In addition, the prior physical activity models using only the SCT were developed by selecting 4-10 variables and these models tested only personal factors and social support with physical activity (Rovniak et al., 2002; McAuley et al., 2003a; Anderson et al., 2006; Umstattd et al., 2008). For instance, self-efficacy, outcome expectations, socio-demography characteristics were frequently chosen from personal variable, as well as social support was selected from environmental variable. Besides, those findings could accounted for 16-55% of the variance of physical activity (Rovniak et al., 2002; McAuley et al., 2003a; Anderson et al., 2006; Umstattd et al., 2008); the model developed and tested by Rovniak and colleagues (2002), Anderson and associates (2006) explained 55 % and 46 % of the variance in physical activity among adults. Two models were developed and examined in the older people, suggesting that the variance of physical activity could be explained 40% and 42.6% (McAuley et al., 2003a; Umstattd et al., 2008). Meanwhile, a model was developed by Gee (2005) explained 16% of the variance of physical activity among hypertensive older people.

Besides, three prior models illustrated that social support indirect influenced on physical activity through self-efficacy (Rovniak et al., 2002; McAuley et al., 2003a; Anderson et al., 2006). Also self-efficacy significantly direct and indirect affected on physical activity through outcome expectations (Rovniak et al., 2002). More interestingly, a model developed by Anderson and colleagues (2006) showed that self-efficacy indirect effected on physical activity via only positive outcome expectations not negative outcome expectations but the coefficient between positive outcome expectations and physical activity was negative direction. As well, this model demonstrated that age significantly negative direct affected on physical activity (Anderson et al., 2006). In contrast, a model was built up by Gee (2005) depicted self-efficacy had a no significant indirect effect on physical activity through positive outcome expectations.

6. Structural equation modeling for analysis

Structural equation modeling (SEM) is a complex combination of statistical hypothesis and is frequently applied to analyze multivariate data in behavioral and social science researches (McDonald and Ho, 2002). As pointed out by MacCallum and Austin (2000), SEM is an approach for specifying and estimating models of linear relationships among variables. Causal model may consist of measured variables and latent variables which hypothetical constructs cannot be directly measured (MacCallum and Austin, 2000). Each variable in the model is conceptualized as a latent one, measured by multiple indicators. Many indicators are constructed for each model. A specific model is established based on prior investigations' knowledge and the theory behind such development, therefore the researcher's judgment is of great importance (Munro and Sexton, 1984). A model is established not only to explain the variation and covariation of the measured variables (MacCallum and Austin, 2000), but also to account for the modeling of interactions, nonlinearities, correlated independents, measurement error, correlated error terms and multiple latent independents (Hoyle, 1995; Byrne, 2000).

Generally, the SEM process consists of two steps : 1) validation of the measurement model, and 2) suitability of the structural model (McDonald and Ho, 2002). McDonald and Ho (2002) stated that "structural model for the composite SEM, the combined measurement and path models.

The measurement model determines how latent variables or constructs as common factors are indicated by the observed variables or indicators through confirmatory factor analysis. The latent variables and the error or specific terms are uncorrelated (McDonald and Ho, 2002). Furthermore, concept constructs will be evaluated to specify reliability and construct validity using confirmatory factor analysis (CFA). The model uses the following equation:

$$\mathbf{X} = \Delta\xi + \delta$$

x' = (x1, x2, ………, xq) are the measured variables
Δ = matrix Δ x of the general model
ξ' = (ξ1, ξ2,……, ξn) are latent variables, and
δ' = δ1, δ2, ……. δ q) are error variables (Joreskog and Sorborm ,1996-2001: 123)

In turn, the structural model is a hypothesized relationships model using the latent variables which are based on causal relationships. The structural or path model is also a composite hypothesis. It requires the specification of both, a set of present versus absent directed paths between latent variables, and a set of present versus absent non-directed paths.

Though the measurement model and structural model can be concurrently examined, the measurement model should be firstly tested before running the full model. (Hoyle, 1995; Byrne, 2000; Kline, 2005). According to Kline's recommendation (2005) the measurement model is initially tested, and only when the model has a good fit, the second step, which consists of running the structural model is conducted. That is, the researcher runs the structural model only when the measurement model has been validated. Two or more alternative models are then compared in terms of "model fit," which measures the extent to which the covariances predicted by the model correspond to the observed covariances in the data.

The maximum of likelihood (ML) method of parameter estimation is employed because the estimator is consistency efficient and has computed large-sample standard errors under normal theory. The overall fit of the models is examined based on several indices including Chi square (χ^2), the Goodness of Fit Index (GFI), and the Adjusted Goodness of Fit Index (AGFI). The chi-square test indicates the amount of difference between expected and observed covariance matrices. A chi-square value close to zero indicates little difference between the expected and observed covariance matrices. The probability level must be greater than 0.05 when chi-square is close to zero. Chi square statistics is sensitive to a large sample size; therefore, χ^2 divided by degrees of freedom (χ^2/df) is used to correct for sample size, and a value of less than two considered an acceptable fit (Tabachnick and Fidell, 2007). On the other hand, the comparative fit is examined using the Benter-Bonett Normed Fit Index (NFI>.90), and the Comparative Fit Index (CFI>.90). The CFI is equal to the discrepancy function adjusted for sample size (Hu and Bentler, 1999). The covariance residual fit is evaluated using the Root Mean Square Error of Approximation (RMSEA) (Hair et al., 1998). A RMSEA value of less than 0.05 and a GFI and AGFI value close to 1 or greater than 0.9 indicate a good fit (Hair et al., 1998).

In addition, confirmatory factor analysis can be used to estimate the reliability (R^2) and standardized validity coefficient (λ^s) of the measurement. An R^2 for an item above 0.40 provides evidence of acceptable reliability (Munro, 2001) and a coefficient above 0.50 is considered acceptable validity (Bollen, 1989; Nunnally and Bernstrin, 1994).

If model fit is acceptable, the parameters estimated are tested. The ratio of each parameter estimate to its standard error is distributed as a z statistic and is significant at the 0.05 level if its value exceeds 1.96 (Hoyle, 1995). In turn, if an unacceptable model fit is found, the model is then modified until a suitable fit is found or tested for as long as the parameters do not lose their meaningfulness. Model modification involves adjusting a specified and estimated model by either freeing parameters that were fixed or fixing parameters that were free. On the other hand the model can be re-specified, if necessary, based on the researcher's rationality and understanding of the model to support them.

SEM is an appropriate approach in the present study for three reasons. First, the development of the hypothesized causal pathway in the model has been based upon significant prior research knowledge and substantial theory. Second, the parameters of the model will estimate both the direct and indirect effects of the proposed determinants on physical activity so that the total effect of the significant variables on physical activity can be more accurately accounted for. Finally, it will illustrate the overall causal structure because of the mediator variables in the causal model.

However, there are potential problems in using causal models. The selected variables in the model may not be genuine sources in the effects estimated. This issue has been reduced by including all known variables in the causal models which were strongly supported from other studies. Another problem may result from measurement errors which influence parameter estimates. The researcher attempted to minimize this issue by using measurements which were based on the theoretical framework and of acceptable value from psychometric properties. Another problem might be due to cross-sectional research design. Although, this design is limited in its ability to explain the causal relationship between variables due to a lack of manipulation or control of the independent variables, it has still benefit for investigation (Polit and Hungler, 1995). As stated by Polit and Hungler (1995), this design can determine the relationship among variables in natural occurring situations without any artificial manipulation, and it is a feasible design rather than an experimental one. According to two criteria for inferring causality: one variable preceded the other (logical reason) and a theoretical framework points the analysis (Polit and Hungler, 1995; Cohenet al., 2003), therefore this design is appropriate for the current study

Summary

Although the health benefits of participation in physical activity by older people have been accepted, inadequate participation in physical activity by this age group should be considered. Based on literature reviews, the participation in physical activity has been correlated with and has been predicted by several personal factors such as self-efficacy, positive outcome expectation, negative outcome expectation, age, and environmental variables such as social support, and physical environment. These determinants have significantly supported the relationship with physical activity as well as the correlation among these determinants. However, it is interesting that the association of these determinants and physical activity and the interrelationship between those variables are not established in the Thai context.

Additionally, the mediating roles of self-efficacy, positive outcome expectation, and negative outcome expectation relating to physical activity have not been extensively studied. Although, SCT's consideration of multiple levels of influence is useful for understanding physical activity, not many researches have examined the direct and indirect effect of these determinants with in the previous model. Therefore, a study is required to explain the relationship between these factors and physical activity based on the proposed model. Furthermore, within SCT perspective, the existing knowledge is needed for confirmation to assess the effect of the determinants and the explanation of prior models on physical activity by senior citizens. To fill this gap, the study of causal model of physical activity based on SCT is helpful in understanding direct and indirect affects between the determinants and physical activity of older people. Thus, the study of a causal model of physical activity is important and necessary in older Thai people.

CHAPTER III
METHODOLOGY

This chapter describes the research design and methodology used for the present study. The research design, population, sampling technique and sample selection, instrumentation, ethics approval, pilot study, data collection and data analysis procedure are included.

1. Research design

A cross-sectional study was designed to examine the causal relationships among variables including self-efficacy, positive outcome expectation, negative outcome expectation, age, social support, physical environment, and physical activity among older Thai people.

2. Population sample

According to the Thailand National Statistical Office (2007), Thailand has a population of 65,684,004 older people, 19,946,289 of whom reside in urban areas while 45,737,715 live in rural areas. The participants of this study were elderly persons aged 60 years and over who resided in both municipal and non-municipal areas from all parts of Thailand including the Northern, Southern, Central, Northeastern, Western, and Eastern regions.

2.1 Sample size

The sample size was estimated from *df* (the degrees of freedom), εo (the null value of the root-mean-square error of approximation (RMSEA), εa (the alternative value of RMSEA), and the level (MacCallum, Browne, and Sugawara, 1996). Degrees of freedom are equal to the number of parameters (relationships between variables). For a given *df* equaling 36 in the regular physical activity model every variable has an error term which is usually related to at least one other variable. Therefore, twice the number of observed variables is used to estimate the *df*. By following the table of minimum sample size of MacCallum and colleagues, the sample was projected to be approximately 305 with a power of .80(α=.05, εo=0.05, εa= 0.08). In addition, 10% of the total sample size was added to take into account drop outs. The current study therefore, has a total sample of 336 older Thai people, 320 of which had usable data while data from 16 were unusable and therefore deleted for reasons explained later in the study.

2.2 Sampling technique

The following steps were followed to select participants and to maximize the normal distribution of the samples. Thailand is divided into six regions: Northern (9 provinces), Central (21 provinces), Southern (14 provinces), Northeastern (19 provinces), Western (5 provinces), and Eastern (7 provinces). Each province is divided into districts, which are further divided into sub-districts; a subdistrict is a collection of villages which can be classified as either municipal or non-municipal areas. This sampling frame ensured all regions of the country were covered and that there were adequate municipal and non-municipal samples to represent the lifestyle of older Thai people.

Stage 1. Phitsanulok, Saraburi, Surat Thani, Udon Thani, Prachuap Khiri Khan, and Chon Buri provinces were randomly selected from each of the 6 regions of Thailand.

Stage 2. One district was randomly selected from each selected province including Mueang, Muak Lek, Khian Sa, Kumphawapi, Sam Roi Yot, and Mueang district, respectively.

Stage 3. Two subdistricts were randomly chosen from each district including Tha Thong, Wat Phrik, Muak Lek, Lang Kao, Khian Sa, Khao Tok, Huai Koeng, Pak Ho, Rai Mai, Sam kratai, Ang Sila, and Nong Khang Khok subdistricts, respectively.

Stage 4. Within a sub-district, a village or community in a municipal area and a village in a non-municipal area were randomly chosen. Tha Thoung, Sao Hin, Muak Lekม Lang Kao, Khian Sa, Mo Ha. Huai Koeng, Pakho, RaiMai, Sankratai, AngSila, and Nong Khang Khok villages were randomly selected from Tha Thong, Wat Phrik, Muak Lek, Lang Kao, Khian Sa, Khao Tok, Huai Koeng, Pak Ho, Rai Mai, Sam kratai, Ang Sila, and Nong Khang Khok sub-districts, respectively.

Stage 5. In each village, 28 participants were selected based on the inclusion criteria, using a systematic sampling technique from a name list(family folder) obtained from the village's primary care unit (PCU). A simple random technique was applied and every second name in the list was selected until the required sample size was reached. Furthermore, only one member of each family was included in the study.

The sampling frame configuration is depicted in Figure 3.1

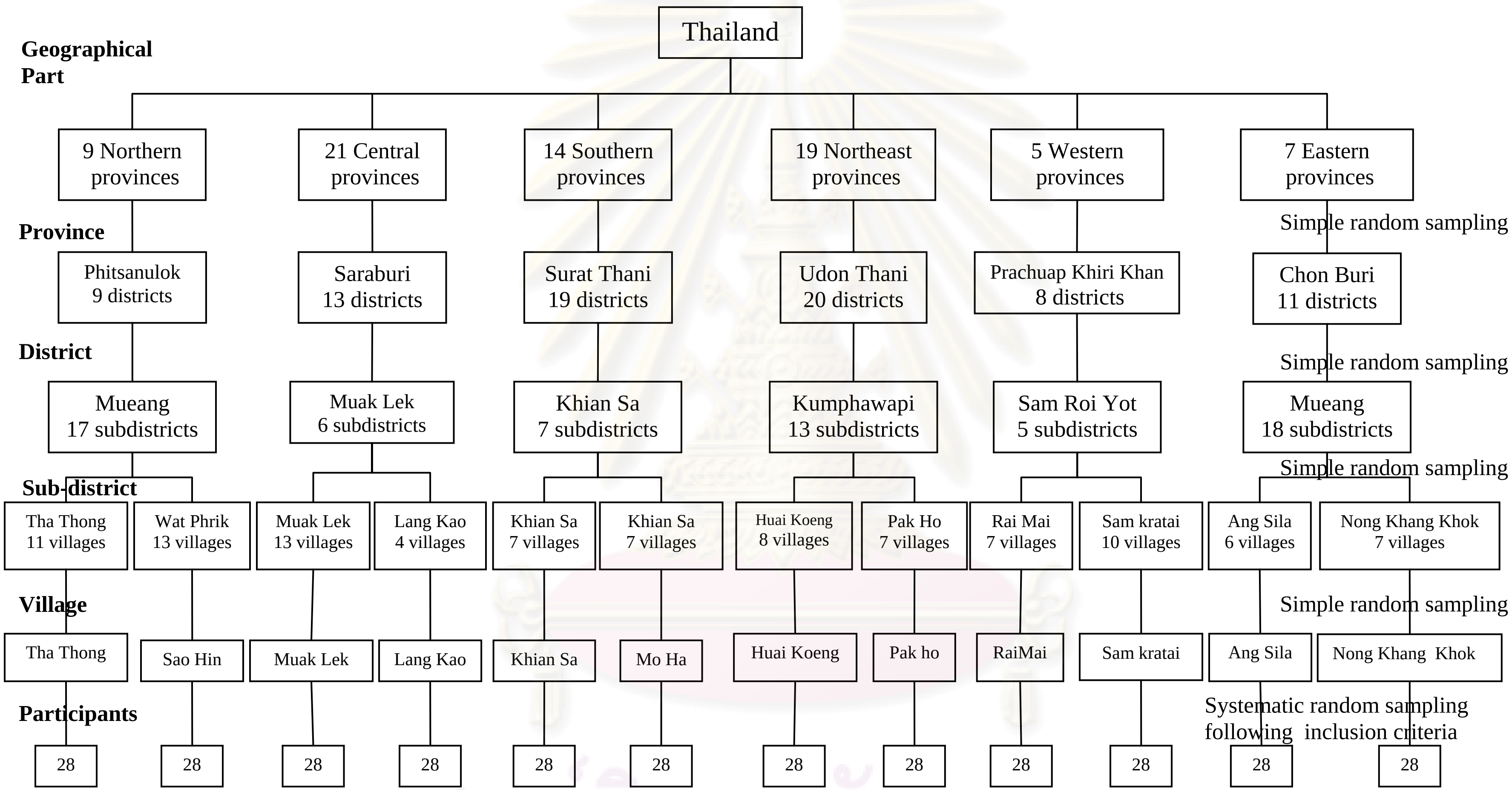

Figure 3.1 Multi- stage random sampling

90

2.3 Sample selection

The target population in the present study was older Thai people. The following criteria were used to select the participants.

1) 60 years of age and over

2) No cognitive impairment and having a score of at least 15 points on the Chula Mental Test,

3) No health problems or ongoing treatments that would interrupt participation in physical activity such as having suffered a recent cardiovascular event (prior 6 months), renal failure, liver cirrhosis, human immunodeficiency virus, major surgery in the last 6 weeks, or a history of medication use for the heart or blood vessels during the last three months.

4) Able to ambulate without assistive devices

5) Willing to participate in the present study.

3. Instrumentation

Structured questionnaires were used to collect data. The questionnaires included a personal data sheet, the Chula Mental Test, the Self-efficacy for Physical Activity (SEPA), the Positive Outcome Expectation for Physical Activity (POEPA), the Negative Outcome Expectation for Physical Activity (NOEPA), the Social Support for Physical Activity (SSPA), the Thai Environment Supports for Physical Activity scale (TESPA), and the International Physical Activity Questionnaire-Long form (IPAQ-L). The study variables and its indicators or instruments are presented in Table 3.1. This section addresses: 1) translation procedures of the translated instruments; 2) instrument refinements, 3) content validation of the instruments; and 4) instrument description.

Table 3.1 Variables and indicators of instruments

Variable	Indicator or instrument
• Self-efficacy	• Self-efficacy for Physical Activity (SEPA)
• Positive outcome expectation	• Positive Outcome Expectation for Physical Activity (POEPA)
• Negative outcome expectation	• Negative Outcome Expectation for Physical Activity (NOEPA)
• Social support	• Social Support for Physical Activity (SSPA)
• Physical environment	• Thai Environment Supports for Physical Activity scale (TESPA)
• Physical activity	• International Physical Activity Questionnaire-Long form (IPAQ-L)

3.1 Translation procedure for translated instruments

After obtaining written consent from each author, the instruments were applied and modified by the researcher to reflect physical activity in older people through back-translation.

The NOEPA, the TESPA, and the IPAQ-L were translated into Thai versions using the translation-back translation method. The instruments were translated from English into Thai by the researcher and an independent translator. The Thai versions of the instruments were evaluated by three Thai/English bilingual people. The questionnaire was translated back into English by two Thai-English independent translators who each had taught English to graduate students for more than 20 years. The investigators then compared both versions in the original language, conducted checks with the translators, discussed the differences, and produced a final consensus version.

3.2 Instrument refinements

After translation, the researcher adapted the translated instruments to achieve a closer cultural fit for older Thai people. The Thai versions of all instruments were refined based on preliminary work conducted by the investigator on older Thai people with similar characteristics. The preliminary work consisted of informal interviews with ten elderly Thais: five who lived in a municipal area and five in a non-municipal area. Open-ended interviews were applied to assure that instrument contents and language were suitable for elderly Thais. The participants were selected from a broad range of backgrounds; five had an elementary education and had worked in the agricultural sector, three had a secondary education and had worked as small businesses owners, and two were retired holders of a bachelor's degree. The participants were encouraged to share their opinions regarding the relevance of the items, and appropriateness to the culture of older Thai people. The participants were also encouraged to think of additional items that could potentially be used in each questionnaire. The following are examples of questions asked:

"Did you understand all the words?"

"Do you know what is being asked?"

"Do you have any questions about it?"

"How could the wording be clearer?"

At the end of the interview participants were asked questions such as "Did any of the questions make you feel uncomfortable?" "Are there questions that we missed, and should have included?"

The results illustrate that the translation of the word "physical activity" into Thai as "*git-ja-gam-taang-gaai*" was unfamiliar to older people. Most participants thought this term was difficult to understand and felt that it was not applicable to them. The subjects preferred the term "*kleuan-wai-awk-raeng*" instead to define physical activity. The term "kleuan-wai-awk-raeng" was therefore applied to this study.

Regarding the Environment Support for Physical Activity (ESPA) questionnaire, all participants recommended that some items be deleted, and that the questionnaire's format and other minor issues be reconsidered. Most participants in the preliminary work recommended that the twenty-one physical environment items in the questionnaire rarely existed in Thailand, such as public swimming pools, sidewalks, parks, walking trails, bike paths, recreational centers, and shopping malls which are used for physical activity or walking programs, and private membership in recreational facilities. In addition, the participants revealed having difficulty turning five pages to complete the questionnaire and answering questions such as "*In general, would you say that motorized traffic in your neighborhood is…. Heavy, Moderate or Light.", " When walking at night, would you describe the STREET lighting in your neighborhood as….Very good, Good, Fair, Poor or Very poor" and "How safe are the public recreational facilities in your community? Very safe, somewhat safe, somewhat unsafe or not safe at all?*". Furthermore, the majority of participants expressed that they generally preferred engaging in physical activity at home, in the neighborhood and within the community, for reasons of safety and convenience.

In addition, on the Social Support for Physical Activity questionnaire (SSPA), seven participants suggested that item 7 of the family subscale "*Family members* *complained about the time you sp end performing phy sical activities"* should not be included because usually in Thai culture, the children or grandchildren are expected to respect the elderly rather than complain about their parent's participation in physical activity. Thus, there was some difficulty in answering this item.

The investigator consulted two Thai experts and an American expert in geriatric nursing. Based upon their feedback, the ESPA and SSPA were modified as follow. Firstly, twenty–one items that were considered irrelevant on the ESPA were eliminated; the investigator then formulated some relevant items based on substantive data and reviewed literature. Four additional items relating to interior and exterior home environment were added to the ESPA. For instance, items assessing physical environment including "You feel more comfortable walking inside your home", "You feel safer inside your home", "You feel more comfortable walking around your home" and "You feel safer around your home" were categorized into three different environments in the ESPA; the modified scale was called "Thai Environment Support for Physical Activity in older Thai people (TESPA)". Additionally, the TESPA questionnaire's format was modified so that all physical environment items could fit on one page and could be specifically designed using the Likert-type scale from 1 (strongly disagree) to 5 (strongly agree). Secondary, item 7 was eliminated from the SSPA. The refined instruments used in the present study therefore, included 10 TESPA and 22 SSPA items.

3.3 Content validation of the instruments

Content validity of the NOEPA, TESPA, and IPAQ-L questionnaire were determined by six Thai physical activity experts including five nursing instructors and one physician expert. The experts were asked to rate the level of relevancy between the items and the definition of the concepts as represented. A four-point Likert-type scale ranging from 4 (strongly relevant) to 1 (Strongly irrelevant) was used to rate each item. The Content Validity Index (CVI) was calculated for each instrument. The CVI of the NOEPA, TESPA, and IPAQ-L questionnaire were 1.00, 0.92, and 0.96 respectively. Some items were rephrased following the expert's recommendation and the advisor's suggestions. The SEPA, and POEPA had been previously validated in Thai elders (Teeranut Harnirattisai et al., 2006). As well, the SSPA had been validated for Thai adults (Thanee Kaewthummanukul, 2006).

3.4 Instrument description

The following section describes the instruments applied in the current study and includes: description of instrument, adaptation, validity, and reliability.

3.4.1 Personal data sheet

A personal data sheet was developed by the investigator. This instrument was used to collect demographic and socioeconomic data including age, gender, income, marital status, education level, and medical history. A detailed medical history was obtained from each participant. The medical history addressed comorbid conditions such as joint pain, dyspnea, diabetes, arthritis, and hypertension.

3.4.2 Chula Mental Test (CMT)

The Chula Mental Test for older people is an interview questionnaire developed by Sutthichai Jitapunkul, Lailert, and Puangsoi Worakul (1996) to determine the cognitive function of older people who have difficulties in reading and writing. The CMT consists of 13 items related to cognitive function. Scales are coded on a dichotomous score of 0 (incorrect) and 1 (correct); items 5 and 12 have two sub-scales, and items 3 and 13 have three sub-scales each. Total scores indicate the cognitive function in a range from 0-19. Scores 0-4 illustrate severe cognitive impairment, scores 5-9 depict moderate cognitive impairment, score 10-14 reflect mild cognitive impairment, and scores 15-19 demonstrate normal cognitive function.

Content validity of the CMT was determined by two neurologists, two psychiatrists and two psychologists. The concurrent validity and criterion validity of the CMT was determined based on a study of 212 older people who reside in their homes in Bangkok. The findings reveal that concurrent validity strongly correlated with the Mini-Mental State Examination (MMSE) (r = 0.78) and the Abbreviated Mental Test (AMT) (r = 0.78). Additionally, the criterion validity of CMT showed a sensitivity value of 100% and a specificity value of 90% by detection of clinical diagnosis dementia (Sutthichai Jittapunkul et al., 1996). Furthermore, the reliability of the CMT using test-retest kappa coefficient and an internal consistency coefficient was 0.65 and 0.81, respectively (Sutthichai Jittapunkul et al., 1996).

3.4.3 Self-efficacy for Physical Activity (SEPA)

Self-efficacy in the present study was assessed using SEPA, a modified version of the Self-efficacy for Exercise (SEE) (Resnick and Jenkins, 2000). The original SEE by McAuley in 1990 (Resnick and Jenkins, 2000) comprised 13 items. The SEE was modified to 9 items by Resnick and Jenkins (2000) and translated into Thai by Teeranut Harnirattisai and colleagues (2006). This instrument was selected in the current study because it has been conceptualized on Bandura’s self-efficacy theory. Furthermore, the SEE was designed specifically for older people and has been tested on a variety of populations (Allison and Keller, 2004; Resnick, 2001b; Resnick et al., 2002; Resnick and Nigg, 2003; Resnick et al., 2004; Gee, 2005: Chang, Fang, and Yang, 2006; Teeranut Harnirattisai et al., 2006). The SEE focuses on self-efficacy as it relates to the ability to maintain one's participation in the face of high, moderate and low obstacles (Resnick and Jenkins, 2000).

Numerous studies testing the validity of the SEE were based on confirmatory factor analysis in the elderly. There was a reasonable fit of the data to the model. All the items were significantly loaded greater than .50 on their respective constructs (Resnick and Jenkins, 2000; Resnick, 2001b; 2004; Resnick and Nigg, 2003; Resnick et al, 2004). Evidence of construct validity was based on a statistically significant correlation between self-efficacy and physical activity (Resnick, 2001b; Resnick and Nigg, 2003; Resnick et al., 2004). These results strongly indicate that each item was reflective of self-efficacy expectation.

A sample of 187 older people living in a retirement community was taken to gather evidence supporting reliability of the SSE. Results reveal that there was sufficient evidence to support internal consistency (alpha=.92) and a squared multiple correlation coefficient using structural equation modeling provided further evidence of reliability (R^2 ranged from 0.38 to 0.76) (Resnick and Jenkins, 2000). Cronbach's alpha coefficients of the SEE were consistently greater than .70 (Allison and Keller, 2004; Resnick and Spellbring, 2000; Resnick, 2001a; 2001b; 2002; 2004; Resnick and Nigg, 2003; Resnick et al., 2004; Gee, 2005: Chang et al., 2006). Moreover, SSE was tested for reliability with 30 older Thai adults who had had knee replacement surgery (Teeranut Harnirattisai et al., 2006). The test-retest reliability with an interval of two days was found to be .84 and Cronbach's alpha coefficient was .84 (Teeranut

Harnirattisai et al., 2006).

The investigator adapted the SEE to fit the concept of physical activity to older Thai people**.** The SEE was modified and renamed SEPA by replacing the term “exercise” with “physical activity”. The SEPA focuses on self-efficacy as it relates to the ability to maintain participation in physical activity in the face of high, moderate and low obstacles. Low obstacles for physical activity included conditions such as the weather, lack of interest, exercising alone**,** and feeling depressed. Moderate obstacles for physical activity included lack of enjoyment, preoccupation with other activities, tiredness, and stress. Pain associated with participation was considered a high obstacle for physical activity. The participants used a scale from 0 (not confident) to 10 (very confident) to describe the level of confidence in their ability to participate in physical activity for 10 minutes, 3 times a day. The scales are scored by finding the sum of the numerical ratings for each response and dividing by the number of responses. Thus, the total possible score for SEPA ranged from 0 to 90. Higher scores indicate a higher level of self-efficacy for physical activity. The scores were classified into three categories, using a proportional method as follows:

1) Low - the sum of individual scores up to 30.00.
2) Moderate - the sum of individual scores from 31.00 to 60.00.
3) High - the sum of individual scores greater than 60.00.

Construct validity was confirmed by confirmatory factor analysis (results are presented in the subtopic of model assessment measurement in Chapter IV). The reliability of the Thai version of the SEPA questionnaire was tested in this study by 320 older Thai people. Cronbach’s alpha coefficient was 0.92.

3.4.4 Positive Outcome Expectation for Physical Activity (POEPA)

Positive outcome expectation was measured using the POEPA, a modified version of the Outcome Expectations for Exercise Scale-2 (OEE-2) (Resnick, 2005), with permission from the original author. The OEE-2 was developed from the original Outcome Expectations for Exercise (OEE) (Resnick et al., 2000). The OEE-2 focuses on the positive and negative consequences of exercise for older adults and is conceptually consistent with Bandura's definition of outcome expectations (Resnick, 2005). The OEE-2 was conceptualized to include two subscales, with the original nine items serving as positive outcome expectation for the exercise subscale (POEE), and four new items as negative outcome expectation for the exercise subscale (NOEE). The POEE was translated into Thai by Teeranut Harnirattisai and colleagues (2006). The items within the positive section are more appropriate to the assessment of the positive outcomes of the physical (5 items) and psychological (4 items) domains.

The construct validity of the positive section of the OEE-2 was confirmed by confirmatory factor analysis. The path coefficients of the POEE subscales ranged from .69 to .87, and the model fit the data (Resnick et al., 2000); Resnick, 2001b; Resnick et al., 2004). The criterion-related validities of the POEE subscale and the OEE-2 scale were significantly related to exercise, with Pearson correlation values of .32 and .38, respectively ($p<.05$) (Resnick, 2005). With regards to reliability, the original OEE-2 scale was initially tested using structural-equation modeling with a group of 161 older adults living in a retirement community (Resnick, 2005). There was sufficient evidence for reliability of the OEE-2 based on the internal consistency of the POEE whose alpha coefficient was 0.93 (Resnick, 2005). The reliability of the POEE based on R^2 values ranged from 0.42 to 0.77 (Resnick et al., 2001). The internal consistency of the POEE reported alpha coefficient values from 0.70 to 0.95 (Resnick and Spellbring, 2000; Resnick, 2001a; 2001b; Resnick and Nigg, 2003; Resnick et al., 2004; Gee, 2005; Teeranut Harnirattisai et al., 2006), and test-retest reliability yielded a correlation of 0.61 to 0.76 between the two testing periods (Resnick, 2001a; 2001b; Teeranut Harnirattisai et al., 2006).

The researcher adapted the OEE-2 to fit the concept of physical activity to older Thai people**.** The positive section of the OEE-2 was modified and renamed POEPA by replacing the term “exercise” with “physical activity”. POEPA focuses on the perceived positive outcome expectation of participation in physical activity for 10 minutes, 3 times a day. The respondents were asked “what do you perceive as the benefits of the physical activity which you participated in for at least 10 minutes, 3 times a day”. The modified questionnaire consisted of 9 items. The items within the positive section were more appropriate to the assessment of the positive outcomes of the physical (5 items) and psychological (4 items) domains. A Likert scale was used in the questionnaire and responses consisted of; 1 (strongly disagree), 2 (disagree), 3 (neither agree nor disagree), 4 (agree), and 5 (strongly agree). The scores were assessed by summing the numerical ratings for each response and dividing that number by the number of responses. Thus, the total scores represent the positive outcome expectation for physical activity. The total possible score of the POEPA ranged from 9 to 45 with a higher score indicating a higher level of positive outcome expectation for physical activity. These scores were classified into three categories, using a proportional method as follows:

1) Low - the sum of individual scores up to 22.00.
2) Moderate - the sum of individual scores from 22.00 to 33.00.

3) High- the sum of individual scores greater than 33.00.

Confirmatory factor analysis was used to confirm validity of the instrument (results are presented in the subtopic, model assessment measurement in Chapter IV). The reliability of the POEPA questionnaire reported a Cronbach alpha coefficient of 0.86 in 320 older Thai people in this study.

3.4.5 Negative Outcome Expectation for Physical Activity (NOEPA)

Negative outcome expectation was measured using the NOEPA, a modified version of the negative section of the OEE-2 (Resnick, 2005), with permission from the original author. The OEE-2 was selected because the items developed in that study were based on an outcome expectation concept of SCT (Resnick, 2005). Four negative outcome expectation items were included in a section of the OEE-2. Two items referred to physical outcomes and another two referred to psychological outcome expectations. Construct validity of the NOEE was confirmed by confirmatory factor analysis (Resnick, 2005). Criterion-related validities of the NOEE subscale, and the OEE-2 scale were significantly related to exercise as seen in Pearson correlations of .34 and .38, respectively ($p<.05$) (Resnick, 2005). There was sufficient evidence for reliability of the OEE-2 based on the internal consistency of the NOEE, whose alpha coefficient was 0.80 (Resnick, 2005).

The researcher translated and adapted the OEE-2 to fit the concept of physical activity for older Thai people. The OEE-2 was translated into Thai using the back translation method (Marin and Marin, 1991). The OEE-2 was modified and renamed NOEPA by replacing the term “exercise” with “physical activity”. NOEPA focuses on the expected negative outcomes of physical activity participation for 10 minutes, 3 times a day. The NOEPA contained 4 items. A Likert scale was used in the design of the questionnaire with possible responses as follows; 1(strongly disagree), 2 (disagree), 3 (neither agree nor disagree), 4 (agree), and 5 (strongly agree). The scores were assessed by summing the numerical ratings for each response and representing the negative outcome expectation for physical activity. The total possible score of the NOEPA ranged from 4 to 20. A higher score indicates a higher level of negative outcome expectation for physical activity. These scores were classified into three categories using a proportional method as follows:

1) Low - the sum of individual scores up to 10.00.
2) Moderate - the sum of individual scores from 10.00 to 15.00.
3) High - the sum of individual scores greater 15.00.

The NOEPA was validated by three geriatric experts including one physician in geriatric physical activity and two experts in geriatric nursing. The content validity index (CVI) of the NOEPA was 1.00. Confirmatory factor analysis was used to confirm the construct validity of the instrument (results are presented in the subtopic, model assessment measurement in Chapter IV). In addition, the reliability of the NOEPA questionnaire reported a Cronbach alpha coefficient of 0.81 in 320 Thai older people. This exceeded the desired criterion of .70 for new scales (Nunnally, 1978).

3.4.6 Social Support for Physical Activity (SSPA)

Social support was measured using the SSPA, which was adapted from the Social Support for Exercise behavior (SSE). The SSE was developed by Sallis and colleagues (1987) and was translated into Thai by Thanee Kaewthummanukul (2006*).* The scale was divided into two parts: 1) the Family Support scale: a thirteen-item scale including family participation and involvement factors such as rewards etc; and 2) the Friend Support scale: a ten-item scale including categories such as friend participation. Both subscales assess how often family and friends provide support to a participant for exercise related activities. With respect to validity and reliability, a number of studies demonstrated that the criterion validity of the SSE positively correlated with vigorous exercise (*r*= .23 and .46, p<.05) (Sallis et al., 1987; Treiber et al., 1991). Additionally, reliability of the Family Support and the Friend Support subscales was supported by test-retest reliability (Sallis et al., 1987). Furthermore, studies have shown a good internal consistency of the Family and Friend Support subscales in adults and older people (alpha = 0.61 to 0.96, and 0.84 to 0.96, respectively) (Sallis et al., 1987; Resnick et al., 2002; Wilcox et al., 2003; Sharma et al., 2005; Gee, 2005). Moreover, test-retest reliability for the Family and the Friend Support subscale was 0.77 and 0.79, respectively (Thanee Kaewthummanukul, 2006).

To increase feasibility and reduce recall biases, the investigator slightly modified the SSE and renamed it SSPA by replacing the term "exercise" with "physical activity". The SSPA focuses on the frequency of social support from family and friends relating to participation in physical activity. Family support refers to older peoples' perception of the frequency of support from family members residing in the same address.The support could be in the form of rewards, or co-participation in physical activity with the individual in the preceding month. Friend support refers to older peoples' perception of the frequency of support from friends, acquaintances, or coworkers. The support could be provided either verbally or physically within the previous month. Participants rated items on a 5-point Likert-type scale ranging from 1 (None) to 5 (Very often). The possible scores ranged from 22 to 110. Higher scores indicated a stronger social support for physical activity. These scores were classified into three categories, using a proportional method as follows:

1) Low - the sum of individual scores up to 51.00.
2) Moderate - the sum of individual scores from 51.00 to 80.00.
3) High - the sum of individual scores greater than 80.00.

With regard to this study, construct validity was confirmed using confirmatory factor analysis (results are presented in the subtopic, model assessment measurement in Chapter IV). The reliability of the SSPA questionnaire reported a Cronbach alpha coefficient of 0.86 in 320 older Thai people.

3.4.7 Thai Environment Support for Physical Activity (TESPA)

Physical environment was assessed using the TESPA which was adapted from the Environmental Supports for Physical Activity Questionnaire (the SIP 4-99 Research Group, 2002: online). The Environmental Supports for Physical Activity Questionnaire (ESPA) consists of two categories: social environment and physical environment. In the present study, only the physical environment is mentioned. It was composed of two sets: one set of 7 items focused on neighborhood-level variables, and a second set of 5 items focused on community-level variables. “Neighborhood” is defined as the area within a 10-minute walk from the respondent’s home, and “community” is defined as the area within a 20–minute drive from the respondent’s home. Additionally, the instrument includes social and physical environment items. A study demonstrated a good degree of coefficience in the rural and urban respondents for this instrument (Brownson et al., 2004). In addition, a group of studies demonstrated that the kappa values for neighborhood and community items of ESPA were -.02 to 0.37 and -0.07 to 0.25, respectively (Kirtland et al., 2003). Likewise, a study demonstrated that test-retest reliability for both the neighborhood subscale and community subscale ranged from .42 to .74 and .28 to .56 respectively (Kirtland et al., 2003). The values for Intraclass Correlation (ICC) for the neighborhood variable were between 0.39 and 0.87 and the values for ICC for community variables were between 0.42 and 0.65 (Brownson et al., 2004).

The researcher translated and modified the ESPA and renamed it TESPA taking into account older Thai peoples' physical activity habits and the physical environment of Thailand. The ESPA was translated into Thai using the back translation method (Marin and Marin, 1991). The ESPA was modified to TESPA by replacing the term "exercise" with "physical activity". TESPA focuses on the physical environment including home, neighborhood, and community environments. Home environment refers to participants' perceptions on the convenience and safety of their home environment (inside and around their home) as it relates to participation in physical activity. Neighborhood environment refers to participants' perceptions of supports and barriers to physical activity in their neighborhood. Community environment refers to older people's perceptions of supports and barriers to physical activity in their community. The TESPA was conceptualized to include 3 subscales: six items serving as neighborhood and community environment, and four new items as home environment. A Likert scale was used to assess the physical environment variable. Possible responses were 1 (strongly disagree), 2 (disagree), 3 (neither agree nor disagree), 4 (agree), and 5 (strongly agree). The total score was assessed by summing the numerical ratings for each response. The discouragement items were reverse scored (strongly disagree = 5, disagree = 4, neither agree nor disagree = 3, agree = 2, and strongly agree = 1). The possible scores ranged from 10 to 50. Higher scores indicate that an individual perceived greater support for physical activity in their physical environment. These scores were classified into three categories, using a proportional method as follows:

1) Low - the sum of individual scores up to 23.00.
2) Moderate - the sum of individual scores from 23.00 to 36.00.
3) High- the sum of individual scores greater than 36.00.

Content validity of the final 10-items of the TESPA in this study was evaluated by three geriatric experts including one physician in geriatric physical activity, one expert in geriatric community nursing, and one expert in geriatric nursing. The CVI of the TESPA was .92. Construct validity was confirmed by confirmatory factor analysis (results are presented in the subtopic, model assessment measurement, in Chapter IV). The reliability of the TESPA questionnaire reported a Cronbach alpha coefficient of 0.77 in 320 Thai older people. This exceeds the desired criterion of .70 for new scales (Nunnally, 1978).

3.4.8 International physical activity questionnaire-long form (IPAQ-L*)*

Physical activity was assessed using the IPAQ-L. The IPAQ-L was developed by Booth and the International Consensus Group for the Development of an International Physical Activity Questionnaire at the WHO in 1998. The IPAQ-L was designed for research that requires a comprehensive evaluation of daily physical activity (Craig et al., 2003). The IPAQ-L includes 5 sections: work-related physical activity, transport-related physical activity, leisure time physical activity, domestic activities, and time spent sitting during the previous 7 days. The IPAQ-L identifies the frequency and duration of vigorous and moderate physical activity involved in work-related activities, domestic activities, and leisure-time physical activities. For transportation related activities, the actual time spent was used as the criterion. The items are structured to provide separate, domain-specific scores for walking, moderate physical activity and vigorous physical activity. Additionally, the concurrent validity of the IPAQ-L with the International physical activity questionnaire-short form (IPAQ-S) was revealed to be reasonablely parallel, with a correlation coefficient of over .70 (Craig et al., 2003). The criterion validity of IPAQ-L was correlated with the accelerometer, based on Spearman's coefficients, and ranged from 0.05 to 0.52 (Craig et al., 2003). Moreover, numerous studies testing the test-retest reliability of the IPAQ-L revealed a Spearman correlation coefficient ranging from 0.63 to 0.91, which indicated good repeatability (Craig et al., 2003; Meriwether et al., 2006).

The IPAQ-L was selected and slightly modified in order to describe physical activity among older Thai people. The IPAQ-L was chosen because it can be expected to have lower levels of recall bias than instruments attempting to measure physical activity occurring over longer periods of time, such as months, or years. In addition, the IPAQ-L assesses the frequency, intensity and duration of all daily physical activities. Although the IPAQ-L criterion is limited for adults 15-69 years of age, other studies have reported using the IPAQ-L in studies involving people 60 years and over (Timperio et al., 2004; Yazigi and Armada-da-Silva, 2007).

The researcher translated and adapted the IPAQ-L to fit the habits of older Thai people. The IPAQ-L was translated into Thai and includes 5 parts: work-related physical activity, transport-related physical activity, leisure time physical activity, domestic activities, and time spent sitting during the previous 7 days. However, the questions relating to time spent sitting are not used in the present study since this study does not consider sitting a type of physical activity. Thus, the IPAQ-L used in this study is limited to 25 items. Total physical activity equals the MET score which is the sum of minutes spent in each domain multiplied by the MET value (Craig et al., 2003). Scores lower than 600 MET-minutes/week refer to a low level of physical activity, while scores greater than 600 MET-min/week to moderate, and scores of at least 3000 MET-minutes/week to a high level of physical activity.

Content validity of the final 25-items of IPAQ_L in this study was determined by three experts including one physician in geriatric physical activity and two experts in geriatric nursing. The CVI of the IPAQ_L was .96. The reliability of the IPAQ-L questionnaire had a reported stability of 0.77 in 30 older Thai people.

4. Protection of human subjects

This study was conducted with the approval of the Chulalongkorn University Institutional Review Board (IRB). Both written and verbal informed consent was obtained in Thai on the same date as the data collection. The informed consent form explained the purpose of the study, benefits, risks, the types of questionnaires and tasks to be completed, and the length of time needed to complete the interview. In particular, it explained about risk prevention and treatment when the risk may occur during the interview or when collection of data is taking place.

Permission was obtained from participants prior to data collection. At the setting, the participants were informed about the purpose of the study and their right to refuse participation. If participants chose not to answer the questionnaire, they could withdraw from the study at any time without penalty. They were also notified that their relationship with the health care team would not be affected. Their names were not used; instead, a code number was used to ensure confidentiality. There was no harm to the participants in this study.

5. Pilot study

The pilot study was carried out in October 2008. The aims of the pilot study were to assess the feasibility of using the proposed instruments, to assess psychometric properties, and to evaluate data-collection procedures. It provided an opportunity to test the instructions and the translated instruments including IPAQ-L, NOEPA, and TESPA. These three instruments were used for the first time with older Thai people.

After obtaining ethical approval from the IRB, Chulalongkorn University, consent was obtained from the directors of 2 primary care units, in two villages, to conduct the pilot study. Participants were older Thai people who met the following inclusion criteria; 60 years of age and over and cognitively capable of answering questions accurately. Convenience sampling was employed to recruit a sample of 15 older people from each setting. After the participants were identified and introductions were made, the investigator explained the objectives of the study. They were informed of their rights; if the subject was willing to participate in the pilot study they would be asked to sign a consent form. The participants were then asked to complete the questionnaire and to evaluate the clarity and appropriateness of the questions. The investigator recorded the time spent to complete the questionnaires, administration issues associated with the questionnaire and suggested improvements. They were interviewed at their homes or at a local temple, whichever suited them.

Each participant was given a handkerchief as a token of appreciation for their participation.

Inferential statistics were used to determine the reliability of the instruments. Data was analyzed using the statistical package SPSS-PC. Alpha was set at .05 for significance. The SEPA, POEPA, NOEPA, SSPA, TESPA instruments were assessed for internal consistency using Cronbach's alpha reliability coefficient. The IPAQ-L measurement was assessed for stability by test-retest over two weeks using the Spearman correlation coefficient.

The participants were older people, with a mean age of 70 $\pm$ 4.19 years. Most participants were female (76.7%), married (53.3%), had elementary education (80%), employed (62.6%), with a household income of less than 5,000 Baht per month (approximately US $147) (76.7%). A total of 90 % reported living with a spouse and /or child or grandchild. A substantial proportion (63.3%) lived in urban areas and had lived on average 44.6 years in their current home. Of the sample, more than half reported sufficient physical activity levels (50%), whereas 20% had a low physical activity level. A total of 23.3% reported not having health problems, while 16.7% suffered hypertension. The most frequent type of physical activity reported was household related activity, followed by leisure time activity, transportation related activity, and occupational activities.

Psychometric properties of all the instruments had acceptable scores. The reliability coefficients of all scales ranged from 0.73 to 0.88 as shown in table 3.2. The POEPA measurement had the highest reliability (α =.88). Moreover, results of the pilot study demonstrated that respondents took between 65 and 80 minutes to complete the questionnaire. The measurements were culturally appropriate for older Thai people and the procedures were followed without any issues.

Table 3.2: Psychometric properties of the instruments used in the pilot study (n=30) and main study (n=320)

Instruments	Test-retest reliability	Coefficient alpha	
		Pilot study (N=30)	Main study (N=320)
• Self-efficacy for Physical Activity	-	.87	.92
• Positive Outcome Expectation for Physical Activity	-	.88	.86
• Negative Outcome Expectation for Physical Activity	-	.76	.81
• Social Support for Physical Activity	-	.84	.87
• Thai Environment Support for Physical Activity	-	.73	.77
• International Physical Activity Questionnaire-Long version	.77	-	-

Prior to gathering data, two research assistants, nursing graduates with master's degrees who had previous research experience, were trained to interview participants who met the criteria. The research assistants were instructed and tested to confirm their understanding of sample criteria, definitions, and base concepts of each questionnaire until a satisfactory level had been reached at the discretion of the investigator. Each research assistant and the investigator interviewed 5 samples and inter-rater reliability was assessed. Agreement between the research assistants and the investigator ranged from 78-92%, with an average agreement of 87%.

6. Data collection

Data were gathered from December 2008 to April 2009. Data were only collected after obtaining approval from the IRB at Chulalongkorn University. The following describes the data collection procedures for this study.

1. The investigator conducted a pilot study to test the reliability of the proposed instruments with 30 older Thai people in two villages in Khon Kaen province, Thailand. The details were described in the pilot study section of this study.

2. Authorization letters were sent to related officers of primary care units, in all twelve villages to ask for their consent. After obtaining consent, public health nurses of primary care units were asked by the researcher to make an appointment with each participant. At a meeting, the researcher informed the nurses about the objectives and importance of the study. The questionnaires and data collection procedures were discussed and ethical considerations were attended to.

3. Based on inclusion criteria, 28 participants were recruited from a name list of family folder of each PCU by the investigator and nurses. If family folders were not updated, staff nurses additionaly supported the name list of the participant. An extra 2-3 names were selected from each list in case participants were unwilling to participate and to take into account dropouts.

4. The investigator then contacted the selected participants to take part in the study. Prior to the interview, the researcher introduced herself, established rapport, explained the purpose of the study, the contributions the participants would make, the selection criteria and emphasized the confidentiality or anonymity of the information being collected. Nine participants declined the invitation; the investigator politely thanked the individuals and selected the next participant from the name list.

5. After agreement had been obtained, the participants were asked to sign a consent form. Participants were notified that the interview could be held either at their home or at the primary care unit, whichever suited them. In addition, the participants were allowed to complete the questionnaires at a time convenient for them.

6. Following receipt of the consent form, each participant was screened for cognitive impairment using the CMT for 5-10 minutes. One of the selected participants had a mild cognitive impairment with a score of 10; the investigator ceased the interview and consulted the primary care unit's public health nurse to assess the cognitive consequence and to provide appropriate intervention and treatment.

7. The interview process was divided into 3 sections each section taking approximately 15-20 minutes to complete. A 5- minute rest was given after completing each section. Participants were initially asked to complete the questionnaire on personal data, physical environment, and social support, followed by questionnaires on self-efficacy, positive outcome expectations and negative outcome expectations. Finally, participants were interviewed to assess their physical activity level. The interview took approximately 65 to 80 minutes to complete.

8. During data collection, three participants declined to continue with the questionnaire due to inconvenience; the investigator stopped the interview immediately and informed participants of their rights to refuse or withdraw from the study at any time without penalty.

9. After completing the questionnaire, each participant received a handkerchief in appreciation for their participation. Thus, data from 332 participants were collected and used in this study.

7. Data analysis

Data analysis included the application of descriptive and inferential statistics. Descriptive statistics (i.e. frequency, percentage, range, mean, and standard deviation) were applied to delineate characteristics of the sample, and examine the distribution of demographic variables and the variables of interest in this study using the Statistical Package of the Social Science for Personal Computer (SPSS/PC) version 13. LISREL 8.53, a structural equation modeling program, was used to answer research questions. An alpha level of .05 was selected as the accepted level of significance for this study. The processes used for data analysis are described in the following section.

1. Preparation of data for analysis: Missing data and outliers were determined to prevent compromised analytic power and non-response bias by the researcher. The data was cleansed to prevent random and systematic errors (e.g. typing or coding the wrong value) using descriptive statistics. A total of 332 questionnaires were selected for accuracy of data. The amount of missing data was analyzed using the missing value analysis technique in SPSS. A univariate statistic was used to examine the amount of missing value on each study variable. A missing range of 0.31 to 0.63% was found in the study variables; this represented a value of less than 5% (Tabachnick and Fidell, 2007). However, the statistical analysis showed that one case with a single or more than one missing value on friend support (n=1) was deleted, leaving 331 cases for analysis.

According to IPAQ Research Committee guidelines, the physical activity scores were processed to reduce data comparability. Data processing functions first by excluding outlier data related to the responses regarding duration. The maximum values of the total sum of all walking, moderate and vigorous "walk" time (more than 960 minutes), and/or the day variable (more than 7 days), were excluded (7 cases) from analysis. Finally, two cases were excluded by the truncation process due to the total duration value being more than 3 hours per activity (180 minutes).

Univariate outliers were examined using box plots. Family support, friend support, and physical activity scores had a large number of outliers reflecting that their scores were prepared for analysis. Multivariate outliers were examined using the Mahalanobis Distance analysis. Multivariate outliers were determined by chi-square values (36.123) that were significant at $p<.001$ with the respective degrees of freedom which was equal to the number of variables examined (Hair et al., 2006). These measures indicated the observation's distance in multidimensional space from mean center of all observations on a set of variables (Hair et al., 1998, 2006). After data analysis, two cases were identified as multivariate outliers. Therefore, 320 cases remained after the multivariate outliers were deleted.

2. The samples' characteristics were analyzed using descriptive statistics.

3. The assumptions underlying multivariate analysis for structural equation modeling were tested, including normality, homoscedasticity, the linearity of relationship and multicollinearity.

4. The measurement model was evaluated to verify that the theoretical constructs were accurately represented by observed variables using confirmatory factor analysis. Separate measurement models were tested for each latent variable. According to Jöreskog and Sörbom (1996), there are two methods to assess the measurement model, overall fit and measurement model fit. The overall model fit is indicated by chi-square value (χ^2), relative or normed χ^2 (χ^2/df) and goodness of fit

indices. If the goodness of fit index (GFI) and adjusted goodness of fit index (AGFI) are greater than 0.9, the root mean square residual (RMR) is close to zero (Hair et al., 1998) and normed χ^2 is less than 2 (Pedhazur and Schmelkin, 1991), this indicates a good fit. To determine measurement model fit, the observed variable loading related to the construct and the relationship among indicators and the construct were examined. The square multiple correlation (R^2), which is the proportion of variance in the observed variable that is accounted for by the latent variables for which it is an indicator, were examined.

5. Once it was determined that the measurement model fit the data, the hypothesized model was then analyzed. In the proposed model, there were three exogenous variables (age, social support, and physical environment) and three endogenous variables (self-efficacy, positive outcome expectation, and negative outcome expectation). In this step, path coefficient and R^2 were estimated and the effects of the independent variable on dependent variables were determined to answer the research questions and test the hypotheses. The goodness-fit-indices were used to determine whether the model adequately fit the data.

CHAPTER IV

RESULTS

This chapter presents the findings of the study. Firstly, it presents the characteristics of the study sample. Then, the characteristics of the study variables and the preliminary analysis are illustrated. Finally, principal analyses including model testing and hypothesis testing are presented.

1. Characteristics of the study sample

Participants' ages ranged from 60 to 94 years and half of the participants (50.0%) were between 60-69 years old. Female participants accounted for 64.4% of the total. 55% of the participants were married. Most of the participants were Buddhist (99.4%) and had completed elementary education (75.6%). More than half of the participants were employed (58.1%). A total of 35% of employed participants were still working in the agricultural sector. Up to two-thirds had a household income of less than 5,000 Baht per month (65%), while only 1.9% reported an income above 30,000 Baht per month. Regarding health status, 66.6 % of the participants expressed that they suffered health problems; joint pain (12.2%), hypertension (11.9%), and hypertension and diabetes mellitus (7.8%), respectively (Table 4.1). Regarding type of living arrangement, shared accommodation was the most frequently reported (92.8%) (Table 4.1) with an average of 4.11 persons (SD = 1.77) (Table 4.2) per household. Nearly eighty percent (79.4%) of the participants did not take care of other family members, whereas approximately twenty one percent (20.6%) did take care of a grandchild under 7 or a disabled person. More than half of the participants (55.6%)

did not take part in senior s' club activities, while 44.4% were members of one for a median of 25.5 m onths (n = 142, SD = 29.69) (Table 4.2). A substantial proportion (61.9%) lived in a municipal area and stayed in their own residences. Regarding style of residence, 62.2% lived in a two storey house or a raised house for an average of 19.93 years (SD = 3.11) (Table 4.2).

Table 4.1 Demographic characteristics of the study samples (n = 320)

Demographic characteristics	**n**	**%**
Age (years)		
60-69 160		50.0
70-79 126		39.4
> 79	34	10.6
Gender		
Male 114		35.6
Female 206		64.4
Marital status		
Married 176		55.0
Single 13		4.0
Widowed 126		39.4
Separated 5		1.6
Religion		
Buddhist 318		99.4
Muslim 2		0.6
Education		
No formal education	25	7.8
Elementary education	242	75.6
Secondary education	35	10.9
Vocational education	6	1.9
Bachelor's degree or higher	12	3.8
Employment		
Retired	134	41.9
Working	186	58.1
Type of employment (n=186)		
Agriculture 112		35.0
Trade 37		11.6
Part time or casual employment	14	4.4

Table 4.1 (con't)

Demographic characteristics	n	%
Small business/ self-employed	11	3.4
Labor	10	3.1
The committee for local administration organization	2	0.6
Income (Baht per month)		
Less than 5000	208	65.0
5,001-10,000	76	23.7
10,001-20,000	22	6.9
20,001-30,000	8	2.5
More than 30,000	6	1.9
Health problems		
No health problems	107	33.4
Past/Current health problems	213	66.6
Type of health problem (more than 1 problem) (n=213)		
• Joint pain	39	12.2
• Hypertension(HT)	38	11.9
• Hypertension and DM	25	7.8
• Hypertension and joint pain	18	5.6
• Diabetes Mellitus(DM)	16	5.0
• Respiratory problems: asthma, tuberculosis,	13	4.1
• Cardiovascular problems, HT, and DM	9	2.8
• Hypertension, joint pain, and DM	8	2.5
• Cardiovascular problems and DM	7	2.2
• Cardiovascular problems	6	1.9
• Hyperlipidemia	6	1.9
• Visual problems	5	1.6
• Cardiovascular problems, HT, joint pain, and DM	4	1.3
• Joint pain and DM	4	1.2
• Cardiovascular problems, HT, and joint pain	3	0.9
• Hypertension and visual problems	2	0.6
• Hypertension, visual problems, and DM	2	0.6
• Others(Not specified)	8	2.5
Living arrangement		
Living alone	23	7.2
Shared accommodation	297	92.8
Cohabitants (n=297)		
Spouse	33	10.3
Child and grandchild	170	53.1
Spouse and child/grandchild	94	29.4

Table 4.1 (con't)

Demographic characteristics	**n**	**%**
Taking care of a grandchild under 7 or a disabled person		
No	254	79.4
Yes	66	20.6
Member of a Seniors' club		
Not a member/Do not participate	178	55.6
Participate	142	44.4
Location of home		
Municipal area	198	61.9
Non-municipal area	122	38.1
Characteristics of home		
One level	121	37.8
Two storey or raised house	199	62.2

Table 4.2 Descriptive statistics of the participant characteristics

Characteristics	**Min-Max**	**Mean (SD)**	**Median**	**Skewness** (SE=.14)	**Kurtosis** (SE=.27)
Number of cohabiting family members (n=297)	1-11	4.11 (1.77)	4.0	.41	.52
Number of grandchildren under 7 or disabled persons cared for (n=66)	1-3	1.4 (0.55)	1.0	.93	-.14
Period of time spent in a seniors' club (months) (n=142)	1-240	33 (29.69)	25.5	3.11	16.91
The length of time in current residence (years) (n=320)	0.50-83.50	19.9 3 (3.11)	30.0	.67	-.17

2. Characteristics of the study variables

The current study includes behavioral variables (physical activity), personal variables (self-efficacy, positive outcome expectation, negative outcome expectation, and age), and environmental variables (social support and physical environment). This section presents descriptive statistics for behavioral variables of the respondents followed by personal and environmental variables.

2.1 Behavioral variable

2.1.1 Physical activity

The physical activity score or total energy expenditure is a continuous indicator calculated as the median MET-minutes/week of physical activity. METs are multiples of the resting metabolic rate and a MET-minute is computed by multiplying the MET score of an activity by the minutes performed (Craig et al., 2003). Table 4.3 demonstrates that the physical activity score ranged from 0 to 2,203.50 MET-minutes/week with a median of 849.25 ($\bar{x}$ = 873.52, SD = 438.63). The skewness coefficient (.26) was slightly positive indicating a normal distribution. This also indicates that the majority of the subjects reported a moderate physical activity score. In addition, the kurtosis statistic of -.52, a value close to zero, indicates a close proximity to a normal distribution. Based on the IPAQ research committee recommendations, 67.5% of the participants of this study met moderate level physical activity and 32.5% engaged in a low level of physical activity (Table 4.4). Furthermore, 80.6% of participants who lived in the eastern region participated in moderate level physical activity.

Table 4.3 Descriptive statistics for physical activity (n=320)

Variables	**Mean (SD)**	**Median**	**Possible range**	**Actual range**	**Skewness** (SE=.14)	**Kurtosis** (SE=.27)
Physical activity	873.52 (438.63)	849.25	0- highest possible	0 -2,203.5	.26	-.52

Table 4.4 Proportion of subjects meeting IPAQ research committee recommendations results in each region (n=320)

Region	**Level of physical activity N (Percent)**		
	Low (<600 MET-min/week)	Moderate (600-3,000 MET-min/week)	High (> 3,000 MET-min/week)
Northern	11 (21.1)	42 (78.9)	-
Southern	15 (29.6)	34 (70.4)	-
Central	20 (38.5)	32 (61.5)	-
Northeast	22 (39.4)	35 (60.6)	-
Eastern	10 (19.4)	44 (80.6)	-
Western	12 (21.2)	43 (78.8)	-
Total	104 (32.5)	216 (67.5)	-

In addition, the physical activity scores or MET score, was calculated for 4 categories including occupation, transportation related, household chores, and leisure time physical activity. Table 4.5 shows the participation of subjects in each type of activity. Household activities had the highest level of participation, followed by transportation related activities, leisure, and occupation, respectively.

The median MET scores were highest for household activity and lowest for occupation related activities (Table 4.5). Approximately 87 percent of participants reported participation in household activities, with a median total energy expenditure of 232.50 ($\bar{x}$=261.19, SD = 211.77) MET-minutes/week. 75% of participants reported engaging in leisure-time physical activities, with a median total energy expenditure of 231.00 ($\bar{x}$= 298.38, SD = 297.94) MET-minutes/week. Participants who participated in transport-related physical activity (76 %) stated a median total physical activity score of 99.00 ($\bar{x}$= 144.75, SD = 140.60) MET-minutes/week. Furthermore, approximately 54% of the subjects who performed occupational physical activities (n = 174) reported a median total energy expenditure of 49.50 ($\bar{x}$= 168.48, SD = 230.81) MET-minutes/week.

Table 4.5 Proportion of subjects who participated in physical activity and analysis of MET score (n=320)

Type of Physical activity*	n (%)	**MET**(MET-minutes/week)		
		Mean (SD)	**Median**	**Actual range**
Occupation	174 (54.4)	168.48 (230.81)	49.50	0-2,079.00
Transportation	243 (76.0)	144.75 (140.60)	99.00	0- 615.00
Household	278 (86.9)	261.91 (211.77)	232.50	0-1,365.00
Leisure time	240 (75.0)	298.38 (297.94)	231.00	0-1,680.00

Note* = one person could give more than one answer

Data in table 4.6 depict the statistics associated with each type of physical activity. Closer examination reveals that the majority of participants expended energy in household related activities. Both indoor and outdoor chores were associated with moderate-intensity activity (n=250 and 198, respectively), while leisure time and occupation related activity were considered vigorous-intensity activities (n=11 and 12, respectively). The most common household activity reported was indoor chores, such as cleaning and food preparation, both considered moderate-intensity activities. For occupation related activity (n=174), the most common reported were considered moderate-intensity activities (n=104). The most frequently performed leisure time activity was walking (n=199), while only a small number of participants took part in vigorous-intensity activities (n=11).

Table 4.6 Proportion of subjects who participated in each type of physical activity

Type of physical activity	Intensity and activity	Number
Occupation*	• Vigorous intensity	12
(n=174)	• Moderate intensity	104
	• Walking	13
Transportation*	• Cycling	62
(n=243)	• Walking	230
Household*	• Vigorous intensity	21
(n=278)	• Moderate outdoor chores	198
	• Moderate indoor chores	250
Leisure time*	• Walking	166
(n=240)	• Vigorous intensity	11
	• Moderate intensity	140

Note* = one person could give more than one answer

2.2 Personal variables

2.2.1 Self-efficacy

Data in table 4.7 depict the total scores of self-efficacy which ranged from 4 to 89, with a mean of 45.72 (SD = 19.07). The skewness value (.12) indicates that the majority of respondents had a moderate self-efficacy score, however the kurtosis value (-.76) showed a flat distribution. Regarding subscales, the total sum score of self-efficacy for low obstacles ranged from 1.00 to 10.00 while perceived self-efficacy for moderate and high obstacles varied from 0.00 to 10.00. The means of low, moderate and high obstacles were 6.14 (SD = 2.15), 4.57 (SD = 2.51), and 2.90 (SD = 2.44), respectively. Self-efficacy for low and moderate obstacle values were normally skewed (-.15 and .27), which indicates that most participants had a moderate level of self-efficacy. In addition, the kurtosis of self-efficacy for low and moderate obstacles had a flat or platykurtic distribution (-.74 and -.83, respectively). Moreover, the self-efficacy for high obstacles was highly positively skewed (.87), which indicates that most of the study samples had a low level of self-efficacy. The kurtosis value (.19) was reasonably normally distributed.

Table 4.7 Descriptive statistics for self-efficacy (n=320)

Self-efficacy	**Mean (SD)**	**Median**	**Possible range**	**Actual range**	**Skewness** (SE=.14)	**Kurtosis** (SE=.27)	**level**
• self-efficacy for low obstacles	6.14 (2.15)	6.25	0-10	1-10	-.15	-.74	Moderate
• self-efficacy for moderate obstacles	4.57 (2.51)	4.25	0-10	0-10	.27	-.83	Moderate
• self-efficacy for high obstacles	2.90 (2.44)	2.00	0-10	0-10	.87	.19	Low
Total	45.72 (19.07)	45.00	0-90	4-89	.12	-.76	Moderate

2.2.2 Positive outcome expectation

Data in table 4.8 reveal that the total of positive outcome expectation scores including both physical and psychological outcomes ranged from 20 to 45, with a mean of 36.50 (SD = 5.53). The skewness (-.37) and kurtosis (-.51) values were negative which indicates that most of the samples had high scores for positive outcome expectation regarding physical activity and a variance of score as seen in a normal distribution. In addition, the total sum score for physical positive outcome expectation ranged from 2.20 to 5.00, with a mean of 4.02 (SD = .65). The skewness (-.23) and kurtosis (-.74) values were negative which indicates that most subjects had a moderate score for positive physical outcome expectation regarding physical activity with a flat distribution.

Furthermore, the total psychological positive outcome expectation ranged from 2.25 to 5.00, with a mean of 4.10 (SD = .67). The sum score was negatively skewed (-.57), indicating that most samples had high scores for positive psychological outcome expectation regarding physical activity. The kurtosis value (-.21) however, was reasonably normally distributed.

Table 4.8 Descriptive statistics for positive outcome expectation (n=320)

Positive outcome expectation	**Mean (SD)**	**Median**	**Possible range**	**Actual range**	**Skewness** (SE=.14)	**Kurtosis** (SE=.27)	**level**
• Physical outcome expectation	4.02 (.65)	4.00	1-5	2.20-5.00	-.23	-.74	High
• Psychological outcome expectation	4.10 (.67)	4.25	1-5	2.25-5.00	-.57	-.21	High
Total	36.50 (5.53)	37.00	9-45	20.00-45.00	-.37	-.51	High

2.2.3 Negative outcome expectation

Data in table 4.9 illustrate that the total of negative outcome expectation scores including both physical and psychological outcome ranged from 4 to 20, with a mean of 9.31 (SD = 3.78). The skewness value (.56) was positive which indicates that most of the respondents had a low score for negative outcome expectation regarding physical activity, but the kurtosis value (-.39) was reasonably normally distributed. Moreover, the total sum score for physical negative outcome expectation ranged from 1.00 to 5.00, with a mean of 2.27 (SD = 1.00). The skewness value (.61) was positive which indicates that most participants had a low score for negative physical outcome expectation concerning physical activity, however the kurtosis value (-.41) was reasonably normally distributed.

Still, the total negative psychological outcome expectation ranged from 1.00 to 5.00, with a mean of 2.39 (SD = 1.10). Skewness values (.63) were positive which indicates that most subjects had a low score for negative psychological outcome expectation regarding physical activity. The kurtosis value (-.37) however, was reasonably normally distributed.

Table 4.9 Descriptive statistics for negative outcome expectation (n=320)

Negative outcome expectation	**Mean (SD)**	**Median**	**Possible range**	**Actual range**	**Skewness** (SE=.14)	**Kurtosis** (SE=.27)	**level**
• Physical outcome expectation	2.27 (1.00)	2.00	1-5	1.00- 5.00	.61	-.41	Low
• Psychological outcome expectation	2.39 (1.10)	2.00	1-5	1.00- 5.00	.63	-.37	Low
Total	9.31 (3.78)	9.00	4-20	4.00-20.00	.56	-.39	Low

2.2.4 Age

Data in table 4.10 show that participants ranged in age from 60 to 94 years, with a mean of 70.07 years (SD = 6.81). The skewness (.59) was positive, indicating that most participants were in the low to moderate age range, whereas the kurtosis value (-.07) illustrated a normal distribution.

Table 4.10 Descriptive statistics for age (n=320)

Variable	**Mean (SD)**	**Median**	**Possible range**	**Actual range**	**Skewness** (SE=.14)	**Kurtosis** (SE=.27)
Age	70.07 (6.81)	69.50	60 –upper limit	60 -94	.59	-.07

2.3 Environmental variables

2.3.1 Social support

Data in table 4.11 show that total social support scores ranged from 22.00 to 87.00, with a mean of 51.68 (SD = 13.59). The skewness (.16) and the kurtosis (-.60) values indicate that most samples had moderate social support when dealing with physical activities with a flat distribution. The mean of the family support score was moderate ($\bar{x}$ = 29.76, SD = 7.94) with an actual score range of 12.00 to 48.00 and was reasonably normally distributed (Skewness = .31, and Kurtosis = -.52). Furthermore, the mean of the friend support score was moderate ($\bar{x}$ = 21.91, SD = 8.32) with an actual score range of 10.00 to 45.00 and was positively skewed (.42) indicating that most respondents had a low level of support towards physical activity from friends. The kurtosis value (-.60) shows a platykurtic distribution.

Table 4.11 Descriptive statistics for social support (n=320)

Social support	**Mean (SD)**	**Median**	**Possible range**	**Actual range**	**Skewness** (SE=.14)	**Kurtosis** (SE=.27)	**Level**
• Family support	29.76 (7.94)	29.00	12-60	12-48	.31	-.52	Moderate
• Friend support	21.91 (8.32)	21.00	10-50	10-45	.42	-.60	Moderate
Total	51.68 (13.59)	52.00	22-110	22-87	.16	-.60	Moderate

2.3.2 Physical environment

Data in table 4.12 demonstrate that the total scores of physical environment ranged from 19.00 to 50.00, with a mean of 34.87 (SD = 6.47). The skewness value (.26) and the kurtosis value (-.49) indicate that the majority of the respondents had moderate physical environment scores and the variance was normally distributed. Also, the mean of the home environment score was moderate ($\bar{x}$= 14.95, SD = 3.40) with an actual score range of 7.00 to 20.00. The skewness coefficient value of this score (-.12) was negative and close to zero indicating a normal distribution. The kurtosis value (-.87), however, was platykurtic.

The mean of the neighborhood environment score was moderate ($\bar{x}$= 10.36, SD = 2.72) with an actual score range of 3.00 to 15.00. The skewness value (.01) and the kurtosis value (.63) indicate that most of the study sample had a moderate neighborhood environment score with a flat distribution. Moreover, the mean of the community environment score was moderate ($\bar{x}$= 9.56, SD = 2.18) with an actual score range of 3.00 to 15.00. Also, the community environment score was reasonably normally distributed (Skewness = -.04, and Kurtosis = .42).

Table 4.12 Descriptive statistics for physical environment (n=320)

Physical environment	**Mean (SD)**	**Median**	**Possible range**	**Actual range**	**Skewness** (SE=.14)	**Kurtosis** (SE=.27)	**Level**
• Home	14.95 (3.40)	15.00	4-20	7-20	-.12	-.87	Moderate
• Neighborhood	10.36 (2.72)	10.00	3-15	3-15	.01	-.63	Moderate
• Community	9.56 (2.18)	9.50	3-15	3-15	-.04	.42	Moderate
Total	34.87 (6.47)	34.00	10-50	19-50	.26	-.49	Moderate

3. Preliminary analysis

According to Tababnick and Fidell (2007), the assumptions underlying multivariate analysis include normality, multicollinearity, homoscedasticity, and linearity. This section presents the assessment of the statistical assumptions prior to the structural equation model (SEM) analysis.

3.1 Normality

Estimation procedures in SEM assume normal distributions for continuous variables. Univariate normality was examined using a histogram with a normal curve, normal probability plot, skewness, and kurtosis. Multivariate normality was diagnosed through bivariate normality testing using scatter plots for each pair of variables. Most of the normal probability plots of each study variable demonstrate that the line representing the actual data distribution closely follows the diagonal. Skewness values ranged from -.57 to .87 and kurtosis values from -.87 to .42 (Table 4.13). The Pearson's Skewness Coefficients {skewness= (mean-median)/SD} did not exceed ± .2 indicating that these study variables were normally distributed (Hildebrand, 1986 cited in Munro, 2001, p.43). Despite the skewness and kurtosis values being above ±2.58 indicating non-normal distributions (Hair et al., 2006), West and colleagues (1995) suggested the high of normal and non-normal are greater than 3.00 for skewness and 21.00 for kurtosis. Moreover, by using the PRELIS program (Jöreskog and Sörbom, 1996), the current data met assumptions of multivariate normality with a relative multivariate kurtosis of 1.020, meaning that no serious deviations from multivariate normality existed. The type of estimation used was maximum likelihood. Therefore, the data were acceptable for SEM analysis.

Table 4.13 Normality of study variables

Variable	Min	Max	Skewness (SE=.14)	Kurtosis (SE=.27)
Physical activity	**0**	**2,203.50**	**.26**	**-.52**
Self-efficacy	**4.00**	**89.00**	**.12**	**-.76**
• Low obstacles for self-efficacy	1.00	10.00	-.15	-.74
• Moderate obstacles for self-efficacy	0.00	10.00	.27	-.83
• High obstacles for self-efficacy	0.00	10.00	.87	.19
Negative outcome expectation	**4.00**	**20.00**	**.56**	**-.39**
• Physical negative outcome expectation	1.00	5.00	.61	-.41
• Psychological negative outcome expectation	1.00	5.00	.63	-.37
Age	**60**	**94**	**.59**	**-.07**
Social support	**22.00**	**87.00**	**.16**	**-.60**
• Family support	12.00	48.00	.31	-.52
• Friend support	10.00	45.00	.42	-.60
Physical environment	**19.00**	**50.00**	**.26**	**-.49**
• Home environment	7.00	20.00	-.12	-.87
• Neighborhood environment	3.00	15.00	.01	-.63
• Community environment	3.00	15.00	-.04	.42

3.2 Multicollinearity

Bivariate multicollinearity was checked by examining the correlation matrix among individual variables included in the analysis. Bivariate multicollinearity occurs when correlations of any variable is greater than .85 (Munro and Page, 1993). In addition, multivariate multicollinearity occurs when the tolerance values are less than 0.01, the variance inflation factor (VIF) values are greater than 5.3, or the condition index is greater than 30 for two or more coefficients in the same dimension with a value greater than .90 (Hair et. al, 2006). Evidence of multicollinearity was not found, with correlation coefficients among the predictor variables ranging from - .002 to .737 (Table 4.14), tolerance values from 0.35 to 0.91, and VIF values ranging from 1.10 to 2.87 (Table 4.15). The tolerance and VIF values indicate no evidence of multicollinearity. Although the two dimensions had a condition index of 44.74 and 66.85, overall condition indices were under the threshold values of 30 and all proportional variances of coefficient in the same dimension were less than .90 (Table 4.16).

Table 4.14 Correlations among the study variables

	LOWSE	MODSE	HISE	PPOE	MPOE	PNOE	MNOE	AGE	FAM	FRI	HOME	NBH	COM	PA
LOWSE	1													
MODSE	.737**	1												
HISE	.559**	.637**	1											
PPOE	.396**	.369**	.354**	1										
MPOE	.354**	.322**	.296**	.737**	1									
PNOE	-.309**	-.258**	-.244**	-.438**	-.410**	1								
MNOE	-.361**	-.407**	-.293**	-.431**	-.346**	.619**	1							
AGE	-.199**	-.156**	-.122*	-.217* *	-.234**	.139*	.094	1						
FAM	.368**	.253**	.236**	.041	.048	.102	.059	.011	1					
FRI	.042	-.066	-.033	-.075	-.044	.113*	.128*	.029	.396**	1				
HOME	.329**	.337**	.343**	.478**	.364**	-.266**	-.297**	-.069	.082	.057	1			
NBH	.165**	.262**	.227**	.361**	.299**	-.282**	-.255**	-.012	-.022	.022	.510**	1		
COM	.146**	.167**	.124*	.196**	.199**	-.156**	-.235**	-.037	-.015	-.002	.285**	.381**	1	
PA	.537**	.571**	.449**	.377**	.358**	-.388**	-.435**	-.229**	.084	-.047	.267**	.297**	.203**	1

*p<.05, **p<.01

Note:

LOWSE	= Low obstacles for self-efficacy	FAM	= Family support
MODSE	= Moderate obstacles for self-efficacy	FRI	= Friend support
HISE	= High obstacle for self-efficacy	HOME	= Home environment
PPOE	= Physical positive outcome expectation	NBH	= Neighborhood environment
MPOE	= Psychological positive outcome expectation	COM	= Community environment
PNOE	= Physical negative outcome expectation	PA	= Physical activity
PNOE	= Psychological negative outcome expectation		

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Table 4.15 Assessment for multicollinearity among the predicting variables (n=320)

Variable	Tolerance	Variance Inflation Factor (VIF)
Low obstacle for self-efficacy	0.37	2.70
Moderate obstacle for self-efficacy	0.35	2.87
High obstacle for self-efficacy	0.55	1.81
Physical positive outcome expectation	0.37	2.69
Psychological positive outcome expectation	0.44	2.29
Physical negative outcome expectation	0.54	1.86
Psychological negative outcome expectation	0.52	1.92
Age 0.91		1.10
Family support	0.67	1.49
Friend support	0.79	1.26
Home environment	0.60	1.66
Neighborhood environment	0.63	1.59
Community environment	0.82	1.22

Table 4.16 Condition index of coefficient in physical activity

Dimens- -ion	Eigen- value	Condition Index	Variance Proportions													
			(Constant)	LOW SE	MODSE	HISE	PPOE	MPOE	PNOE	MNOE	AGE	FAM	FRI	HOME	NBH	COM
1	12.6 7	1.00	0.00	0. 00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.61	4.55	0.00	0. 00	0.02	0.15	0.00	0.00	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.00
3	0.21	7.80	0.00	0. 00	0.00	0.35	0.00	0.00	0.09	0.09	0.00	0.00	0.00	0.01	0.01	0.01
4	0.12	10.19	0.00	0. 00	0.01	0.00	0.00	0.00	0.02	0.02	0.00	0.04	0.59	0.00	0.01	0.01
5	0.12	10.48	0.00	0. 05	0.31	0.44	0.00	0.00	0.05	0.00	0.00	0.01	0.01	0.01	0.02	0.01
6	0.07	13.97	0.00	0. 06	0.00	0.01	0.00	0.00	0.52	0.52	0.00	0.01	0.04	0.00	0.01	0.03
7	0.05	15.60	0.00	0. 05	0.27	0.02	0.01	0.01	0.04	0.22	0.00	0.16	0.16	0.00	0.17	0.00
8	0.04	18.62	0.00	0. 00	0.00	0.00	0.03	0.02	0.05	0.02	0.00	0.13	0.03	0.07	0.01	0.62
9	0.04	18.99	0.00	0. 04	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.53	0.16	0.04	0.27	0.17
10	0.03	20.56	0.00	0. 62	0.31	0.00	0.01	0.02	0.07	0.00	0.02	0.05	0.00	0.16	0.03	0.00
11	0.02	23.35	0.00	0. 15	0.08	0.01	0.00	0.00	0.04	0.03	0.00	0.03	0.00	0.65	0.46	0.08
12	0.02	26.38	0.02	0. 01	0.00	0.01	0.05	0.12	0.08	0.01	0.25	0.04	0.00	0.02	0.01	0.04
13	0.01	44.74	0.00	0. 00	0.00	0.00	0.84	0.76	0.00	0.01	0.00	0.00	0.00	0.03	0.00	0.01
14	0.00	66.85	0.97	0. 02	0.00	0.00	0.06	0.04	0.02	0.04	0.71	0.00	0.00	0.00	0.00	0.03

Note:

PPOE = Physical positive outcome expectation
MPOE = Psychological positive outcome expectation
PNOE = Physical negative outcome expectation
PNOE = Psychological negative outcome expectation
LOWSE = Low obstacle for self-efficacy
MODSE = Moderate obstacle for self-efficacy
HISE = High obstacle for self-efficacy

FAM = Family support
FRI = Friend support
HOME = Home environment
NBH = Neighborhood environment
COM = Community environment

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3.3 Homoscedasticity and linearity

Residuals scatter plots were evaluated to assess homoscedasticity and linearity (Munro and Page, 1993). The residual pattern did not deviate from a horizontal band; the spread was equivalent across the zero axis within ± 2 standard deviations which indicates a homoscedasticity and linear relationship. This assumption was therefore reasonably accepted (Appendix. G).

4. Principal analysis

To answer the research questions and test the research hypotheses, the model and hypothesis testing are described below.

4.1 Model testing

The model of physical activity was tested using a two-step approach: the measurement model and the structural equation model. The measurement model was tested first, followed by the structural equation model.

4.1.1 Assessment of measurement models

The measurement model determines how latent variables or constructs are indicated by the observed variables. In this study, 5 concept constructs were evaluated including positive outcome expectation, negative outcome expectation, self-efficacy, social support, and physical environment in order to specify reliability and construct validity using confirmatory factor analysis (CFA). This section presents the fit indices of the measurement models along with the reliability (R^2) and standardized validity coefficient (λ^s) using confirmation factor analysis.

The results of CFA reveal that the five measurement models had a good overall model fit (Table 4.17). The second-order CFA shows that all measurements had low Chi-square values resulting in a non-significant difference level of 0.05. The χ^2 /df ratio fell within the recommended level of 2, with both GFI and AGFI values close to 1.00 and equal to 1.00 respectively. The RMSEA values ranged from 0.00 to 0.03, indicating validity of measurement constructs (Confirmatory factor analysis of the measurement models are presented in Appendix H, Figure 6-14).

Table 4.17 Statistical Overall Fitted Index Values of measurement models (n=320)

Construct	χ^2	df	χ^2/df	p-value	GFI	AGFI	RMSEA
SEPA	26.56	22	1.21	.23	0.98	0.96	0.03
POEPA	29.13	24	1.21	.21	0.98	0.96	0.03
NOEPA	0.17	1	0.17	.67	1.00	1.00	0.00
SSPA	199.42	171	1.17	.07	0.95	0.92	0.02
TESPA	33.27	25	1.33	.13	0.98	0.96	0.03

Note: GFI = Goodness of fit index
AGFI = Adjusted goodness of fit index
RMSEA = Root mean square error of approximation
SEPA = Self-efficacy for physical activity
POEPA = Positive outcome expectation of physical activity
NOEPA = Negative outcome expectation of physical activity
SSPA = Social support for physical activity
TESPA = Thai environment supports for physical activity

Table 4.18 illustrates the loading with t-values and squared multiple correlations among all observed variables for physical activity measurement. Based on an accepted level of .05, the t-value test statistic needs to be >+_1.96 before the hypothesis could be rejected. The results reveal that all sub-scales of the measurement had significant low to high parameter estimates which were related to their specific constructs and validated the relationships among observed variables and their constructs. (Confirmatory factor analysis of the measurement models is presented in Appendix H, Table 6-10).

Furthermore, the squared multiple correlations (R^2) for observed variables of the latent variables ranged from 0.25 to 1.00 (Table 4.18). The R^2 of all observed variables were strong indicators except for self-efficacy for high obstacles, and home environment which were moderately strong (.48 and .45) (Table 4.18). Moreover, a low R^2 value (.25) was found in the family support sub-scale of social support (Table 4.18).

Table 4.18 Loading and reliability of indicators

Construct and Indicators	Factor loading	t-value	Standard error	R^2
SEPA				
• LOWSE	1.81-2.23	12.57-13.49	0.13-0.17	0.78
• MODSE	2.29-2.62	18.48-19.37	0.12-0.14	0.92
• HISE	2.44	-	-	0.48
POEPA				
• PPOE	0.44-0.64	8.04-9.88	0.07	0.86
• MPOE	0.46-0.65	8.18-9.88	0.07-0.08	1.00
NOEPA				
• PNOE	0.84-0.86	10.65	0.08	0.71
• MNOE	0.90-1.00	10.86	0.09	1.00
SSPA				
• FAM	0.38-0.76	5.57-8.00	0.05-0.12	0.25
• FRI	0.50-1.16	8.25-9.71	0.06-0.12	1.00
TESPA				
• HOME	0.39-1.05	7.47-8.49	0.07-0.14	0.45
• NBH	0.54-1.00	6.57-8.92	0.08-0.09	0.78
• COM	0.15-0.57	1.99-3.43	0.08-0.11	0.71

Note:

R^2	=	Square multiple correlation
SEPA	=	Self-efficacy for physical activity
LOWSE	=	Low obstacle for self-efficacy
MODSE	=	Moderate obstacle for self-efficacy
HISE	=	High obstacle for self-efficacy
POEPA	=	Positive outcome expectation of physical activity
PPOE	=	Physical positive outcome expectation
MPOE	=	Psychological positive outcome expectation
NOEPA	=	Negative outcome expectation of physical activity
PNOE	=	Physical negative outcome expectation
PNOE	=	Psychological negative outcome expectation
SSPA	=	Social support for physical activity
FAM	=	Family support
FRI	=	Friend support
TESPA	=	Thai environment supports for physical activity
HOME	=	Home environment
NBH	=	Neighborhood environment
COM	=	Community environment

In summary, the findings reveal that all measurement models fit the empirical data. Chi-square tests show low values with non-significant levels. Both GFI and AFI values were close to or equal to 1.0, and RMSEA values were less than .05. All measured models' indices were acceptable. The classical testing approach for reliability and validity provided adequate support for the five measures. Therefore, the structural equation analysis was conducted to estimate the hypothesis model of physical activity in the following steps.

4.1.2 Assessment of structural model

Once acceptable measurement models were determined, the SEM was analyzed. To be congruent with the hypothesized model presented (Figure 4.1), age, social support, and physical environment are treated as exogenous variables with six observed variables: age, family support, friend support, home environment, neighborhood environment, and community environment. The endogenous variables include self-efficacy, positive outcome expectation, negative outcome expectation, and physical activity with eight observed variables: low obstacle, moderate obstacle, high obstacle, physical positive outcome expectation, psychological positive outcome expectation, physical negative outcome expectation, psychological negative outcome expectation, and physical activity. The equation of SEM is:

$$\eta = \beta\eta + \gamma\xi + \zeta$$

Where η = an m x 1 random vector of endogenous variable

β = an m x m matrix of coefficient of endogenous variable

γ = an m x m matrix of coefficient of exogenous variable

ξ = an n x 1 vector of exogenous variable and

ζ = an m x vector of equation error in the structure relationship

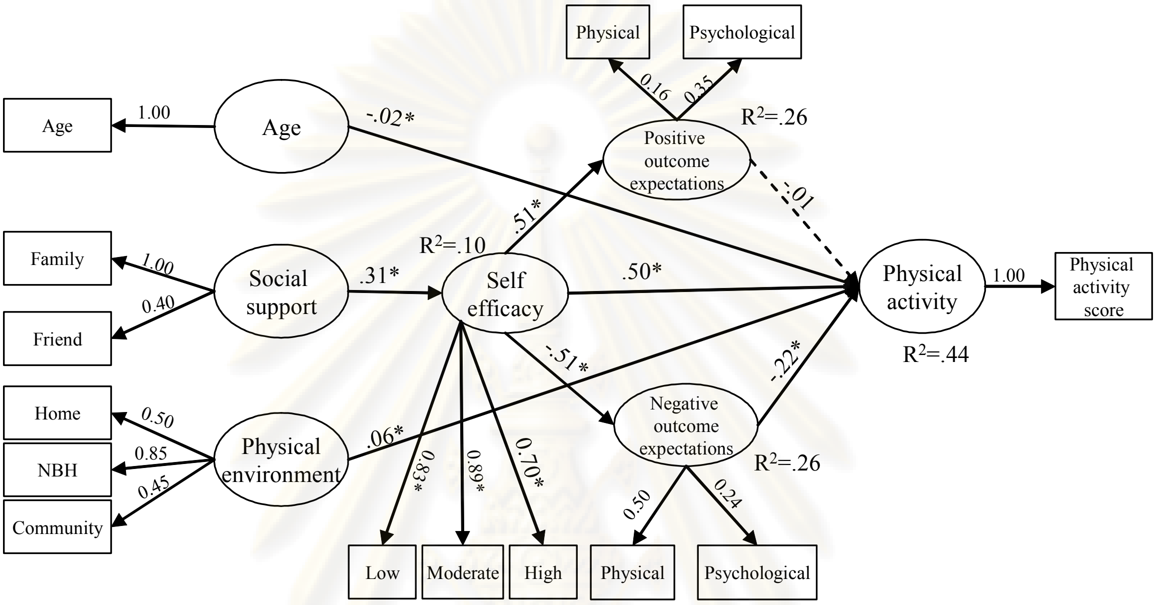
between η and ξ (Jöreskog, and Sörbom, 1996-2001:.2)

Model identification

According to Tabachnick and Fidell's (2007) suggestion, the overidentified model is one with more data points than free parameters. The number of data points is {p (p+1)}/2, where p equals the number of observed variables (Tabachnick & Fidell, 2007,). In the hypothesized model, there are 14 measured variables with a total of 105 data points: 14(14+1)/2= 105 and 36 parameters. The hypothesized model has 69 fewer parameters than data points, thus the model is overidentified which means that it can be identified.

Step one: Hypothesized model testing

The proposed model tested is shown in Figure 4.1 and table 4.19. Path coefficients are standardized because it is easier to compare the model coefficient (Hair, et al, 1998). The results reveal that the hypothesized model did not fit the data using the following values χ^2 = 281.41, *df*= 69, p= 0.00, GFI=0.89, AGFI= 0.83, and RMSEA= 0.10. The hypothesized model accounted for 44% of variance in physical activity among the study sample. Hair and colleagues (2006) suggested that the significant χ^2 for a sample size greater than 250 is an acceptable value. However, the RMSEA values in the current study were higher than expected. The GFI and AGFI values were less than the acceptable value of 0.90. These diagnostics suggest the hypothesized model provided a bad fit with the data. In order to decrease χ^2 values, the modification indices, standardized residuals, and expected value suggested through the Theta-Epsilon metric (TE) and Theta-Delta (TD) was used. Therefore, the proposed model was refitted to get a suitable model that fit the data.



*p<.0, 05

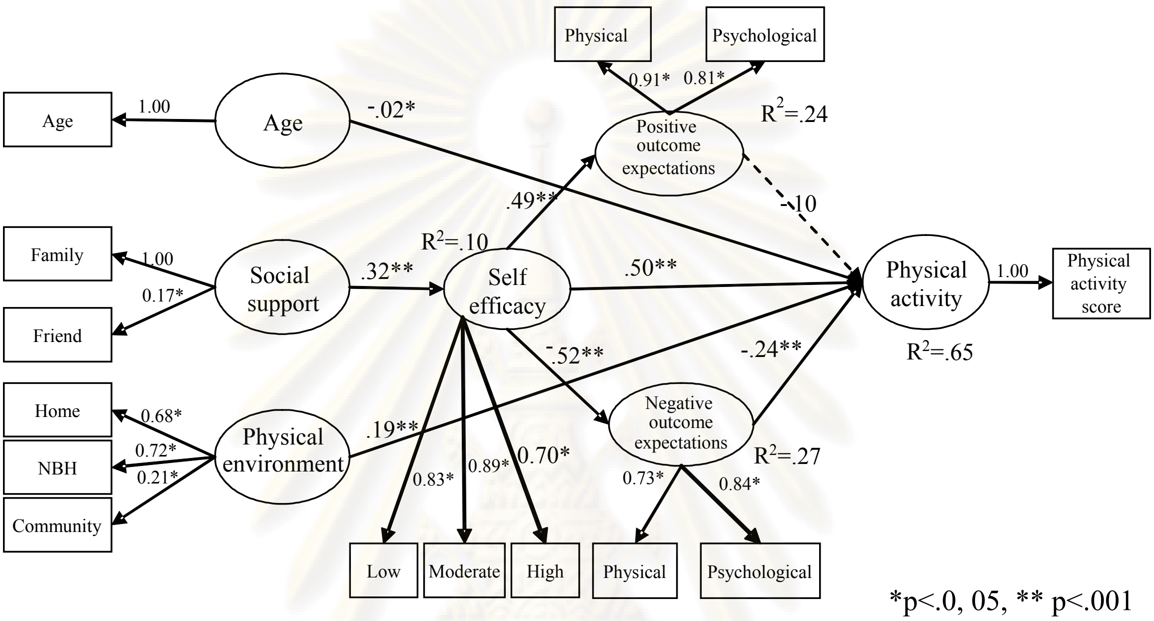
Goodness-of-fit indices: χ^2 = 281.41, *df*= 69, p= 0.00,GFI=0.89, AGFI=0.83, RMSEA= 0.10.

Figure 4.1 The proposed model of physical activity in older Thai people.

Step two: Model modification

The modified model (Figure 4.2 and Ta ble 4.19) had a better fit than the hypothesized m odel. The χ^2 estimate was non-significant (χ^2 = 51.80, *df*= 39, p= 0.08), indicating a good fit. The m odel shows the GFI and AGFI were greater than 0.90 (GFI=0.98, AGFI =0.94) and the RMSEA was less than 0.05 (RMSEA= 0.03); meanwhile the χ^2 per degree of freedom was 1.33. It can be seen that the p value and goodness of fit indices have been im proved by adding the relationship of the error for social support with physical environment, age, and the relationship among the error of positive ou tcome expectation, neg ative ou tcome expectation, and s elf-efficacy.

Furthermore, the difference in χ^2 was greater than that of *df* ($\chi^2 1-\chi^2 2 = 229.61$, *df*1-*df*2= 30 meaning that the modified model had a better fit with the empirical data.



*p<.0, 05, ** p<.001

Goodness-of-fit indices: χ^2 = 51.80, *df*= 39, p= 0.08, GFI=0.98, AGFI=0.94, RMSEA= 0.03

Figure 4.2 The modified model of physical activity in older Thai people.

Table 4.19 Comparison of hypothesized and revised structural model

Goodness of Fit indices	**Hypothesized model**	**Revised model**
Chi-square	281.41	51.80
Degree of freedom	69	39
p-value	.00	.08
Goodness of fit index(GFI)	0.89	0.98
Adjusted goodness-of fit- index(AGFI)	0.83	0.94
Comparative Fit Index (CFI)	0.91	0.99
Root mean square error of approximate (RMSEA)	0.10	0.03
Normed fit index(NFI)	0.89	0.98
R^2 for structural equations	0.44	0.65

Evaluation of goodness of fit criteria:

1. Offending estimates

The modified model had no negative error variance, standardized coefficient close to 1, or very large standard errors indicating that there were no offending estimates.

2. Overall fit index

The absolute fit measures showed that elements of the covariance matrix reproduced by the parameter estimates of the hypothesized model were not significantly different from the covariance of empirical data (p = 0.08); the RMSEA was small (0.03) indicating the empirical data fit. The GFI and AGFI were above 0.90 and close to 1 (.98 and .94) respectively. The ratio of χ^2 to the degrees of freedom was less than 2 which indicates the relative efficiency of the competing model in accounting for the data.

3. Measurement model fit

All indicators loading were statistically significant at level .05. The reliability of indicators ranged from 0.25 to 1.00 suggesting that most indicators were sufficient to represent the constructs.

4. Structural model fit

All path coefficients were statistically significant. The correlations between the constructs were not high. The R^2 for the structural equation was 0.65, meaning that the revised model accounted for 65% of the variance in physical activity among older Thai people. For other predictors, the model accounted for 10% of the variance in self-efficacy, 24% of the variance in positive outcome expectation, and 27% of the variance in negative outcome expectation.

In conclusion, the statistics confirm that the revised model fit with the empirical data.

4.2 Hypothesis testing

Six hypotheses and their direct and indirect effects were estimated. A summary of the effects of the causal variables on the affected variables is presented in table 4.20. The hypotheses of the proposed causal model of physical activity in older Thai people were examined and the findings were as follows.

4.2.1 Effect of self-efficacy on physical activity

Self-efficacy had a significant positive direct effect on positive outcome expectation (β = .49, p<.001) and a significant negative direct effect on negative outcome expectation (β = - .52, p<.001). Self-efficacy had a significant indirect effect on physical activity through negative outcome expectation (β =.17, p<.001), and a non-significant indirect effect on physical activity via positive outcome expectation. The total effect of self-efficacy on physical activity was .67, p<.001.

4.2.2 Effect of positive outcome expectation on physical activity

Positive outcome expectation had a non-significant positive direct effect on physical activity (β = .10, p >.05). The total effect of positive outcome expectation on physical activity was .10, p >.05.

4.2.3 Effect of negative outcome expectation on physical activity

Negative outcome expectation had a significant negative direct effect on physical activity (β = -.24, p<.001). The total effect of negative outcome expectation on physical activity was -.24, p<.001.

4.2.4 Effect of age on physical activity

Age had a significant negative direct effect on physical activity (β = -0.02, $p<.05$).

4.2.5 Effect of social support on self-efficacy

Social support had a significant positive direct effect on self-efficacy (β = .32, $p<.001$) and a significant positive indirect effect on positive outcome expectation (β = .16, $p<.001$) and physical activity (β = .21, $p<.001$) through self-efficacy. Social support had a significant indirect effect on negative outcome expectation (β = - .17, $p<.001$) through self-efficacy. The total effect of social support on physical activity, self-efficacy, positive outcome expectation, and negative outcome expectation were .21, .32, .16, -.17, at respectively, $p<.001$.

4.2.6 Effect of physical environment on physical activity

Physical environment had a significant positive direct effect on physical activity (β = .19, $p<.001$). The total effect of negative outcome expectation on physical activity was .19, $p<.001$.

Table 4.20 Summary of the effects of causal variables on affected variables (n=320)

Causal variable	Affected variables											
	Physical activity			**Positive outcome expectation**			**Negative outcome expectation**			**Self-efficacy**		
	DE	IE	TE	DE	IE	TE	DE	IE	TE	DE	IE	TE
SE	.50**	.17**	.67**	.49**	-	.49**	-.52**	-	-.52**		-	
POE	.10	-	.10									
NOE	-.24**	-	-.24**									
AGE	-.02*	-	-.02*									
SS	-	.21**	.21**	-	.16**	.16**	-	-.17**	-.17**	.32**	-	.32**
EN	.19**	-	.19**									
	R^2= 0.65			R^2=0.24			R^2= 0.27			R^2= 0.10		

*p<.05, ** p<.001

Note: SE = Self-efficacy
POE = Positive outcome expectation
NOE = Negative outcome expectation
SS = Social support
EN = Physical environment
DE = Direct effect
IE = Indirect effect
TE = Total effect

Hypothesis 1: *Self-efficacy has a positive direct influence on physical activity. It also has an indirect effect on physical activity through positive outcome expectation and negative outcome expectation.*

According to the modified model, self-efficacy had a strong and significant positive direct effect on physical activity (β= .50, p<.001) (Table 4.20, Figure 4.2). On the other hand, self-efficacy had a significant indirect effect on physical activity through negative outcome expectation only (β= .17, p<.001), but a non-significant indirect effect on physical activity via positive outcome expectation. Thus, hypothesis one is partially supported as proposed in the hypothesized model of physical activity in older Thai people.

Hypothesis 2: *Positive outcome expectation has a positive direct influence on physical activity.*

The parameter estimates in table 4.20 and figure 4.2 indicate that positive outcome expectation has a non-significant positive direct effect on physical activity (β = .10, p >.05). Therefore, hypothesis two is not supported as proposed in the hypothesized model of physical activity in older Thai people.

Hypothesis 3: *Negative outcome expectation has a negative direct influence on physical activity.*

The parameter estimates in table 4.20 and figure 4.2 show that negative outcome expectation has a significant negative direct effect on physical activity (β = -.24, p <.001). Therefore, hypothesis three is supported as proposed in the hypothesized model of physical activity in older Thai people.

Hypothesis 4: *Age has a direct influence on physical activity.*

The parameter estimates in table 4.20 and figure 4.2 reveal that once a number of parameters had been freed, age had a significantly negative direct effect on physical activity (β = .02, p<.05). Thus, hypothesis four supports the causal relationship as proposed in the hypothesized model of physical activity in older Thai people.

Hypothesis 5: *Social support has an indirect effect on physical activity through self-efficacy.*

The parameter estimates in table 4.20 and figure 4.2 demonstrate that following model modification, social support was still reported as statistically significant with a positive direct effect on self-efficacy (β =.32, p<.001), and a positively significant indirect effect on physical activity (β = .21, p<.001). Therefore, hypothesis five is supported as proposed in the hypothesized model of physical activity in older Thai people.

Hypothesis 6: *Physical environment has a positive direct influence on physical activity.*

The parameter estimates in table 4.20 and figure 4.2 show physical environment to have a significant positive direct effect on physical activity (β = .19, p <.001). Therefore, hypothesis six is supported as proposed in the hypothesized model of physical activity in older Thai people.

In summary, the descriptive static characteristics of study variables have been explained. The preliminary analysis demonstrated that the assumptions for SEM analysis were not violated. Each one of the measurement models was examined and confirmed the construct validity. Following this, the hypothesized causal model of physical activity in older Thai people was analyzed and modified. The modified causal model fits well with the empirical data. Although one of the research hypotheses was not supported, the model retained significance and is practical for explaining factors affecting physical activity in older Thai people. As a final point, all the variables in the modified model explain approximately 65% of the variance in overall physical activity.

CHAPTER V

DISCUSSION, IMPLICATIONS, AND RECOMMENDATIONS

The findings of the study will be discussed in this chapter. It includes a discussion of the characteristics of the study sample and variables, model and hypothesis testing, conclusion, implications for nursing, and recommendations for future research.

1. Characteristics of the study sample

The statistical analyses demonstrated that the characteristics of the study sample were similar to those of previous studies. Half of the participants were in the young-old group. Most were female, married, Buddhist, had an elementary level of education, and a household income of less than 5,000 Baht per month. Over half of the respondents were employed, which was similar to the subjects of previous Thai studies (Nareerat Jitramontree, 2003; Varin Binhosen, 2003; NSO, 2007; Knodel and Napaporn Chayovan, 2008b). In addition, the majority of participants worked in the agricultural sector, which was consistent with the studies of Panitnun Chotikacharoensuk (2002), Varin Binhosen (2003), Ammarittagul (2004), Jirawan Inkoom (2006), and the NSO (2007). According to Wilaiwan Wattananon (2001), one-third of older Thai people had taken part in activities to promote health, raise their household income, increase self-value and feel content with their lives. Nonetheless, the current findings differ from an Australian study, (Booth et al., 2000) where most seniors were retired (84.3%). With regard to living arrangements, the majority of the study samples lived with their spouse and/or their child/grandchild but did not have an outside caregiver. This finding reflects the nature of the Thai extended family structure which is similar to results from the NSO (2007), in which nearly all older Thai people (92.3%) lived with or very near their children. Thai families have taught their children to repay their gratitude to their parents by living with and maintaining them particularly with respect to health and living expenses. The present study also confirms that older Thai people usually live in their own two-storey or raised home. The results are similar to those of previous Thai research (Wilaiwan Wattananon, 2001; Institute of Geriatric Medicine, 2006; NSO, 2007).

It has to be acknowledged that senior Thai citizens have higher rates of health problems than younger people. The Thai National Survey in 2006 (NSO, 2007) pointed out that the two most common health problems among the elderly over 60 years of age were hypertension and joint pain, findings that were similar to the current study. These findings were also consistent with previous studies (Prapaporn Chinuntuya, 2001; Panitnun Chotikacharoensuk, 2002; Varin Binhosen, 2003; Jirawan Inkoom, 2006; Institute of Geriatric Medicine, 2006). Moreover, the results of the present study demonstrate that 55.6% were members of a senior's club and the average length of time of participation was 25.5 months. Conversely, the NSO (2007) reported that only 25.6% of older Thai people were members of a seniors club. The influence of health care policy (2002-2021), of creating a seniors club per sub-district (Ministry of Public Health, 2007) may be a possible explanation for the increase in participation.

2. Characteristics of the study variables

2.1 Physical activity

Physical activity was measured in the present study with the IPAQ_L. The proportion of the respondents meeting the IPAQ recommendation (67.5%) was higher than in another Thai study (13.7%) (ABAC Poll Research Center, 2005). This result indicates that older Thai people might have a tendency to participate in physical activity at a level known to have beneficial health outcomes. The level of participation in the current study was also greater than that of a Saudi Arabian study (Al-Hazzaa, 2006), but differed from western studies (Ainsworth et al., 2006; Guthold et al., 2008). Al-Hazzaa (2006) showed that only 42.7 % of Saudi Arabian people aged 60-78 year were sufficiently active in physical activities. In contrast, Ainsworth and colleagues (2006) reported that 79.8% of US people aged 55 and older met the recommended level, similar to a study of 60-69 year olds from 51 countries (Guthold et al., 2008).

The total physical activity scores were compared with other samples of healthy older adults using IPAQ_L. The mean overall weekly energy expenditure of 873.25 METs from the current study is similar to the 839 METs identified in a 7-day recall period from participants of the European Union aged 65 years and over (Rutten and Abu-Omar, 2004). Furthermore, this is slightly lower than figures from an investigation in China (Deng et al., 2008), Croatia (Jurakic, Pedisic, and Andrijasevic, 2009) and Norway (Graff-Iversen et al., 2007: online). Deng and colleagues (2008), who studied 224 older Chinese adults, suggested that the sample subjects were physically active in terms of MET-value with a mean score of 4583 METs. Furthermore, a study by Graff-Iversen and colleagues (2007: online) illustrated higher mean energy expenditure than the present study. Their study focused on Norwegian participants aged 31 to 67 years old. However, comparing the findings of our study with others may be difficult. This is because 66.6 % of the participants in the present investigation had health problems. It would appear that the scores are reasonable when compared to asymptomatic older people in the study cited above.

One possible explanation for the increase in energy expenditure when compared with other Thai studies could be the fact that between November 2008 and the end of March 2009, during which the current investigation was conducted, a health promotion campaign was implemented by the Ministry of Public Health under the 2nd Strategy of the 10th National Health Development Plan (2007-2011) (Ministry of Public Health, 2007: online). Following the introduction of this health initiative, health providers and related organizations encouraged older Thai people to engage in physical activity. “Exercise for health” clubs have been established nationwide, with at least one club per tambon. Also, the Ministry of Public Health has promoted a campaign for all elderly Thai citizens to participate for at least 30 minutes, 3 days a week, in moderate-intensity physical activities. Consequently, the study sample was exposed to a variety of interventions to promote and to increase physical activity. Perhaps more importantly, the provision of information was intended to change the level of knowledge regarding the benefits of physical activity and raise awareness about the opportunities within the community to increase physical activity. Probably a result of the national campaign, the mean score of physical activity for this study was higher than previous empirical studies.

More interestingly, the current results illustrate that most physical activities were within the confines of the household. Since household chores can be incorporated into daily activities where no specific equipment is required and because of the lower risk of pain or injury, this is thought to be the primary reason why most physical activities were undertaken within the household. Consistent with previous studies, most participants engaged in household work as ordinary activities with moderate intensity (Prapaporn Chinuntuya, 2001; Varin Binhosen, 2003). In general, moderate-intensity household activities such as sweeping, mopping floors, meal preparation, laundry and care giving have been performed mostly by elderly women, whereas, home repair, outdoor gardening, and yard work were mostly done by elderly men. A study of elderly Thais by Kaysorn Sumpowthong (2001) supported the notion that females were more engaged in domestic chores than males. In addition, most of the participants in the present study were female. It is seen that the continuity of their routine activities was maintained by values and attitudes that they had developed from their early life (Easly and Schaller, 2003). As a consequence, household activities have become their activity of choice.

2.2 Self-efficacy

The total sum of self-efficacy for physical activity ranged from 4 to 89 with a mean of 45.72, indicating that participants in the current study perceived a moderate confidence that they could successfully perform physical activity under various impediments. The self-efficacy for physical activity in the current study was measured by the SEPA which was modified from the SEE. Comparatively, the mean score was slightly lower than those from previous studies that used the SEE scale on elderly western participants (Resnick, 2001; Resnick et al., 2002; Resnick et al., 2003; Resnick, et al., 2004; Gee, 2005). For instance, the retired elderly had a self-efficacy mean score of 49.5 (Resnick et al., 2003). In contrast, the mean score from the current study did not differ from a study among older Thai people who had had knee replacements (Harinirattisai and Johnson 2005). In the latter study, the mean SEE score for the experimental group was 44.82 and for the control group 45.72 before intervention (Harinirattisai and Johnson, 2005).

The respondents revealed that they perceived self-efficacy as a low mean score for high obstacles, and as a moderate to high mean score for moderate and low obstacles. A possible explanation for this finding may be the complexity of the tasks that people believe they can accomplish. This finding was consistent with Bandura's view (1997) that magnitude is one of three dimensions varying individual's self-efficacy. In other words, the elderly might have different levels of self-efficacy for obstacles of different types of magnitude. Owing to the fact that more than a half of the participants had health problems and faced joint pain, pain as the high obstacle might influence the participant's performance. According to Kaysorn Sumpowthong's study (2002) of older Thai people, the greatest obstacle to engaging in activities was health problems. Similarly, Prapaporn Chinuntuya (2001) studied elderly Thais who resided in Bangkok and found that health problems such as joint pain and/or fatigue restricted activities requiring mobility. On the other hand, for low and moderate obstacles, doing them alone, bad weather, and joylessness, could also affect self-efficacy. Elderly Thais felt they were able to find a solution. The mean score for self-efficacy for low obstacles was the highest, followed by self-efficacy for moderate obstacles and self-efficacy for high obstacles. For that reason, the combination of self-efficacy among low, moderate, and high obstacles is presented as a moderate level in the present study.

Moreover, performance attainment, vicarious experience and verbal persuasion might enhance self-efficacy for engaging in physical activity. The current study fits these characteristics since the majority of the samples were employed, participated in seniors clubs, and lived with their children or grandchildren. It is thought that engaging in occupations, household activities, and gardening activities as routine tasks, with time to build up confidence, allowed the elderly to achieve their goals. In addition, verbal motivation by family members and friends might have encouraged the elderly to participate in physical activities. According to Bandura (1997), performance accomplishment, vicarious experience, and verbal persuasion are significant sources that contribute to self-efficacy. Consequently, participants of the current study had a moderate self-efficacy level.

2.3 Positive outcome expectation

The current study results indicate that the study sample had a high positive outcome expectation score. As expected, the physiological and psychological domains of positive outcome expectation of physical activity appeared to be important among elderly Thais, in particular, physical fitness and mental alertness. In the present study, perceived positive outcome expectation was measured by the POEPA which had been modified from the OEE-2 (Resnick, 2005). The mean score of this finding ($\overline{X}$ = 36.50) was higher than previous investigations among healthy older adults (Resnick, et al., 2001; Resnick and Nigg, 2003; Resnick et al., 2004), and slightly lower than those studies among the elderly with health problems (Gee, 2005; Teeranut Harnirattisai et al., 2005). For example, Teeranut Harnirattisai and colleagues (2005) measured positive outcome expectation in older Thai people after knee replacement using the OEE; the mean score for the experimental group was 38.61 and for the control group 38.70. However, a recent study among healthy older adults by Resnick, Luisi, and Vogel (2008) demonstrated a mean score similar to the present study.

A possible explanation for the high positive outcome expectation score may be the implementation of the health promotion project. The present study was conducted in the year 2008-2009, during which the Ministry of Public Health under the 10th National Health Development Plan (2007-2011) (Ministry of Public Health of Thailand, 2007: online) implemented a campaign of health promotion. It is highly possible that the elderly in the current study could have gathered health information on the benefits of physical activity through friends and health care providers in their community. Since most were affiliated with a seniors club and had completed elementary education. Additionally, television was the source mostly used by elderly Thais to obtain information on increasing physical activity (Kaysorn Sumpowthong, 2001; Wilaiwan Wattananon, 2001; NSO, 2007). It is believed that, as a result of the campaign, there was an increased understanding and awareness of the benefits of physical activity for older Thai people. Moreover, due to the fact that most of the participants in the current study had health problems, it is possible that they viewed physical activity as beneficial to their health. Thus the tendency to perceive a positive outcome expectation by engaging in physical activity became stronger in this group of elderly with and without health problems.

A final explanation for the high positive outcome expectation scores may be the sense of social desirability. Thai people normally avoid overt disagreements of any kind and positive outcome expectation was determined in a face to face interview, therefore the respondents may have overestimated scores to present what they perceived to be more acceptable responses. According to Kaysorn Sumpowthong's study (2001), the benefit of engaging in physical activity was highly regarded by a sample of older Thais.

As can be seen therefore, the mean positive outcome expectation score for the present study was higher than that shown in previous research. Based on previous evidence, nevertheless, the benefits of outcome expectation of physical activity have been an important factor for engaging in physical activity.

2.4 Negative outcome expectation

The NOEPA, which had been modified from the OEE-2 subscale (Resnick, 2005), was used to measure negative outcome expectation. The findings demonstrate that the participants had a moderate mean score for negative outcome expectation ($\overline{X}$=9.31). This could be explained by a perceived fear of falling and other beliefs of the elderly. The results in the present study show the mean score for fear of falling or getting hurt from engaging in physical activity was the highest. Similarly, several studies have reported fear of falling to be associated with a restriction of physical activity among the elderly (Murphy, Wiliams, and Gill, 2002; Wilcox et al., 2003; Fletcher and Hirdes, 2004; Wijlhuizen, Jong, and Hopman-Rock, 2007). According to previous research in the elderly Thai population (Kaysorn Sumpowthong, 2001; Hataichanok Apikomonkon, 2003; Nareerat Jitramontree, 2003), almost half of the samples reported that they restricted their activities for fear of falling (NSO, 2008). These results illustrate that the decline in skeletal muscle strength and previous falls both directly and indirectly might influence the perceived risks of engaging in physical activity by the elderly. Nonetheless, the present study shows that the majority of participants took part in moderate-intensity household activities as a part of their routine or daily life. It might be thought that some elderly believe that low and moderate intensity activities were more suitable than vigorous ones, and past performance seemed to provide a positive response rather than thoughts of negative outcomes. The negative outcome expectation in the current study had a moderate score.

Regarding the NOEPA measurement, the scale was developed in 2005 and this is the first reported validation study in older Thai adults. Meanwhile, this instrument has been less used in western research. Although the questionnaire had been validated, normative data for comparison were not available. Therefore the scale should be applied to different populations and in other countries to identify the normative data for different age groups and cultures.

2.5 Social support

The analysis of the present study shows that participants had a moderate level of social support for physical activities ($\overline{X}$ = 29.76, 21.91). Social support in the present study was measured by the SSPA, which was modified from the SSE (Sallis et al., 1987). The mean score for family support in this study has a higher value whereas the average for the support of friends score was slightly lower than in prior studies (Resnick et al., 2002; Gee, 2005; Wei-Fen MA, 2005; Thanee Kaewthummanukul, 2006; Marquez and McAuley, 2006). For instance, Wei-Fen MA (2005) assessed Taiwanese participants aged between 20 and 60 years with anxiety and found that the mean score for support from family and friends was 21.99, and 22.0, respectively. Similarly, female Thai nurses had a lower mean score for family support, but a higher average score for friend support (Thanee Kaewthummanukul, 2006). This contradicts the findings of the current study. Nevertheless, the two latter studies were conducted only with adult samples.

The moderate level of social support for physical activities found in the current study might be related to some of the characteristics of Thai culture and perceptions of family members. Generally, the lifestyle of Thai senior citizens is associated with close family ties and community affiliations, whereas this might not be the case in western societies. Thai tradition values a sense of gratitude, obligation, and respect towards the elderly within the family and community (Jiraporn Kespichayawattana, 1999). Children and grandchildren have been educated to repay gratitude to their parents and grandparents by living with them, supporting and taking care of them (Wannipa Asawachaisuwikrom, 2001; Knodel and Napaporn Chayovan, 2008a: online; 2008b). Beyond this, most Thai children who migrate to work somewhere else, still keep in contact with their parents by phone and visit the family home on special occasions (NSO, 2008). The majority of participants in the present study were married and lived with other family members. Family relationships may motivate and provide the elderly an opportunity to perform light to moderate physical activities. Therefore, it is possible that family members have an influence on the activity level of their elderly relatives. Consequently, this might explain the relatively higher level of social support from family members in the current study compared to previous investigations and other age groups.

On the other hand, some Thai societal expectations contribute to a sedentary lifestyle among the elderly. Some elderly Thais believe that they need to be careful and not overexert themselves. Furthermore, family members may believe the elderly need to rest rather than be active. As a result, those families may try to protect their parents or grandparents by restricting their activities. Similarly, the results from the qualitative data in Wannipa Asawachaisuwikrom's study (2001) also underpinned these findings; one participant expressed that her child did not allow her to perform any type of physical activity for fear she might hurt herself. Thus, it is possible to say that the moderate score obtained from family support in this study is reasonable.

Moreover, this result reflects senior Thai society, not only for the close relationships between the older people and family members, but also with respect to the contribution of friendship. In Thai tradition, the elderly and their friends often perform many social activities (Wilaiwan Wattananon, 2001) and merit making activities (Institute of Geriatric Medicine, 2006) together. Consequently, the elderly might find motivation from friends through social interactions, role modeling or seeing others' activities, and by receiving verbal encouragement to engage in group activities. Nevertheless, opportunities for friends' support might be dependant on the activity which they are involved in. Therefore, the mean score for friend support in the current study was moderate.

2.6 Physical environment

The results of this study illustrate the total sum of physical environment for physical activity with a mean score of 34.87, indicating the elderly perceived physical environment at a moderate to high level. The mean score of home environment was perceived as the highest, followed by neighborhood and community environment. The results can be explained in terms of the duration of one's stay in such an environment which ranged between 6 months to almost 84 years. In addition, the qualitative data show that most elderly preferred to engage in physical activities inside their home setting due to safety concerns, familiarity, and convenience. The results were similar to previous studies in elderly Thais (Wilaiwan Wattananon, 2001; Nareerat Jitramontree, 2003). Accordingly, Kaysorn Sumpowthong (2001) reported that Thai seniors engaged in walking, gardening and exercising at home. Likewise, a recent study of elderly Swedish (Dahil-Ivanoff et al., 2007) cited that most participants performed daily activities in their home environment.

On the other hand, the elderly fear being injured outside their home. Several studies support that elderly participation in outdoor activities contributed to the risk of falling (Murphy, Wiliams, and Gill, 2002; Fletcher and Hirdes, 2004; Wijlhuizen, Jong, and Hopman-Rock, 2007). This is also supported by Hataichanok Apikomonkon (2003) and the Institute of Geriatric Medicine's study (2004), which showed that the majority of elderly Thais have a fear of falling and that most falls took place outdoors.

Participants in the present study were familiar with their physical environment including their home, the neighborhood, and the community environment. Therefore, for these reasons, the mean score for the home environment would be higher than other environments. Moreover, the total sum of the physical environment score was moderate to high.

However, the physical environment was measured using the TESPA which had been modified from the Environmental Support for Physical Activity Questionnaire (the SIP 4-99 Research Group, 2002), with the addition of the home subscale related to elderly Thais. Thus, this is the first reported validation study of the TESPA in older Thai adults. Although, the original instrument had been validated in western studies, normative data for comparison in Thailand is not available for the TESPA measurement. Thus, further research using the TESPA with Thai samples is needed to identify normative data for each age group.

3. Model and Hypotheses testing results

The results of the SEM analyses demonstrate that the physical activity model was a better fit as it takes into account the relationship between the errors of self-efficacy, positive outcome expectation, negative outcome expectation, age, social support, and physical environment.. The goodness of fit measure indicates that the revised model constructed from SCT theories fit the empirical data and accounted for 65 % of the variance in physical activity levels of older Thai people. These findings demonstrate that strong predictors are included in the model and the model is parsimonious. Moreover, the results of this study underpin the causal relationships among those predictors.

3.1 Hypothesis testing

The findings reveal that 4 of 6 hypotheses were fully supported by the empirical data whereas one hypothesis was only partly supported.

Hypothesis one: *Self-efficacy has a positive direct influence on physical activity and it has an indirect effect on physical activity through positive outcome expectation and negative outcome expectation.*

1). Self-efficacy has a positive direct effect on physical activity

As expected, the results of the current study support the hypothesis that perceived self-efficacy had a strong positive direct effect on physical activity. This illustrates that older Thai people with a high belief in their capabilities to overcome the constraints and impediments of their circumstances, were more likely to undertake physical activity than those with less belief. According to the SCT, self-efficacy beliefs can underpin an individual's behavior by providing motivation and a sense of personal accomplishment (Bandura, 1986; 1997). The perception of self-efficacy therefore, is important to understand physical activity behavior (Lee, Arthur, and Avis, 2008). Likewise, the results of the present study are congruent with evidence elsewhere suggesting that self-efficacy is a predictor for participation in physical activity (Allison and Keller, 2004; Laffrey, 2000; McAuley et al., 2003a; Wilcox et al., 2003; Anderson et al., 2006; Lee and Laffrey, 2006; McNeill et al., 2006b; Umstattd et al., 2006; 2008; Pan et al., 2009).

A possible explanation for why self-efficacy has a positive direct effect on physical activity might have to do with the characteristics of the physical activity. In the present study, most of the elderly performed uncomplicated activities such as house cleaning, mowing the lawn, food preparation, harvesting, etc. These activities are familiar tasks that contribute to daily life; they do not require complex skills. . Within SCT, performance accomplishment refers to a positive experience in performing a behavior, and it is believed that this is the most influential source of belief in self-efficacy (Bandura, 1986; 1997). Thus, it is possible that the motivation of the elderly could have grown through cumulative performance which might be rated as having low to moderate obstacles. It is claimed that their confidence to undertake physical activity grew as a consequence of past performance, therefore motivating the individual to perform similar activities again. Particularly, if that activity is closely involved with routines of daily life, the elderly will be more likely to do it. However, the individual will probably reassess their ability as a guide for performance if the situation changes (Bandura, 1997).

In conclusion, our findings regarding the physical activity model with respect to older Thai people confirm a causal relationship between self-efficacy and physical activity level as proposed in SCT (1997).

2). Self-efficacy has an indirect effect on physical activity through positive outcome expectation and negative outcome expectation.

Regarding the physical activity model, the findings show that self-efficacy had a significantly negative indirect effect on physical activity through negative outcome expectation; there is a non-significant indirect effect of self-efficacy on physical activity via positive outcome expectation. These results suggest that the elderly with a stronger belief in their ability to perform an activity with less undesirable outcomes expectation would most likely take part in physical activity. In turn, the elderly with a stronger belief in their capabilities and high expectation of the outcome benefits of physical activity might not engage in physical activity.

This result was different from previous studies which used a structural equation analysis. Anderson and colleagues (2006) showed that self-efficacy had a significant direct and indirect influence on physical activity through positive outcome rather than negative outcome expectation. Additionally, one study demonstrated that outcome expectation including positive and negative outcomes was a significant mediator of self-efficacy within the physical activity model (Rovniak et al., 2002). These two investigations were conducted on participants 18-92 years old (Anderson et al., 2006) and university students (Rovniak et al., 2002). However the effect of positive outcome expectation on physical activity was significantly in the negative direction (Anderson et al., 2006).

Furthermore, the physical activity model in the current study indicates that self-efficacy exerted the largest total effect on physical activity. Self-efficacy had both a direct and indirect influence on physical activity through negative outcome expectation. There are at least three potential reasons that can explain these findings.

First, a negative outcome expectation may have a greater impact on the elderly in terms of experience and healing time. Negative outcome expectation flows from performance non-achievement and perceptions of risk would be predicted to be higher for individuals who have low self-efficacy (Bandura, 1997). By comparing positive and negative outcome expectation, it can be seen that the benefits of physical activity do not have immediate effects in terms of reinforcement (Lee, Arthur, and Avis, 2008). It is possible that if the elderly had previously experienced a number of negative outcomes such as pain, fatigue, or a fall, they might tend to anticipate undesired outcomes rather that desired ones. Thus, it can be assumed that incentive outcomes might not influence the motivational process even for those with high self-efficacy.

Second, the participation in physical activity among older Thai people might be best predicted by a combination of self-efficacy and negative outcome expectation rather than positive expected outcomes. According to the perspective of SCT, an aggregate of self-efficacy and some types of expected outcomes would predict individual performance (Bandura, 1997). Within the physical activity model, self-efficacy significantly predicted negative outcome expectation ($\beta = -.52$, p<.001) more than positive outcome expectation ($\beta = .49$, p<.001). Furthermore, negative outcome expectation had a significant negative direct effect on physical activity (β = -.24, p<.001) as opposed to positive outcome expectation (β = .10, p>.05.). Therefore, the influence of negative outcome expectation and self-efficacy on physical activity has been included in the current model in order to better understand their mediating effects.

A final plausible reason is related to redundancy. Positive outcome expectation might not be suitable to explain the physical activity model because the coefficient associated with the effect of positive outcome expectation on physical activity was not significant and had a slightly low level, whereas, the correlation between self-efficacy and physical activity was moderate. This result is congruent with statements by Bandura (1997). He indicates that a strong association between self-efficacy and physical activity may reduce the correlation of outcome expectations; as a consequence, outcome expectation is a redundant predictor. Also, within the physical activity model, it may be possible that positive outcome expectation is a redundant predictor rather than negative outcome expectation.

In conclusion, the results of the current study illustrate that self-efficacy did not have an indirect effect on physical activity through positive outcome expectation in older Thai people, and therefore is considered an inconclusive factor in the present study. The physical activity model among the older Thai people in the present study only partially confirmed a causal relationship between self-efficacy, positive outcome expectation, negative outcome expectation, and physical activity as proposed in SCT. There is a need to conduct further research to determine the moderator role.

Hypothesis two: *Positive outcome expectation has a positive direct influence on physical activity.*

The results of this study demonstrate that positive outcome expectation had a non-significant direct effect on physical activity, indicating that the elderly with a stronger positive outcome expectation of physical activity might not necessarily take part in physical activity. Nevertheless, the findings of the current study were congruent with previous studies (Stutts, 2002), in which the perceived benefits of physical activity had no effect on participation in physical activity. Even for older people who reported positive beliefs regarding physical activity, these were usually insufficient to increase physical activity participation (King, 2001). Similarly, a univariate analysis demonstrated that a beneficial outcome expectation was not significantly correlated with physical activity level in elderly Thais (Wannipa Asawachaisuwikrom, 2001; Apa Youngpradith, 2004).

The reasons behind this finding may have to do with a lack of knowledge on the part of seniors as to the detailed requirements recommended for physical activity. Most participants in the present study were aware of the health benefits of physical activity, however they might not have been aware of the intensity, duration, and frequency of physical activity required to benefit health. Bandura (1997) stated that even though individuals believe that a certain course of action will achieve specific outcomes, they may not, in fact, proceed with any action when they perceive that they do not possess the appropriate skills to achieve the desired outcomes.

Another explanation may be related to the ceiling effect. In fact, most participants of this study have lived in urban areas and have been educated about the benefits of physical activity by public health campaigns. Additionally, the majority of participants had few health problems, which suggests they might have been previously educated by their physician or health care providers. As a consequence, they might have been familiar with the incentives. According to qualitative investigations, an appreciation of the benefits of physical activity was supported among the elderly (Kaysorn Sumpowthong, 2002; Belza et al., 2004; Jancey et al., 2007). Similarly, the findings of the current study imply that the mean positive outcome expectation has a high score with a low standard deviation, indicating that the expectation of the beneficial outcomes of physical activity have slightly different values. Consequently, a ceiling effect might be created that would probably lead to diminished correlations between positive outcome expectation and physical activity (Polit and Hungler, 1999).

For these reasons, it can be assumed that the findings of the physical activity model among older Thai people did not confirm a causal relationship between positive outcome expectation and physical activity as proposed in SCT.

Hypothesis three: *Negative outcome expectation has a negative direct influence on physical activity.*

As hypothesized, negative outcome expectation had a negative direct effect on physical activity, indicating that the elderly with lower negative outcome expectations towards physical activity were more likely to be physically active. Correspondingly, Bandura (1997) explains that, if individuals expect an unachievable physical activity behavior, they will reduce their participation in physical activity. According to the findings of older people’s perceptions, the expectation of negative outcomes such as the fear that physical activity may cause injury or pain, interrupt their physical activity

(Devereaux et al., 2001; O'Brien Cousins, 2003; Wilcox et al., 2003; Kolt, Paterson, and Cheung, 2006; Lin et al., 2007). For this reason, it can be stated that the findings of the physical activity model among older Thai people confirmed causal relationships between negative outcome expectation and physical activity as proposed in SCT.

Hypothesis four: *Age has a direct influence on physical activity.*

Our results demonstrate that age had a significant and negative direct effect on physical activity (β =-.02, $p<.05$), indicating that participation in physical activity decreased with age. Based on SCT, perception of physiology was used to judge one's ability before performance of physical activities (Bandura, 1997). With advancing age, there is a decline in the size, elasticity, and strength of all muscle tissue (Stewart, 2005); thus, activities requiring muscular effort become less efficient and require greater effort to accomplish a given activity. Changes in physiology may diminish the personal efficacy belief because elderly individuals interpret their state as a sign that they do not have the physical ability to engage in physical activity; therefore, they tend to expect failure rather than success. The direct effect of age on physical activity was to be expected in the elderly; this finding was consistent with the previous investigation (Booth et al., 2000; Laffrey, 2000; Wilcox et al., 2003; Pitakpong Punta, 2004: Umstattd et al., 2006). Indeed, this result is similar to the previous evidence using a structural equation analysis (Ploncaynski, 2003; Anderson, et al., 2006).

In spite of the fact that the results might be positively correlated to other studies, the standardized path coefficient of age was lower than in previous studies. A possible explanation for this result may be related to the characteristics of Thai society. More than half of the study samples were employed and most worked in the agricultural sector. According to Wilaiwan Wattananon's study (2001), one-third of older Thai people had taken part in work related activities to promote health, raise their household income, and increase self-value. Additionally, some elderly Thais reported they engaged in occupation related activities with the aim of increasing pride and coping with loneliness (Varin Binhosen, 2003; NSO, 2007). Moreover, due to a decreased burden of family members and maintenance of responsible activities, elderly Thais seek to maintain moderate-intensity physical activity and activities that are relatively easy or that they have done in the past. This statement was reflected by more than three-fourths of all participants who engaged in household activities, in particular, older Thai men who undertook activities around the household and older Thai women who engaged in domestic chores. Therefore, a significant standardized path coefficient of age had a small influence on physical activity in the current study.

In conclusion, the results of the present study on the physical activity model among older Thai people support the idea that there is a causal relationship between age and physical activity as proposed in SCT.

Hypothesis five: *Social support has an indirect effect on physical activity through self-efficacy.*

The findings of the present study also show that social support had a positive direct influence on self-efficacy and a significant indirect effect on physical activity via self-efficacy. This means that elderly Thais who perceived a high degree of support from family and friends were more likely to have a high level of confidence in their ability to engage in physical activity under any circumstances. Consistent with

SCT, social influences can create and adjust one's belief by transferring information and arousing emotional reactions through modeling, instruction, and social persuasion (Bandura, 1986; 1997). In Thai society, children and/or grandchildren have been taught to help their parents or grandparents. Most family members (usually adult daughters or daughters-in-law) therefore may join the elderly in household activities (Tassana Choowattanapakorn, 1999; Kaysorn Sumpowthong, 2002). During physical activity participation, positive feedback from others was considered an important reward which induces the elderly to perform and maintain a specific behavior because it helped them to interpret the experience in successful terms (Bandura, 1997).

Some of the elderly might have cooperated with friends in activities organized by seniors clubs, activities at the temple, or neighborhood social activities. By interacting with friends, observing others' achievements, learning from others' behavior, obtaining recommendations, receiving support, and persuasion, especially from older adults within a similar age group, the belief that the elderly possess the capabilities to perform equivalent activities is reinforced. This point was supported by previous Thai studies which revealed that the support of family and friends was an important catalyst, serving as reinforcement, and encouragement for engaging in physical activity (Taweeluk Vannarit, 1999; Prapaporn Chinuntuya, 2001; Kaysorn Sumpowthong, 2001). It is possible to consider that, the higher perception of verbalization and engagement in physical activity both with family members and friends could strongly promote the motivation of an individual to believe that they can participate in physical activity.

Likewise, the results of the current study are in accordance with the findings of previous physical activity research among older adults (Rovniak et al., 2002;

McAuley et al., 2003a; Anderson et al., 2006; McNeil et al., 2006b). Consistent with SCT, for some health behaviors social support influences behavior through self-efficacy rather than directly (Bandura, 1997). In addition, in a qualitative study which determined the elderly perspective on physical activity from multiple cultures, Belza and colleagues (2004) indicated that children and other family members helped their parents or grandparents to participate in physical activities by accompanying them and providing encouragement. For that reason, the physical activity model of the current study depicted physical activity as not only influenced by self-efficacy, but also indirectly by social support. Even though the relationship between the presence of social support and self-efficacy was for the first time ever determined among older Thai people, this result supports previous research which suggests that self-efficacy is associated with social support in order to facilitate physical activity among older adults.

Therefore, it is reasonable that the current findings of the physical activity model among older Thai people support causal relationships between social support and physical activity through self-efficacy as proposed in SCT.

Hypothesis six: *The physical environment has a positive direct influence on physical activity.*

The findings in the current study of the physical activity model demonstrate that physical environment had a significant and direct effect on physical activity, indicating that older people with a high perception of safety, convenience, and accessibility in their home, neighborhood, and community environment tend to have a greater participation in physical activity. With increasing age, the place in which the elderly spend most of their time and conduct the majority of their daily activities is the home and local neighborhood (Dahlin-Ivanoff et al., 2007).The majority of the elderly in this study had lived in their home for a median of 30 years, so they were familiar with the physical characteristics of their environment including home and the environs of the home. Findings of the current study suggest that walking was frequently stated as a favorable physical activity outside the home and that, safe neighborhoods and low traffic roads might also provide encouragement to the elderly to walk. Furthermore, a friendly environment was more likely to facilitate seniors' motivation to engage in physical activity. According to the SCT approach, the physical environment affects participation in activities by means of the interaction between cognitive functions and environment through human motivation (Bandura, 1986; 1997). Moreover, Bandura (1997) states that a good environment provides greater opportunities to perform a desired behavior.

As predicted, this finding was partly congruent with prior studies, (Wilcox, et al., 2003; McNeil et al., 2006b; Wannipa Asawachaisuwikrom, 2001; 2004) which indicated that convenient facilities, safe neighborhoods and a supportive community environment were significantly associated with physical activity. Wilcox and colleagues (2003) illustrated that older African American and white women who lived in safe neighborhoods tend to perform moderate activity, particularly walking, more often. In addition, sidewalks, street lighting, low traffic volumes, low crime rates, having a place to exercise in the neighborhood and community support were regarded as important factors to facilitate performing physical activities (Wannipa Asawachaisuwikrom, 2004; Kaysorn Sumpowthong, 2001). Although Thai studies reveal quality of neighborhood and community environment as a significant predictor of physical activity within the age group, home environment was less explored in the previous empirical evidence. However, the results of the current study indicate that home environment is an important place to take part in physical activity and no other study was available for comparison. Therefore, it can be suggested that the current results will extend the knowledge of the importance of the physical environment, that is, the home environment, as opposed to only the neighborhood and community environment, and that it contains both motivators and obstacles for participation in physical activity by elderly Thais. Obviously, this is an additional area where research is needed.

In spite of the fact that the results might be reliable when compared to other studies, the standardized path coefficient (β=.19, p<.001) of physical environment was less than in previous studies. A possible explanation for this result may have to do with measurement. Based on SCT, appropriate behaviors will be generated and stimulated, if nearly all favorable aspects of the environment are operative (Bandura, 1989). Owing to the fact that the TESPA measurement includes only the safety, convenience, and accessibility aspects of physical environment, it is possible that the other features of physical environment make a greater contribution to physical activity. Thus, it is considered necessary that all features of the physical environment as well as the use of both self-reporting and objective assessment be included in further studies.

In conclusion, the physical environment has a direct effect on physical activity. This finding strongly supports our hypothesis. Moreover, the results of the present study on the physical activity model among older Thai people supports the existence of causal relationships between physical environment and physical activity as proposed in SCT.

3.2 The conceptual model of the study

The conceptual model in the present study was derived from Social Cognitive Theory (Bandura, 1997) and it was hypothesized that greater social support, good physical environment, high self-efficacy, high positive outcome expectation, low negative outcome expectation, and low age would be significantly associated with participation in physical activity among older Thai people. In regards to explanation and prediction of physical activity behavior, a substantial amount of evidence had adopted only the SCT as a conceptual framework (Rovinak et al., 2002; McAuley et al., 2003a: Gee, 2005; Anderson et al., 2006; Umstattd et al., 2008). By comparing the present model with a previous model (Rovniak et al., 2002), it can be seen that self-efficacy had a significant direct and indirect effect on physical activity through outcome expectations. However, the empirical data of the present study provide support for the indirect effect of self-efficacy on physical activity via negative outcome expectation but do not provide support for positive outcome expectation, similar to Gee’s study (2005). Nonetheless, the model by Anderson and colleagues (2006) showed that self-efficacy had an indirect effect on physical activity via positive outcome expectation only. It is deemed that ambiguity of the mediator role of positive outcome expectation on physical activity exists.

As noted above, the inconsistency in findings between the present study and previous investigations may be related to the differences in positive outcome expectation measurement, since physical and psychological positive outcome expectations were assessed in the current study. Nevertheless, positive outcome expectation is a cognitive factor which can be developed and shaped over time (Bandura, 1997). Hence, it is thought that the mediator roles of positive outcome expectation between self-efficacy and physical activity in older adults should be re-estimated in future investigations.

Within the current model, even though the overall power of age in predicting physical activity was low, age was a significant factor in the final model. Additionally, three models illustrated that social support had an indirect influence on physical activity through self-efficacy (McAuley et al., 2003a; Anderson et al., 2006; Rovniak et al., 2002), which was similar to the current model. It is therefore possible that social support could precede self-efficacy and negative outcome expectation in the present model. This finding was consistent with Bandura's view (1997) that social support was an antecedent of cognitive-perceptual factors.

In addition, prior physical activity models used only SCT tested personal factors such as self-efficacy, outcome expectations, self-regulation, and environmental factors like social support with physical activity (Rovniak et al., 2002; McAuley et al., 2003a; Anderson et al., 2006; Umstattd et al., 2008). None of those studies combined physical environment variables in their models. In an attempt to make the current model more parsimonious and in accordance with SCT, physical environment as an environmental factor was added as a predictor of physical activity. Adding physical environment to the present model accounted for greater variance than previous models, thus, further studies should consider using this variable. Furthermore, prior physical activity models whose findings could account for 16-55% of the variance of physical activity were developed by selecting 4-10 variables

(Rovniak et al., 2002; McAuley et al., 2003a; Anderson et al., 2006; Umstattd et al., 2008). In spite of the fact that previous models provided a good explanation and prediction of the phenomenon, the physical activity model in the current study takes into account six determinants with varying degrees of direct and indirect effects on physical activity that can explain 65% of the variance of physical activity. Therefore, the physical activity model of the current study demonstrates a statistically significant model for explaining and predicting the engagement in physical activity by older Thai people.

4. Conclusion

The purpose of this cross-sectional descriptive research was to examine the causal relationships between selected personal factors (self-efficacy, positive outcome expectation, negative outcome expectation, age), environmental factors (social support, physical environment), and behavior factors (physical activity) among older Thai people. A descriptive SCT model has provided a conceptual framework for the study.

A sample of 320 Thai older people was randomly selected using multistage random sampling from twelve villages across all parts of Thailand. The data collection was conducted from December 2008 to April 2009.

Instruments used in this study included the SEPA, POEPA, NOEPA, SSPA, TESPA, and IPAQ-L. The back translation technique was used to assure the accuracy of the translation for NOEPA, TSEPA, and IPAQ-L. The TESPA was modified and developed by the researcher. The validity and reliability of the instruments were examined. A confirmatory factor analysis was conducted to determine construct validity and to test the hypothesized measurement model of the instruments. Finally, LISREL version 8.52 was used to examine the causal model. The measurement model of the five latent constructs including SEPA, POEPA, NOEPA, SSPA, and TESPA was assessed before testing structural paths, and all showed a good overall fit.

Most of the participants were female, married, Buddhist, had elementary education, with a household income of less than 5,000 Baht per month. Approximately 70% of the participants reported at least one health problem. Almost half of the samples were members of a seniors club. The majority of participants lived with their spouse and /or child and grandchild.

Of the sample, more than half reported having a moderate physical activity level or met the sufficient level of physical activity. The mean overall weekly energy expenditure was 873.25 METs. In addition, the analysis results illustrate that most physical activities were conducted within the confines of the household. Moreover, participants in the current study reported moderate self-efficacy, high positive outcome expectation, moderate negative outcome expectation, moderate social support, and moderate physical environment scores. Likewise, regarding the physical environment, the mean score of the home environment was perceived as the highest, followed by the neighborhood and community environment.

The modified physical activity model fit better with the empirical data with χ^2 = 51.80, df= 39, p= 0.082, GFI=0.98, AGFI=0.94, RMSEA= 0.03. The predictors of the overall model accounted for 65% of the variance of physical activity, 27% of negative outcome expectation, 24% of positive outcome expectation, and 10% of self-efficacy. The findings of the causal relationship testing of the overall model were as follows:

1. Self-efficacy had a significant positive direct effect on physical activity (β = .50, p<.001). As well, self-efficacy had a significant indirect effect on physical activity through negative outcome expectation (β=.17, p<.001), but a non-significant indirect effect on physical activity through positive outcome expectation. Self-efficacy could directly and indirectly predict physical activity through only negative outcome expectation. However, positive outcome expectation failed to act as the mediator linking self-efficacy to physical activity in this study.

2. Positive outcome expectation did not have a significant direct effect on physical activity (β=.10, p>.05). Positive outcome expectation did not predict physical activity among older Thai people in the current study.

3. Negative outcome expectation had a significantly negative direct effect on physical activity (β=-.24, p<.001). Negative outcome expectation did predict physical activity among older Thai people in the present study.

4. Age had a significantly negative direct effect on physical activity (β = .02, p<.05). Age did predict physical activity among older Thai people in the current study.

5. Social support was statistically significant; it had a positive direct effect on self-efficacy (β=.32, p<.001) and a positive indirect effect on physical activity (β= .21, p<.001). Social support could indirectly predict physical activity among older Thai people in this study.

6. Physical environment had a significantly positive direct effect on physical activity (β = .19, p <.001). Physical environment could predict physical activity in this study.

5. Implications for nursing

The implications of this study with respect to nursing are as follows:

Implications for nursing science

Since little is known about the determinants for physical activity among older Thai people, this study proposed a causal model which explained 65% of the variance in seniors' physical activity. The results of this study contribute in the nursing knowledge by explaining the important effects of self-efficacy, negative outcome expectation, age, social support, and physical environment on the likelihood of older Thai people engaging in physical activity. This study also contributes to nursing's body of knowledge by developing a middle-range theory to explain and guide the promotion of physical activity behavior in this age group.

Implications for nursing practice

Based on the findings of the current study, some participants believed that being active in their current occupation, transportation, household chores, and leisure activities could provide sufficient physical activity for good health. Nurses who are responsible for promoting the health of older people should be aware of the type, intensity, duration and frequency of physical activity most appropriate for that group, that is, the accumulation of 30 minutes per day of moderate-intensity physical activity, 5 days per week. Three short sessions (at least 10 minutes per session), totaling 30 minutes or more per day would obtain health benefits. Additionally, other types of physical activity such as household and transportation activities such as walking should be promoted. Health providers should encourage the elderly to be physically active whenever possible.

Motivation should be provided to the elderly to achieve performance along with interdisciplinary physical activity programs. This can be accomplished by enhancing social support, self-efficacy, physical environment, and decreasing negative outcome expectation. The results of this study suggest that social support resources that normalize physical activity as part of their daily routine may be helpful to increase self-efficacy. As self-efficacy increases, favorable changes resulting from engaging in physical activity are likely to occur. This program should include not only friends and family members to provide verbal encouragement and reinforce the advantages of physical activity, but also related organizations to facilitate convenience, and a safe physical environment. Although intervention in the physical environment is likely to be complicated, creating walkways and providing safe traffic conditions may address some of the safety concerns regarding physical infrastructure. Moreover, activities that can be done in the comfort and safety of one's own home may also be particularly appealing to older people who have limited access to outside facilities.

However, even after considering only positive outcome expectation, an association between self-efficacy and positive outcome expectation was found. So, using negative outcome expectation and positive outcome expectation may be important in encouraging the initiation of physical activity by seniors. Nurses need to be ready to address the changes in these expectations once physical activity has begun. It is important not only to consider what negative outcome expectations exist but also what the positive outcome expectations are.

On the other hand, the effects of negative outcome expectation can help nurses to become aware of what keeps the elderly from engaging in more physical activities.

Once a physical activity program is established and these negative outcome expectations are addressed, participation in and adherence to these programs will increase. It is also helpful for nurses to be aware of what the elderly perceive as negative outcome expectations such as pain and falling with respect to a particular physical activity. If these perceptions are corrected, nurses can provide further encouragement using positive beliefs as support. Alternatively, if the perceptions are incorrect or incomplete, then nurses can educate the elderly. However, further research based on the findings of the current study should be considered before any proposed program is conducted for this age group.

Implications for nursing education

The findings of the present study suggest the need to promote physical activity among the elderly in light of the significance of social support, self-efficacy, negative outcome expectation, age, and physical environment. That is, engagement in physical activity could be improved through a holistic approach, particularly one incorporating cognitive and environmental factors. Thus, the physical activity model should be included in the curriculum of geriatric nursing.

6. Recommendations for future research

Instrumentation issues

Psychometric evaluations of the instruments used in this study including content validity, construct validity, internal consistency and stability were satisfactory. All of instruments are subjective measure; the responses of participants can be over-or-under estimated for a variety of reasons such as personal influences, and social desirability.

Regarding TESPA measurement, it was modified to suit the Thai context, and this is the first time that it has been used to study elderly Thais. Although the instrument was found to be suitable for measuring physical environment with an acceptable internal consistency, only a small proportion of the variability in physical activity was explained by the physical activity model in this study. Therefore additional variables such as quality of physical environment need to be explored to fully understand the physical activity behavior of older Thai people. Moreover, objective measures of the physical environment including home, neighborhood, and community should be considered as they might help validate subjective data.

In addition, even if the subjective report of physical activity was confirmed by the IPAQ-L, using an activity monitor would further confirm the subjects' report and add to the validity of the findings. Due to the fact that this questionnaire estimates energy expenditure with time, and since most elderly did not wear a wristwatch it might have been difficult to recall physical activities undertaken for 10 minute intervals over the entire day. As a result, the time recorded might have been inaccurate. Still, the researcher took this limitation into account by interviewing and following the truncation process of the IPAQ Research Committee guidelines. The guidelines work by rechecking the period of time before data analysis. Additionally, the length of the questionnaire may lead the participants to feel fatigue. Nonetheless, the IPAQ-L is a quantitative questionnaire for measuring physical activity which is inexpensive, and convenient. Moreover, this short version questionnaire, which is being used by the Ministry of Public Health in Thailand, may provide helpful information on older Thai people. Thus, the IPAQ long version should be considered and revised for other studies.

Data collection issues

Interviews were found to be appropriate for older Thai people, since most participants had at least a primary education. The researcher and co-researcher were aware of the importance of clarity in the respondents' answers and the words used in the questions. In addition, the face-to-face interview might have led the participants to feel pressured into answering the questions according to social norms. As a consequence, these factors might have had some influence on the internal validity of the research. The investigator should therefore reserve time to collect data and be concerned about the social desirability issue.

Research design issues

This study had a cross-sectional design. All the variables in the theoretical model were measured at one point in time and not manipulated during the study period. Nevertheless, this design is a systematic way to determine predicted relationships and a preliminary step for intervention research. The data collection procedure took into consideration the sequence in which variables occurred. Each participant was asked to answer three sets of questionnaires in the respective order: 1) the time when the participants perceived social support and physical environment related to physical activity; 2) when it was perceived that self-efficacy, positive outcome expectation, and negative outcome expectation contributed to physical activity; and 3) the time when they performed physical activity in the last 7 days. Due to the limitation in the research design, an intervention study design may be needed. This study demonstrates that the SCT can be used to develop a framework and to provide a direction for the development of interventions for physical activity participation in older Thai people. Researchers may be able to improve the physical activity behavior of elderly Thais by providing intervention programs designed to strengthen self-efficacy, social support, and physical environment and to decrease negative outcome expectation. That is, negative outcome expectations could be improved by providing adequate supervision with practical knowledge. Social support could be encouraged by increasing the participation of family members and friends. Furthermore, a friendly home, neighborhood, and community environments would encourage the elderly to further engage in physical activity. Moreover, further investigations are needed to validate the physical activity model in different population subgroups such as the elderly who have chronic diseases or who are functionally limited.

Theoretical issue

Results from theoretical modeling can guide further theory development and testing. This study confirms that self-efficacy can predict physical activity among older Thai people. Also, social support was a factor influencing self-efficacy. These findings are consistent with Bandura (1997). Noteworthy, the findings of this study suggest that the effects of positive and negative outcome expectation should be determined separately. According to Rogers and associates (2005), the SCT construct should not be combined for a total expectation score or outcome-expectancy value between positive and negative outcome expectation. As well, a replication of this study using other populations may further validate the theoretical model.

Furthermore, the present study assessed only some of the important variables of interest in physical activity research. Other variables, e.g., self-regulation, affective factors, and goals may be considered and added to the future model to better understand its relationship to activity in the presence of other factors.

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APPENDICES

APPENDIX A

APPROVAL OF DISSERTATION PROPOSAL

ประกาศ คณะพยาบาลศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
เรื่องการอนุมัติหัวข้อดุษฎีนิพนธ์ ครั้งที่ 1/2550 ประจำปีการศึกษา 2550

นิสิตผู้ทำวิจัยและอาจารย์ที่ปรึกษาดุษฎีนิพนธ์

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ชื่อ-นามสกุล	นางมยุรี ลี่ทองอิน
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อาจารย์ที่ปรึกษาร่วม	รองศาสตราจารย์ ร.ต.อ.หญิง ดร. ยุพิน อังสุโรจน์
ชื่อหัวข้อดุษฎีนิพนธ์	โมเดลเชิงสาเหตุของการมีกิจกรรมทางกายของผู้สูงอายุไทย A CAUSAL MODEL OF PHYSICAL ACTIVITY IN OLDER THAI PEOPLE
ครั้งที่อนุมัติ	1/2550
ระดับ	ปริญญาเอก

ประกาศ ณ วันที่ 3 เมษายน พ.ศ. 2551

(รองศาสตราจารย์ ร.ต.อ.หญิง ดร. ยุพิน อังสุโรจน์)
คณบดีคณะพยาบาลศาสตร์

APPENDIX B

APPROVAL OF THE IRB OF CHULALONGKORN UNIVERSITY

AF 01-11

คณะกรรมการพิจารณาจริยธรรมการวิจัยในคน กลุ่มสหสถาบัน ชุดที่ 1 จุฬาลงกรณ์มหาวิทยาลัย
อาคารสถาบัน 2 ชั้น 4 ซอยจุฬาลงกรณ์ 62 ถนนพญาไท เขตปทุมวัน กรุงเทพฯ 10330
โทรศัพท์: 0-2218-8147 โทรสาร: 0-2218-8147 E-mail: eccu@chula.ac.th

COA No. 103/2551

ใบรับรองโครงการวิจัย

โครงการวิจัยที่ 088.1/51 : โมเดลเชิงสาเหตุของการมีกิจกรรมทางกายของผู้สูงอายุไทย

ผู้วิจัยหลัก : นางสาวมยุรี ลี่ทองอิน นิสิตระดับดุษฎีบัณฑิต

หน่วยงาน : คณะพยาบาลศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

คณะกรรมการพิจารณาจริยธรรมการวิจัยในคน กลุ่มสหสถาบัน ชุดที่ 1 จุฬาลงกรณ์มหาวิทยาลัย ได้พิจารณา โดยใช้หลัก ของ The International Conference on Harmonization – Good Clinical Practice (ICH-GCP) อนุมัติให้ดำเนินการศึกษาวิจัยเรื่องดังกล่าวได้

ลงนาม ปรีดา ทัศนประดิษฐ
(รองศาสตราจารย์ นายแพทย์ปรีดา ทัศนประดิษฐ)
ประธาน

ลงนาม นันทรี ชัยชนะวงศาโรจน์
(ผู้ช่วยศาสตราจารย์ ดร.นันทรี ชัยชนะวงศาโรจน์)
กรรมการและเลขานุการ

วันที่รับรอง : 17 พฤศจิกายน 2551 **วันหมดอายุ** : 16 พฤศจิกายน 2552

เอกสารที่คณะกรรมการรับรอง

1) โครงการวิจัย
2) ข้อมูลสำหรับกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัยและใบยินยอมของกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย
3) ผู้วิจัย
4) เครื่องมือที่ใช้ในการวิจัยและเก็บรวบรวมข้อมูล

คณะกรรมการพิจารณาจริยธรรมการวิจัยในคน กลุ่มสหสถาบัน ชุดที่ 1

เลขที่โครงการวิจัย 088.1/51
วันที่รับรอง 17 พ.ย. 2551
วันหมดอายุ 16 พ.ย. 2552

__เงื่อนไข__

1. หากใบรับรองหมดอายุ การดำเนินการวิจัยต้องยุติ เมื่อต้องการต่ออายุต้องขออนุมัติใหม่ล่วงหน้าไม่น้อยกว่า 1 เดือน
2. ต้องดำเนินการวิจัยตามที่ระบุไว้ในโครงการวิจัยอย่างเคร่งครัด
3. ใช้เอกสารข้อมูลสำหรับกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย, ใบยินยอม, และเอกสารเชิญเข้าร่วมวิจัย (ถ้ามี) เฉพาะที่ประทับตราของคณะกรรมการฯ เท่านั้น แล้วส่งสำเนาใบแรกที่ใช้ เอกสารดังกล่าวมาที่คณะกรรมการฯ
4. หากเกิดเหตุการณ์ไม่พึงประสงค์ร้ายแรง (SAE) ต้องรายงานคณะกรรมการฯ ภายใน 5 วันทำการ
5. หากมีการเปลี่ยนแปลงการดำเนินการวิจัย ให้ส่งคณะกรรมการฯ พิจารณารับรองก่อนดำเนินการ
6. โครงการวิจัยไม่เกิน 1 ปี ส่งแบบรายงานสิ้นสุดโครงการวิจัย (AF 03-11) และบทคัดย่อผลการวิจัยภายใน 30 วัน เมื่อโครงการวิจัยเสร็จสิ้น สำหรับโครงการวิจัยที่เป็นวิทยานิพนธ์ให้ส่งบทคัดย่อผลการวิจัย ภายใน 30 วัน เมื่อโครงการวิจัยเสร็จสิ้น
7. โครงการวิจัยเกิน 1 ปี ส่งรายงานความก้าวหน้าการวิจัยทุกปีก่อนใบรับรองหมดอายุ เมื่อโครงการวิจัยเสร็จสิ้นแล้ว ให้ดำเนินการเช่นเดียวกับข้อ 6

APPENDIX C

LIST OF THE EXPERTS

LIST OF EXPERTS

1. Associate Professor Amporn Charoenchai

   Faculty of Nursing, Khon Kaen University

2. Associate Professor Dr. Jiraporn Kespichayawattana

   Faculty of Nursing, Chulalongkorn University

3. Associate Professor Dr. Panittha Panichacheewakul

   Faculty of Nursing, Khon Kaen University.

4. Assistant Professor Dr. Pichayaporn Moolsilpa

   Faculty of Nursing, Chulalongkorn University

5. Dr. Somchai Leethongin

   Director of Division of Physical Activity and Health,

   Department of Health, Ministry of Public Health

6. Associate Professor Dr. Wannapa Srithanyarat

   Faculty of Nursing, Khon Kaen University

APPENDIX D

INFORMED CONSENT FORM AND

PARTICIPANTS INFORMATION SHEET

ข้อมูลสำหรับประชากรตัวอย่างหรือผู้มีส่วนร่วมในการวิจัย

ชื่อโครงการวิจัย โมเดลเชิงสาเหตุของการเคลื่อนไหวออกแรงของผู้สูงอายุไทย

ชื่อผู้วิจัย…นางสาวมยุรี ลี่ทองอิน ….**ตำแหน่ง**…นิสิตคณะพยาบาลศาสตร์จุฬาลงกรณ์มหาวิทยาลัย…

สถานที่ติดต่อผู้วิจัย (ที่ทำงาน) …คณะพยาบาลศาสตร์ มหาวิทยาลัยขอนแก่น

(ที่บ้าน) ...123 แฟลตจามจุรี มหาวิทยาลัยขอนแก่น อ.เมือง จ.ขอนแก่น..

โทรศัพท์ (ที่ทำงาน) 043-202-407…ต่อ .129.. โทรศัพท์ที่บ้าน .. 043-203-724....……………

โทรศัพท์มือถือ …08-9619-4342… E-mail: …Mayureekku@gmail.com………..

ด้วยผู้วิจัยกำลังสนใจและทำการวิจัยเกี่ยวกับการเคลื่อนไหวออกแรงของผู้สูงอายุไทย ซึ่ง **“การเคลื่อนไหวออกแรง”** ในที่นี้หมายถึง การเคลื่อนไหวส่วนต่างๆ ของร่างกายเพื่อออกแรงทำกิจกรรมต่างๆ ได้แก่ การทำงานประกอบอาชีพ, การทำงานบ้าน/งานสวน, การเดินทาง, และการทำกิจกรรมในเวลาว่าง ด้วยความแรงระดับปานกลางจนถึงหนัก โดยมีการทำกิจกรรมนั้นติดต่อกันอย่างต่อเนื่องนานอย่างน้อย 10 นาที อนึ่งวัตถุประสงค์ของเอกสารฉบับนี้จัดทำเพื่อบอกเล่าเกี่ยวกับข้อมูลของผู้ทำวิจัยและการดำเนินการวิจัย ซึ่งท่านสามารถเข้าใจและตัดสินใจแสดงความประสงค์ในการเข้าร่วมหรือไม่เข้าร่วมในการวิจัยครั้งนี้ได้

ข้อมูลที่เกี่ยวข้องกับการให้คำยินยอมและเอกสารอื่นๆในการวิจัย ประกอบด้วย

(1) การศึกษาวิจัยนี้มุ่งค้นหาและอธิบายเกี่ยวกับการเคลื่อนไหวออกแรงของผู้สูงอายุไทย โดยมีวัตถุประสงค์ของการวิจัยเพื่อศึกษาความสัมพันธ์ของปัจจัยกับการเคลื่อนไหวออกแรงของผู้สูงอายุไทย และ เพื่อพัฒนาแบบจำลองเชิงสาเหตุกับการเคลื่อนไหวออกแรงของผู้สูงอายุไทย

(2) ประโยชน์ของงานวิจัย

ทำให้พยาบาลและผู้ที่เกี่ยวข้องเข้าใจถึงปัจจัยต่าง ๆ ที่มีผลทั้งทางตรงและทางอ้อมต่อการเคลื่อนไหวออกแรงในผู้สูงอายุไทย โดยสามารถนำผลการศึกษาไปพัฒนาทั้งทางด้านนโยบาย และด้านการปฏิบัติ เพื่อคงไว้ซึ่งการเคลื่อนไหวออกแรงอย่างต่อเนื่อง อันจะส่งผลให้ผู้สูงอายุมีสุขภาวะที่ดี ทั้งด้านร่างกาย จิตใจ และสังคม อีกทั้งยังเป็นการลดค่าใช้จ่ายทางด้านการรักษาของรัฐรวมด้วย

(3) ลักษณะของประชากรตัวอย่าง สถานที่และวิธีการได้มาซึ่งกลุ่มตัวอย่าง

ในงานวิจัยครั้งนี้ผู้มีส่วนร่วมในการวิจัยเป็นผู้ที่มีอายุมากกว่าหรือเท่ากับ 60 ปี มีคะแนนความสามารถในการจำมากกว่า 15 คะแนน สามารถเคลื่อนไหวร่างกายได้โดยไม่ต้องใช้อุปกรณ์ช่วย และยินดีให้ความร่วมมือในการศึกษาวิจัย ซึ่งการศึกษาครั้งนี้จะไม่ทำการเก็บรวบรวบข้อมูลในผู้ที่ได้รับการผ่าตัดใหญ่ในช่วง 6 สัปดาห์ที่ผ่านมา หรือ มีอาการของโรคหัวใจ โรคหลอดเลือด กล้ามเนื้อหัวใจ ภาวะหัวใจวาย โรคไตวาย โรคตับแข็ง โรคภูมิคุ้นกันบกพร่องหรือไม่สามารถช่วยเหลือตัวเองได้ หรือ ผู้มีปัญหาในการสื่อสาร หรือผู้ที่ได้รับยากระตุ้นการเต้นของหัวใจในช่วง 3 เดือนที่ผ่านมา

สถานที่เก็บรวบรวมข้อมูล คือ 12 หมู่บ้านจาก 6 จังหวัด หลังได้รับอนุมัติให้เก็บรวบรวมข้อมูลจากหมู่บ้านต่าง ๆ แล้ว ผู้วิจัยจะติดต่อขออนุญาติหัวหน้าหน่วยบริการปฐมภูมิแต่ละหมู่บ้าน เพื่อตรวจสอบรายชื่อผู้สูงอายุ การเจ็บป่วยและการรักษาที่ได้รับในขณะนั้น รายชื่อของผู้มีส่วนร่วมใน

การศึกษาจะได้มาจากการสุ่มอย่างมีขั้นตอนจากรายชื่อของหน่วยบริการปฐมภูมิ และคัดเลือกผู้ที่มีคุณสมบัติตามเกณฑ์ข้างต้นมาเป็นผู้มีส่วนร่วมในการศึกษา ซึ่งผู้วิจัยจะสอบถามความสมัครใจก่อนให้ผู้มีส่วนร่วมในการวิจัยตอบคำถามอีกครั้ง

(4) รายละเอียดและขั้นตอนที่ผู้มีส่วนร่วมในการวิจัยจะได้รับการปฏิบัติ

ผู้มีส่วนร่วมในการวิจัยจะได้รับการชี้แจงจากผู้วิจัยถึงวัตถุประสงค์ และกระบวนการเก็บข้อมูล เริ่มจากผู้มีส่วนร่วมในการวิจัยจะได้รับการสัมภาษณ์เกี่ยวกับความจำโดยใช้เวลาประมาณ 5-10 นาที หลังจากนั้นการสัมภาษณ์แบ่งออกเป็นสามช่วง แต่ละช่วงใช้เวลาประมาณ 15-20 นาที พักระหว่างช่วงอย่างน้อย 5 นาที โดยช่วงแรกสัมภาษณ์เกี่ยวกับ ข้อมูลทั่วไป การสนับสนุนของสิ่งแวดล้อมทางกายภาพ และการสนับสนุนทางสังคม ช่วงที่สองสัมภาษณ์เกี่ยวกับ ความเชื่อมั่นตนเองในการเคลื่อนไหวออกแรงและความคาดหวังผลลัพธ์ด้านบวกและลบของการเคลื่อนไหวออกแรง และช่วงสุดท้ายสัมภาษณ์การเคลื่อนไหวออกแรง ซึ่งรวมระยะเวลาในการสัมภาษณ์ใช้เวลาประมาณ 65-80 นาที

(5) ความไม่สะดวกหรือความเสี่ยงที่อาจเกิดขึ้น เช่น อาการเหนื่อย หรืออ่อนเพลีย หรือได้รับผลกระทบกระเทือนด้านจิตใจขณะร่วมการวิจัย ผู้มีส่วนร่วมในการวิจัยสามารถพักเมื่อจบการสัมภาษณ์ในแต่ละสอบถาม นอกจากนี้ผู้มีส่วนร่วมในการวิจัยสามารถหยุดการให้สัมภาษณ์ได้ทุกเวลาที่รู้สึกเหนื่อย หรือไม่สะดวกในการให้สัมภาษณ์ โดยมีผู้วิจัยจะคอยช่วยเหลือเมื่อมีอาการผิดปกติ และอำนวยความสะดวก

(6) ผู้มีส่วนร่วมในการวิจัย มีสิทธิในการปฏิเสธการเข้าร่วมหรือสามารถถอนตัวจากการศึกษาได้ตลอดเวลา ทั้งนี้ การปฏิเสธจะไม่ก่อให้เกิดอันตราย หรือผลกระทบใดต่อผู้มีส่วนร่วมในการวิจัย และจะไม่มีผลรบกวนต่อการได้รับการบริการต่าง ๆ ที่จะได้รับตามปกติ ตลอดจนไม่มีค่าใช้จ่าย ผลการสัมภาษณ์ของผู้มีส่วนร่วมในครั้งนี้อาจยังไม่มีประโยชน์ใดๆ ต่อท่านและครอบครัว แต่ในอนาคตอาจช่วยส่งเสริมสุขภาพของผู้สูงอายุไทยได้

(7) หากผู้เข้าร่วมวิจัยมีข้อสงสัยให้สอบถามเพิ่มเติมได้จากผู้วิจัย โดยสามารถติดต่อผู้วิจัยได้ตลอดเวลาที่ **มยุรี ลี่ทองอิน คณะพยาบาลศาสตร์ มหาวิทยาลัยขอนแก่น** หรือทางโทรศัพท์ ที่ทำงาน 0-432-207-326 หรือ มือถือ 0-896-194-342 และหากผู้วิจัยมีข้อมูลเพิ่มเติมที่เป็นประโยชน์หรือโทษเกี่ยวกับการวิจัย ผู้วิจัยจะแจ้งให้ผู้เข้าร่วมวิจัยทราบอย่างรวดเร็ว เพื่อให้ผู้เข้าร่วมวิจัยทบทวนว่ายังสมัครใจจะอยู่ในงานวิจัยต่อไปหรือไม่

(8) การวิจัยครั้งนี้มีการมอบผ้าเช็ดตัวขนาดกลางราคาประมาณ 20 บาทเป็นของที่ระลึกแก่ผู้มีส่วนร่วมในการวิจัยเมื่อสิ้นสุดการสัมภาษณ์ หรือเมื่อผู้มีส่วนร่วมในการวิจัยที่ถอนตัวระหว่างการศึกษา

(9) ข้อมูลที่ได้จากการสัมภาษณ์ของผู้เข้าร่วมวิจัยจะถูกนำไปรวมกับข้อมูลของผู้ร่วมเข้าร่วมคนอื่นๆ ที่เข้าร่วมในการศึกษา โดยข้อมูลจะถูกเก็บเป็นความลับและผู้วิจัยใช้รหัสแทนชื่อนามสกุลของผู้เข้าร่วมในแบบบันทึกข้อมูล หากผู้วิจัยตีพิมพ์ผลการศึกษา ผู้วิจัยจะไม่มีการระบุชื่อของผู้เข้าร่วมไม่ว่ากรณีใดๆ

(10) จำนวนของผู้มีส่วนร่วมในการวิจัยที่จะใช้ในการวิจัยครั้งนี้ 336 คน

ใบยินยอมของกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย

ชื่อโครงการวิจัย ..โมเดลเชิงสาเหตุของการเคลื่อนไหวออกแรงของผู้สูงอายุไทย.............................

เลขที่ ประชากรหรือผู้มีส่วนร่วมในการวิจัย……………………

ข้าพเจ้าซึ่งได้ลงนามที่ด้านล่างของหนังสือเล่มนี้ **ได้รับคำอธิบายอย่างชัดเจนจนเป็นที่พอใจจาก**ผู้วิจัย ชื่อ นางสาวมยุรี ลี่ทองอิน นิสิตปริญญาเอกคณะพยาบาลศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย ที่ติดต่อ คณะพยาบาลศาสตร์ มหาวิทยาลัยขอนแก่น โทรศัพท์ 043-202-407 ต่อ 129 (ที่ทำงาน) หรือ 0-896-194-342 (มือถือ) ถึงวัตถุประสงค์และขั้นตอนการวิจัย ความเสี่ยงและประโยชน์ซึ่งจะเกิดขึ้นจากการวิจัย ดังนี้

ข้าพเจ้าได้รับทราบว่าการศึกษานี้มีวัตถุประสงค์เพื่อศึกษาวิจัยเกี่ยวกับความสัมพันธ์ของปัจจัยและการพัฒนาแบบจำลองเชิงสาเหตุกับการเคลื่อนไหวออกแรงในผู้สูงอายุไทย โดยประโยชน์ของงานวิจัยนี้จะทำให้พยาบาลและผู้ที่เกี่ยวข้องเข้าใจถึงปัจจัยต่างๆ ที่มีผลทั้งทางตรงและทางอ้อมต่อการเคลื่อนไหวออกแรงในผู้สูงอายุไทย

ข้าพเจ้าได้รับทราบว่า ข้าพเจ้าคือผู้มีส่วนร่วมในการวิจัยคนหนึ่งใน 336 คน ที่ต้องได้รับการสอบถามเพียงครั้งเดียว โดยข้าพเจ้าจะได้รับการสอบถามถึงปัจจัยที่เป็นสาเหตุกับการเคลื่อนไหวออกแรง ซึ่งรวมระยะเวลาในการตอบแบบสอบถามประมาณ 65-80 นาที

ข้าพเจ้าได้รับทราบว่า หากข้าพเจ้ามีอาการเหนื่อย หรืออ่อนเพลียเกิดขึ้น ในระหว่างการให้ข้อมูล ข้าพเจ้าสามารถหยุดพักได้ทุกเวลา โดยผู้วิจัยจะคอยช่วยเหลือเมื่อมีอาการผิดปกติและอำนวยความสะดวก รวมทั้งหากคำถามใดที่ทำให้ข้าพเจ้ารู้สึกอึกอัด ไม่สบายใจหรือไม่สะดวก ข้าพเจ้ามีสิทธิ์จะปฏิเสธ ไม่ตอบ หรือหยุดการให้ข้อมูลได้ทุกเวลา

ข้าพเจ้าเข้าร่วมการวิจัยครั้งนี้ด้วยความ**สมัครใจ** และข้าพเจ้า**มีสิทธิ** จะถอนตัวออกจากการวิจัยเมื่อไรก็ได้ตามความประสงค์ โดยไม่ต้องแจ้งเหตุผล ซึ่งการถอนตัวออกจากการวิจัยนั้น จะไม่มีผลกระทบในทางใดๆ แก่ข้าพเจ้าทั้งสิ้น

ข้าพเจ้าได้รับคำรับรองว่า ข้อมูลของข้าพเจ้าจะนำไปศึกษาวิจัยในภาพรวมโดยใช้รหัสตัวเลข ไม่มีการระบุชื่อและนามสกุลของข้าพเจ้าในผลการวิจัย ผู้วิจัยจะ**รักษาข้อมูลที่แสดงว่าเป็นข้าพเจ้าอย่างเป็นความลับ** หากข้าพเจ้ามีข้อสงสัยสามารถสอบถามเพิ่มเติมจากผู้วิจัยได้

ข้าพเจ้าได้รับสำเนาเอกสารข้อมูลสำหรับกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย และใบยินยอมของกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัยแล้ว

ข้าพเจ้ายินดีเข้าร่วมการวิจัยครั้งนี้ ภายใต้เงื่อนไขที่ระบุไว้ในเอกสารข้อมูลสำหรับกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัยและลงนามในท้ายเอกสารนี้

…………………………	…………………………….
สถานที่ / วันที่	ลงนามผู้มีส่วนร่วมในการวิจัย
…………………………	………………………………
	(นางสาวมยุรี ลี่ทองอิน)
สถานที่ / วันที่	ลงนามผู้วิจัยหลัก
…………………………	………………………………
	( )
สถานที่ / วันที่	พยาน

Patient/participant information sheet

1. **Title:** A causal model of physical activity in older Thai people.
2. **Researcher name:** Mayuree Leethong-in
3. **Office:** Faculty of Nursing, Khon Kaen University, Khon Kaen, Thailand
   Office: 043-202-407 ext 129 Home: 043-203-724
   Mobile phone：08-9619-4342 E-mail: Mayureekku@gmail.com

I am doing a doctoral dissertation on physical activity in older Thai people. Physical activity is defined as older people's participation in moderate to vigorous intensity activity throughout daily accumulation of self-selected activities at least 10 minutes at a time. The activities should fall within each of the four domains: job related physical activity, household, transportation, and leisure time activities. the purpose of this information is to tell you about the researcher and to allow you to make a clear decision about whether you would like to participate or not

4. **Information relevant to informed consent form of this study** consists of:

4.1 The objectives of this study are to develop and examine the causal model used to explain trends associated with participation in physical activity by older Thai people.

4.2 The benefits of conducting this study are that: the results of this study will help nurses, health care providers and policy makers to understand the direct and indirect affect of select factors on participation in physical activity by older Thai people.

4.3 The participants are older Thai people aged 60 years or older who have no cognitive impairment , have a score of at least 15 points on the Chula Mental Test, are able to ambulate without assistive devices, and are willing to participate in the present study. The participants will be excluded from the study if they have suffered a recent cardiovascular event including heart attack, cardiac arrest, valvular disease, myocarditis, congestive heart failure (6 months prior) and have a history of medication use for the heart during the last three months.. The participants will also be excluded if they are non-ambulatory, have renal failure, liver cirrhosis, human immunodeficiency virus/ acquired immunodeficiency syndrome, and have major surgery in the past 6 weeks, or have health problems that cause communication problems and vertigo.

Twelve villages in 6 provinces will be randomly selected as research settings. After permission is obtained from the head of each selected Primary Care Unit, the systematic sampling technique will be used to select the participants who meet the study criteria from a name list obtained from each primary care unit. The researcher will contact participants to invite them to participate in the study.

4.4 Participants will be asked to answer the questions on the Chula Mental Test for around 5-10 minutes. The interview process will be divided into 3 sections, Each section will take around 15-20 minutes with 5 minutes rest after filling out each section. Participants will be initially asked to complete the questionnaire on personal data, physical environment, and social support,followed by questionnaires on self-efficacy, positive outcome expectations, and negative outcome expectations. Finally, participants will be interviewed using the physical activity questionnaire at the 7 day point. It will take around 65-80 minutes for this process.

4.5 The possibility of suffering chances such as fatigue and tiredness may occur. Participants will be asked to take a rest after filling out each questionnaire, and they will be informed that they can take a break whenever they feel tired or uncomfortable. The researcher will observe the participants and check for tiredness and fatigue.

4.6 Participation in the study will be strickly voluntary and participants may drop out of the study at any time, without penalty. This study will not impact participants' health and expenditure, if they do not participate in the study.

4.7 Participants can contact the researcher Mayuree Leethong-In, at the Faculty of Nursing, KhonKaen University by calling 0-432-207-324 ext. 129, at home by calling 043-203-724, and via cell phone by calling 0-896-194-342.

4.8 Participants who participate in the interview whether they later drop off the study or not, will receive a handkerchief which costs around 20 baht.

4.9 The information of the study will be presented the summary of findings as a whole. Each participant will be assigned a number and his or her name will not be connected with this study in any way when the results are reported. The researcher will make every effort to keep the participants' identities confidential. Only the researcher will have accessed to the participants' information. However, this information will be disclosed upon court order.

4.10 The total number of participants in this study will be 336.

Informed Consent Form

Title: A causal model of physical activity in the older Thai people.

Code number: Population or participant …………………………….

I was informed by the nurse researcher named Mayuree Leethong-in, Ph.D.student, Doctoral of Philosophy in Nursing Science Program, Faculty of Nursing, and Chulalongkorn University about the research objectives, procedures, as well as benefits, risks or harm that may occur in this study.

I have been told that the objectives of this study are to develop and examine the causal model used to explain trends associated with participation in physical activity by older Thai people. I have been told that the benefits of conducting this study will help nurses and health care providers to understand the direct and indirect effects of selected factors on participation in physical activity by older Thai people.

I understand that I will be one of 336 older people who will be asked to answer questions related to personal data, social support, physical environment, self-efficacy, positive outcome expectations, negative outcome expectations, and physical activity. These tasks will take approximately 65-80 minutes.

I have been told that some possible risks such as fatigue or tiredness could occur. I have been told that I will be asked to take a rest after each questionnaire and I can stop the task whenever I feel fatigue or uncomfortable. In addition, the nurse researcher will support and check for tiredness and fatigue. If I feel uncomfortable, I can refuse to answer.

I know that my participation in this study is strictly voluntary and that I can withdraw or drop out of the study at any time without any consequences. Whether I participate in the study or not, there will be no effect on me.

I have been told about the reason for the study and my part in it. I understand that I am able to ask questions. I will be assigned a code number and my name or any identifying information will not be disclosed when the results are reported. The nurse researcher will make every effort to keep my identity confidential. I understand that during the study I can contact the researcher, if I have any question about the study.

I receive a copy of this informed consent and participant information sheet.

I have read the information above. I am willing to take part in this study and my participation is voluntary.

…………………………………………….	…………………………………………….
Place/ Date	Name of participant
…………………………………………….	…………………………………………….
Place/ Date	(Miss Mayuree Leethong_in)
	Main reseacher signature
…………………………………………….	…………………………………………….
Place/ Date	(…………………………………………….)
	Witness signature

APPENDIX E

INTERVIEWING FORMS FOR DATA COLLECTION

ส่วนที่ 1 แบบทดสอบสุขภาพจิตจุฬา (Chula Mental test: CMT)

คำชี้แจง ก. ผู้สอบถามอ่านข้อความ

ข. ให้คะแนน 1 เมื่อผู้สูงอายุตอบถูกต้อง

ให้คะแนน 0 เมื่อผู้สูงอายุตอบไม่ถูกต้อง

ค. สรุปตีความระดับความรู้คิดและสติปัญญาของผู้สูงอายุตามเกณฑ์ที่กำหนดให้

	คำถาม	**คำตอบ**	**คะแนน**
1.	ปีนี้คุณอายุเท่าไร?		**1 / 0**
2.	ขณะนี้กี่โมง (อาจตอบคลาดเคลื่อนได้ 1 ชั่วโมง)		**1 / 0**
3.	พูดคำว่า "ร่ม กระทะ ประตู" ให้ฟังช้า ๆ ชัด ๆ 2 ครั้ง แล้วบอกให้ผู้ทดสอบทวนชื่อทั้งสามดังกล่าวทันที (ชื่อที่ถูก 1 ชื่อ = คะแนน)	"ร่ม" "กระทะ" "ประตู"	**1 / 0** **1 / 0** **1 / 0**
4.	เดือนนี้เดือนอะไร? (อาจตอบเป็นเดือนไทย / เดือนสากลก็ได้)		**1 / 0**
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			

ส่วนที่ 2 แบบบันทึกข้อมูลส่วนบุคคล

รหัสผู้ให้สัมภาษณ์.................

<u>คำชี้แจง</u>

โปรดทำเครื่องหมาย / ลงใน ( ) หน้าข้อความที่เป็นคำตอบ หรือ เติมข้อความลงในช่องว่างที่ได้จากการสัมภาษณ์ในคำตอบแต่ละข้อ

1. อายุ ....ปี
2. เพศ ( ) ชาย ( ) หญิง
3. ศาสนา ( ) พุทธ ( ) อิสลาม ( ) คริสต์ ( ) อื่นๆ ระบุ.......................
4. สถานภาพการสมรส

   ( ) โสด ( ) สมรส ( ) แยกกันอยู่ ( ) ม่าย

   ( ) หย่า ( ) อื่นๆ ระบุ................
5. จบการศึกษาสูงสุดชั้น

   ( ) ไม่ได้ศึกษา ( ) ประกาศนียบัตรวิชาชีพ หรือ วิชาชีพขั้นสูง

   ( ) ประถมศึกษาหรือต่ำกว่า ( ) ปริญญาตรี หรือ สูงกว่าปริญญาตรี

   ( ) มัธยมศึกษา

ส่วนที่ 3 แบบสัมภาษณ์การสนับสนุนทางสังคมเพื่อการเคลื่อนไหวออกแรง

คำชี้แจง:

ข้อความต่อไปนี้เหมาะสำหรับผู้ที่มีการเคลื่อนไหวออกแรงเป็นประจำ หากท่านไม่ได้มีการเคลื่อนไหวออกแรงเป็นประจำ บางข้อความอาจไม่ตรงกับการรับรู้ของท่าน อย่างไรก็ตาม ขอให้ท่านโปรดกรุณาตอบทุกๆ ข้อคำถาม แต่ละข้อความจะให้ตอบสองครั้ง

ภายใต้ "ครอบครัว" โปรดระบุความถี่ที่บุคคลในครอบครัวของท่านได้พูดหรือทำในแต่ละข้อความดังกล่าว <u>ในช่วงหนึ่งเดือนที่ผ่านมา</u>

ภายใต้" เพื่อน" ระบุความถี่ที่เพื่อน คนรู้จัก หรือเพื่อนร่วมงานของท่านได้พูดหรือทำในแต่ละข้อความดังกล่าว <u>ในช่วงหนึ่งเดือนที่ผ่านมา</u>

ทั้งนี้การเคลื่อนไหวออกแรง หมายถึง การเคลื่อนไหวออกแรงที่ท่านทำในกิจกรรมต่าง ๆ อาทิ งานอาชีพ งานบ้าน/งานสวน การเดินทาง และกิจกรรมในเวลาว่าง โดยท่านอาจต้องออกแรงทั้งในระดับปานกลางและ/หรือหนักเพื่อทำกิจกรรมนั้นติดต่อกันอย่างต่อเนื่องนานอย่างน้อย 10 นาที ต่อครั้ง

โปรดเขียนเฉพาะตัวเลขที่ตรงกับสิ่งที่เกิดขึ้นลงในช่องว่างที่กำหนดให้

ไม่เคยทำเลย	นานนานครั้ง	2-3 ครั้ง	บ่อยๆ	เป็นประจำ	ไม่ตอบ
(1)	(2)	(3)	(4)	(5)	(8)

ช่วงหนึ่งสัปดาห์ที่ผ่านมา ครอบครัวของท่าน หรือ เพื่อนๆ.........	**ครอบครัว**	**เพื่อนๆ**
1. ทำการเคลื่อนไหวออกแรงในกิจกรรมต่างๆ ร่วมกับท่าน	1a____	1b____
2. อาสาที่จะทำกิจกรรมในการเคลื่อนไหวออกแรงร่วมกับท่าน	2a____	2b____
3. ให้ความช่วยเหลือหรือช่วยเตือนในเรื่องการเคลื่อนไหวออกแรง (วันนี้คุณได้เคลื่อนไหวออกแรงหรือยัง)	3a____	3b____
4.	4a____	4b____
5.	5a____	5b____
11.	11a___	11b___
12. พูดคุยเรื่องความชอบในการทำกิจกรรมการเคลื่อนไหวออกแรงของพวกเขากับท่าน	12a___	12b___

ส่วนที่ 4 แบบสัมภาษณ์การสนับสนุนของสิ่งแวดล้อมกายภาพเพื่อการเคลื่อนไหวออกแรง

คำชี้แจง :

สำหรับคำถามต่อไปนี้ ผู้วิจัยจะสัมภาษณ์ความเห็นของท่านเกี่ยวกับสิ่งแวดล้อมบ้าน บริเวณละแวกบ้านและแหล่งสนับสนุนหรือสิ่งอำนวยความสะดวกในชุมชนของท่านกับการเคลื่อนไหวออกแรง

ในที่นี้ การเคลื่อนไหวออกแรง หมายถึง การเคลื่อนไหวออกแรงที่ท่านทำในกิจกรรมต่าง ๆ อาทิ งานอาชีพ งานบ้าน/งานสวน การเดินทาง และกิจกรรมในเวลาว่าง โดยท่านอาจต้องออกแรงทั้งในระดับปานกลางและ/หรือหนักเพื่อทำกิจกรรมนั้นติดต่อกันอย่างต่อเนื่องนานอย่างน้อย 10 นาที ต่อครั้ง

บ้าน หมายถึง สถานที่ที่ท่านอาศัยอยู่ในปัจจุบันทั้งพื้นที่ในบ้านและบริเวณรอบบ้าน ซึ่งบริเวณรอบบ้าน ได้แก่ บริเวณหน้าบ้าน หลังบ้าน และรอบตัวบ้าน

ละแวกบ้าน หมายถึง บริเวณที่ท่านใช้เวลาประมาณ10 นาทีเดินจากบ้านไปถึง

ชุมชน หมายถึง บริเวณที่ท่านใช้เวลาประมาณ 20 นาที ขับรถหรือนั่งรถจากบ้านไปถึง

ทั้งนี้ขอให้ท่านกรุณาบอกหมายเลขที่ตรงกับความเห็นของท่านมากที่สุด โดยเลือกหมายเลข 1 ถึง 5 ซึ่งหมายเลข 1 หมายถึง ไม่เห็นด้วยกับข้อความนั้นมากที่สุด

2 หมายถึง ไม่เห็นด้วยกับข้อความนั้น

3 หมายถึง ไม่แน่ใจ

4 หมายถึง เห็นด้วยกับข้อความนั้น

5 หมายถึง เห็นด้วยกับข้อความนั้นมากที่สุด

ข้อ	ข้อความ	เห็นด้วยมากที่สุด	เห็นด้วย	ไม่แน่ใจ	ไม่เห็นด้วย	ไม่เห็นด้วยมากที่สุด
1	ท่านรู้สึกสะดวกมากเมื่อเดินภายในบ้านของท่าน	5	4	3	2	1
2	ท่านมีความปลอดภัยจากอุบัติเหตุ.............................	5	4	3	2	1
6						
7	บริเวณละแวกบ้านของท่าน มีปัญหามากในเรื่องสุนัขที่มีเจ้าของ และ/หรือ สุนัขจรจัด	5	4	3	2	1
10	ในชุมชนของท่าน สถานที่สาธารณะหรือสถานที่ราชการต่าง ๆ เป็นสถานที่ที่ปลอดภัยจากอุบัติเหตุสำหรับท่านเมื่อทำกิจกรรมเคลื่อนไหวออกกำลัง	5	4	3	2	1

ส่วนที่ 5 แบบสัมภาษณ์ความเชื่อมั่นตนเองในการเคลื่อนไหวออกแรง

คำชี้แจง:

ขอให้ท่านตอบหมายเลขที่ตรงกับระดับความมั่นใจของท่านว่า เมื่อหนึ่งสัปดาห์ที่ผ่านมา ท่านมีความมั่นใจในระดับมากหรือน้อยเพียงใดที่จะเคลื่อนไหวออกแรง ภายใต้สถานการณ์ต่าง ๆ ต่อไปนี้ โดย7เลือกหมายเลขจาก 0 ถึง 10 ซึ่งคะแนน 0 หมายถึงไม่มีความมั่นใจเลย จากนั้นตัวเลขจะไล่เรียงความมั่นใจ8จากน้อยไปหามากจนถึงคะแนน 10 หมายถึงมีความมั่นใจมากที่สุด

การเคลื่อนไหวออกแรง หมายถึงการเคลื่อนไหวร่างกายที่กระทำที่ทำต่อเนื่องกันนานครั้งละ 10 นาทีขึ้นไป อย่างน้อย 3 ครั้งต่อวัน ในกิจกรรมต่าง ๆ ได้แก่ งานอาชีพ งานบ้าน การเดินทาง และกิจกรรมในเวลาว่าง

1. ท่านมั่นใจเพียงใดว่าท่านสามารถเคลื่อนไหวออกแรงถึงแม้ว่าท่านเผชิญกับอากาศที่รบกวนหรืออากาศไม่ดี

   ไม่มั่นใจ --มั่นใจเต็มที่

   0 1 2 3 4 5 6 7 8 9 10

2. ท่านมั่นใจเพียงใดว่าท่านสามารถเคลื่อนไหวออกแรงถึงแม้ว่าท่านรู้สึกเบื่อหน่ายต่อการออกแรงในการทำกิจกรรมต่าง ๆ

   ไม่มั่นใจ --มั่นใจเต็มที่

   0 1 2 3 4 5 6 7 8 9 10

3. ท่านมั่นใจเพียงใดว่าท่านสามารถเคลื่อนไหวออกแรงถึงแม้ว่าท่านรู้สึกเจ็บปวดขณะเคลื่อนไหวออกแรงทำกิจกรรมต่างๆ

   ไม่มั่นใจ --มั่นใจเต็มที่

   0 1 2 3 4 5 6 7 8 9 10

ส่วนที่ 6. แบบสัมภาษณ์ความคาดหวังผลดีของการเคลื่อนไหวออกแรง

คำชี้แจง :

ข้อความต่อไปนี้กล่าวถึงผลดีที่อาจเกิดขึ้นจากการเคลื่อนไหวออกแรง ท่านเห็นด้วยมากน้อยเพียงใดต่อข้อความดังกล่าว ทั้งนี้ขอให้ท่านกรุณาบอกหมายเลขที่ตรงกับความเห็นของท่านมากที่สุด โดยเลือกหมายเลข 1 ถึง 5 ซึ่งหมายเลข 1 หมายถึง ไม่เห็นด้วยกับข้อความนั้นมากที่สุด จากนั้นตัวเลขจะไล่เรียงความเห็นด้วยจากน้อยไปหามากจนถึงคะแนนหมายเลข 5 หมายถึง เห็นด้วยกับข้อความนั้นมากที่สุด

ทั้งนี้การเคลื่อนไหวออกแรง หมายถึง การเคลื่อนไหวออกแรงที่ท่านทำในกิจกรรมต่าง ๆ อาทิ งานอาชีพ งานบ้าน การเดินทาง และกิจกรรมในเวลาว่าง โดยท่านต้องทำกิจกรรมนั้น **ติดต่อกันนานอย่างน้อย 10 นาทีต่อครั้ง เป็นเวลา 3 ครั้งต่อวัน**

ข้อความ	**ระดับความเห็น**				
	เห็นด้วยมากที่สุด--------ไม่เห็นด้วยมากที่สุด				
ผลดีที่คาดว่าจะได้รับจากการเคลื่อนไหวออกแรง ทำให้					
1. รู้สึกว่าสมรรถนะของร่างกายดีขึ้น	5	4	3	2	1
2. อารมณ์โดยทั่วไปของท่านดีขึ้น	5	4	3	2	1
3. รู้สึกเหน็ดเหนื่อยน้อยลง	5	4	3	2	1
4.	5	4	3	2	1
5.	5	4	3	2	1
6.	5	4	3	2	1
7.	5	4	3	2	1
8.	5	4	3	2	1
9. ช่วยสร้างเสริมกระดูกของท่านให้แข็งแรงขึ้น	5	4	3	2	1

ส่วนที่ 7 แบบสัมภาษณ์ความคาดหวังผลด้านลบของการเคลื่อนไหวออกแรง

คำชี้แจง :

ข้อความต่อไปนี้กล่าวถึงผลด้านลบที่อาจเกิดขึ้นจากการเคลื่อนไหวออกแรง ท่านเห็นด้วยมากน้อยเพียงใดต่อข้อความดังกล่าว ทั้งนี้ขอให้ท่านบอกหมายเลขที่ตรงกับความเห็นของท่านมากที่สุด โดยเลือกหมายเลข 1 ถึง 5 ซึ่งหมายเลข 1 หมายถึง ไม่เห็นด้วยกับข้อความนั้นมากที่สุด จากนั้นตัวเลขจะไล่เรียงความเห็นด้วยจากน้อยไปหามากจนถึงคะแนนหมายเลข 5 หมายถึง เห็นด้วยกับข้อความนั้นมากที่สุด

ทั้งนี้การเคลื่อนไหวออกแรง หมายถึง การเคลื่อนไหวออกแรงที่ท่านทำในกิจกรรมต่าง ๆ อาทิ งานอาชีพ งานบ้าน การเดินทาง และกิจกรรมในเวลาว่าง โดยท่านต้องทำกิจกรรมนั้น **ติดต่อกันนานอย่างน้อย 10 นาทีต่อครั้ง เป็นเวลา 3 ครั้งต่อวัน**

ข้อความ	**ระดับความเห็น**				
	เห็นด้วยมากที่สุด-----------ไม่เห็นด้วยมากที่สุด				
1. การเคลื่อนไหวออกแรง เป็นสิ่งที่ท่านหลีกเลี่ยง เนื่องจากจะทำให้ท่าน**<u>หายใจเร็วและตื้นกว่าปกติ</u>**	5	4	3	2	1
2.	5	4	3	2	1
3.	5	4	3	2	1
4.	5	4	3	2	1

ส่วนที่ 8 แบบสัมภาษณ์การเคลื่อนไหวออกแรงของผู้สูงอายุ

คำชี้แจง

คำถามต่อไปนี้สัมภาษณ์ท่านเกี่ยวกับเวลาที่ใช้ในการเคลื่อนไหวออกแรงทำกิจกรรมประจำวันต่างๆ **ในช่วง 7 วันที่ผ่านมา** ขอให้ท่านโปรดตอบคำถามทุกข้อ แม้ท่านคิดว่าตัวท่านเองไม่ใช่คนที่กระฉับกระเฉงก็ตาม โดยที่คำถามจะถามครอบคลุมกิจกรรมประจำวันทั้งหมด 4 ประเภท ดังนี้

1) กิจกรรมในการทำงานประกอบอาชีพ
2) กิจกรรมในการเดินทาง
3) กิจกรรมในงานบ้าน งานซ่อมบำรุงบ้าน และงานดูแลสมาชิกในครอบครัว
4) กิจกรรมยามว่าง

ขอให้ท่านคิดถึงกิจกรรมประจำวันที่ต้องใช้การเคลื่อนไหวออกแรงทั้งระดับหนักมากและหนักปานกลาง ซึ่งต้องทำต่อเนื่องนานอย่างน้อย 10 นาทีต่อครั้ง ในช่วง7 วันที่ผ่านมา

กิจกรรมการเคลื่อนไหวออกแรงหนักมาก หมายถึง กิจกรรมที่ท่านทำนั้นต้องออกแรงมากและทำให้ท่านต้องหายใจแรงและเร็วมากกว่าปกติมาก จนรู้สึกหอบเหนื่อย

กิจกรรมการเคลื่อนไหวออกแรงปานกลาง หมายถึง กิจกรรมที่ท่านทำนั้นต้องออกแรงปานกลาง และทำให้ท่านต้องหายใจเร็วกว่าปกติบ้าง แต่ไม่รู้สึกหอบเหนื่อย

ตอนที่ 1 การเคลื่อนไหวออกแรงในการทำงานประกอบอาชีพ

คำถามต่อไปนี้ ขอให้ท่านคิดถึงการทำงานที่ท่านต้องเคลื่อนไหวออกแรง เป็นกิจกรรมที่ทำนอกบ้านและเป็นงานที่อาจได้รับหรือไม่ได้รับค่าจ้าง/ ค่าตอบแทนเช่น งานอาชีพ งานทำนา/ทำไร่ งานค้าขาย งานรับจ้างรายวัน งานอาสาสมัคร งานรับสอน และอื่น ๆ เป็นต้น

แบบสอบถามส่วนนี้ ไม่รวมงานที่ทำในบริเวณบ้านที่ไม่มีค่าตอบแทน เช่น งานบ้าน งานตกแต่งสวน งานซ่อมบำรุงทั่วไปและงานดูแลสมาชิกในครอบครัว ซึ่งงานส่วนนี้จะสอบถามท่านในตอนที่ 3

1. **ช่วง 7 วันที่ผ่านมา** ปัจจุบันท่านมีงานประกอบอาชีพ หรือทำงานนอกบ้าน ที่อาจได้รับหรือไม่ได้รับค่าตอบแทนหรือไม่

☐ มี

☐ ไม่มี ⟶ (หากไม่มี ข้ามไปตอบในตอนที่ 2 การเดินทาง)

คำถามต่อไปนี้ เกี่ยวกับการทำงานที่ต้องเคลื่อนไหวออกแรงที่ท่านปฏิบัติ**ในช่วง 7 วันที่ผ่านมา** ให้คิดถึงเฉพาะกิจกรรมการเคลื่อนไหวออกแรงที่ทำติดต่อกันอย่างน้อย 10 นาทีต่อครั้ง ไม่ว่าท่านจะได้รับหรือไม่ได้รับค่าตอบแทนก็ตาม ทั้งนี้ไม่รวมการเดินทางไปกลับระหว่างบ้านกับที่ทำงาน

2. **ช่วง 7 วันที่ผ่านมา** ท่านใช้เวลากี่วัน **ทำงาน**ที่ต้องเคลื่อนไหวออกแรง**หนักมาก** เช่น ยกของหนัก ขุดดิน งานก่อสร้าง หรือ การเดินขึ้นบันไดหลายขั้น ซึ่งทำต่อเนื่องนานอย่างน้อย 10 นาที

___ **วัน ต่อสัปดาห์**

☐ ไม่ได้ทำงานที่ต้องเคลื่อนไหวออกแรงหนักมาก ⟶ (ข้ามไปตอบในข้อ 4)

3. โดยปกติ ในแต่ละวันเหล่านั้น ท่านใช้เวลาทำงานที่ต้องเคลื่อนไหวออกแรงหนักมากรวมเป็นระยะเวลานานเท่าไรต่อวัน

____ **ชั่วโมง ต่อวัน** ____ **นาที ต่อวัน**

Part 1: Demographic information

Explanation: please mark / in the proper space ( ) or fill in the correct information as required:

1. Age…………..years

2. Gender ( ) Male ( ) Female

3. Religion 1. ( ) Buddhist 2. ( ) Islam
3. ( ) Christian 4. ( ) other (specify)…………….

4. Status 1. ( ) Single 2. ( ) Married
3. ( ) Separated 4. ( ) Widowed
5. ( ) Divorced 6. ( ) other (specify)…………….

5. Highest educational level completed:
1. ( ) no formal education 2. ( ) Primary school
3. ( ) Secondary school 4. ( ) Vocational school
5. ( ) Bachelor's degree or higher

Part 2: Social Support for Physical Activity scale (SSPA)

Below is a list of things people m ight do or say to som eone who is trying to physical activity regularly. If you are not tr ying to physical activity, then som e of the questions may not apply to you, but please read and give an answer to every question.

Please rate each question twice. Under *family*, rate how often anyone living in your household has said or done what is described during the **last** month. Under *friends*, rate how often your friends, acquaintances, or coworkers have said or done what is described during the **last** month.

Please write *one* number from the following rating scale in each space:

1	**2**	**3**	**4**	**5**	**8**
none	**rarely**	**A few times**	**often**	**Very often**	**Does not apply**

	During the last month, your family (or members of your household) or friends:	**Family**	**Friends**
1.	Participating physical activity with you.	1.____	1.____
2.	Offered to physical activity with you.	2.____	2.____
3.	Gave you helpful reminders to physical activity ("Are you going to physical activity tonight?”).	3.____	3.____
4.	…………………………………………………………………	4.___	4.____
11.	…………………………………………………………………	11.___	11.____
12.	Talked about how much they like to physical activity.	12.___	12.____

Part 3: Thai Environment Supports for Physical Activity scale (TESPA)

Directions:

"I will be asking you some questions about your house and neighborhood , followed by some questions about the community in which you live."

For the purpose of this interview,

Physical activity referes to older people's participation in moderate to vigorous intensity activity throughout daily accumulation of self-selected activities at least 10 minutes at a time. The activities should fall within each of the four domains: job related physical activity, household, transportation, and leisure time activities.

Home ref ers to your hom e environm ent both in and aro und your ho me (e.g. front yard and back yard) in relation to your participation in physical activity.

Neighborhood refers to the area ar ound your hom e that you could w alk to within 10 minutes from your home.

Community refers to the area with in a 20 minutes drive from your residence.

Please tell me how much you agree or disagree with the statements.

Statements	Strongly agree	Agree	Unsure	Disagree	Strongly disagree
1 You feel more convenient walking inside your home	5 4		3	2	1
2 You feel safer inside your home.	5	4	3	2	1
3. ………………………………..	5	4 3 2			1
4. ………………………………..	5	4 3 2			1
7. The unattended dogs in your neighborhood are big problem for walking.	5	4	3	2	1
10 The public recreation facilities in your community make you more safety for physical activity.	5	4	3	2	1

Part 4: Self-efficacy for Physical Activity scale (SEPA)

Directions: the following are situations that are common reasons for the persons not to participate physical activity at least 10 minutes a time, 3 times a day. Using the numbers from 0 to 10, pleases indicate how confident you are right now that you could physical activity in the event that any of the following circumstances were to occur.

1. How confident are you right now that you could physical activity if the weather was bothering you?
No confidence …………………………………………………………………Total confidence
0 1 2 3 4 5 6 7 8 9 1 0

2. How confident are you right now that you could physical activity if you were bored by the program or activity?
No confidence …………………………………………………………………Total confidence
0 1 2 3 4 5 6 7 8 9 1 0

3. How confident are you right now that you could physical activity if you felt pain when performing?
No confidence …………………………………………………………………Total confidence
0 1 2 3 4 5 6 7 8 9 1 0

Part 5: The Positive Outcome Expectations for Physical Activity scale (POEPA)

Directions: The following statements are about the benefits of physical activity which you participate at least 10 minutes a time, 3 times a day.

Please tell me how much you agree or disagree with the statements

Statements	Strongly agree ---------Strongly disagree
1. The participation in physical activity makes me feel better physically	5 4 3 2 1
2. The participation in physical activity makes my mood better in general.	5 4 3 2 1
3. The participation in physical activity helps me feel less tired.	5 4 3 2 1
4.	5 4 3 2 1
8.	5 4 3 2 1
9. The participation in physical activity helps to strengthen my bone	5 4 3 2 1

Part 6: The Negative Outcome Expectations for Physical Activity scale (NOEPA)

Directions: The following statements are about the negative outcomes of physical activity which you participate at least 10 minutes a time, 3 times a day.

Please tell me how much you agree or disagree with the statements

Statements	Strongly agree -----Strongly disagree				
1. The participation in physical activity is something I avoid because it causes me to be short of breath.	5 4 3 2 1				
2. 5		4	3	2	1
4. 5		4	3	2	1

Part 7: International Physical Activity Questionnaire (IPAQ_L)

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** and **moderate** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal.

PART 1: JOB-RELATED PHYSICAL ACTIVITY

The first section is about your work. This includes paid jobs, farming, volunteer work, course work, and any other unpaid work that you did outside your home. Do not include unpaid work you might do around your home, like housework, yard work, general maintenance, and caring for your family. These are asked in Part 3.

1. During **the last 7 days**, do you currently have a job or do any unpaid work outside your home?

☐ Yes

☐ No → ***Skip to PART 2: TRANSPORTATION***

The next questions are about all the physical activity you did in the **last 7 days** as part of your paid or unpaid work. This does not include traveling to and from work.

2. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, heavy construction, or climbing up stairs **as part of your work**? Think about only those physical activities that you did for at least 10 minutes at a time.

   _____ **days per week**

   ☐ No vigorous job-related physical activity → ***Skip to question 4***

3. How much time did you usually spend on one of those days doing **vigorous** physical activities as part of your work?

   _____ **hours per day**

   ____ **minutes per day**

APPENDIX F:

GUIDELINES FOR DATA PROCESSING AND ANALYIS OF THE INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE –LONG FORM (IPAQ-L)

Guidelines for data processing and analysis of the International Physical Activity Questionnaire-Long Form (IPAQ-L)

Introduction

This document has been prepared for use in this study. It based on IPAQ Research Committee (November 2005).

Summary characteristics of IPAQ-L

The IPAQ-L was developed by Booth and the International Consensus Group for the Development of an International Physical Activity Questionnaire at the WHO in 1998. The IPAQ-L was designed for research that requires a comprehensive evaluation of daily physical activity. The IPAQ-L includes 5 sections: work-related physical activity, transport-related physical activity, leisure time physical activity, domestic activities, and time spent sitting during the previous 7 days. The IPAQ-L identifies the frequency and duration of vigorous and moderate physical activity involved in work-related activities, domestic activities, and leisure-time physical activities. For transportation related activities, the actual time spent was used as the criterion. The items are structured to provide separate, domain-specific scores for walking, moderate physical activity and vigorous physical activity. Computation of the total scores for the IPAQ_L requires summation of the duration (in minutes) and frequency (days) for all the types of activities in all domains.

Overview of Continuous and categorical analyses of IPAQ-L

Both categorical and continuous indicators of physical activity are possible from IPAQ-L. In addition, the continuous indicator be presented as median minutes/week or median MET-minutes /week.

1. **Continuous score**

Data collected with IPAQ-L can be presented as a continuous score and presented as median median minutes/week or median MET-minutes /week. Median score can be computed for walking, moderate-intensity activities, and vigorous-intensity activities with in each domain using the formulas below. Total scores may also be calculated for walking, moderate-intensity activities, and vigorous-intensity activities; for each domain and for an overall grand total.

MET values and formula for computation of MET-minutes

Occupation domain

Walking MET-min/week at work = 3.3 * walking minutes*walking days at work

Moderate MET-min/week at work = 4.0 * moderate-intensity activity minutes*moderate-intensity activity days at work

Vigorous MET-min/week at work = 8.0 * vigorous -intensity activity minutes* vigorous-intensity activity days at work

Total Work MET-min/week = sum of Walking + Moderate + Vigorous MET-minutes/week scores at work

Transportation domain

Walking MET-min/week = 3.3*walking minutes*walking days for transportation

Cycle MET-min/week = 6.0*cycling minutes* cycle days for transportation

Total Transportation MET-min/week = sum of Walking + Cycling MET-minutes/week scores for transportation.

<u>Household domain</u>

Vigorous MET-min/week yard chores = 5.5 * vigorous-intensity activity minutes * vigorous-intensity activity days doing yard work(Note: the MET value of 5.5 indicates that vigorous garden/yard work should be considered a moderate-intensity activity for scoring and computing total moderate intensity activities)

Moderate MET-min/week yard chores = 4.0 * moderate-intensity activity minutes * moderate-intensity activity days doing yard work.

Moderate MET-min/week inside chores = 3.0 * moderate-intensity activity minutes * moderate-intensity activity days doing inside chores.

Total Household MET-min/week = sum of Vigorous yard + Moderate yard + Moderate inside chores MET-minutes/week scores

<u>Leisure -Time domain</u>

Walking MET-min/week leisure = 3.3 * walking minutes*walking days in leisure

Moderate MET-min/week leisure = 4.0 * moderate-intensity activity minutes*moderate-intensity activity days in leisure

Vigorous MET-min/week leisure = 8.0 * vigorous -intensity activity minutes* vigorous-intensity activity days in leisure

Total Leisure-Time MET-min/week = sum of Walking + Moderate + Vigorous MET-minutes/week scores in leisure

Total physical activity scores

An overall total physical activity MET-minutes/week score can be computed as:

Total physical activity MET-minutes/week = sum of total (Walking +Moderate + vigorous) MET-minutes/week scores.

Or

Total physical activity MET-minutes/week = sum of total occupation + total transportation + total household + total leisure-time MET-minutes/week scores.

2. Categorical score

There are three levels of physical activity proposed to classified populations as followed:

Category 1: Low

Those individuals who mot meet criteria for categories 2 or 3 ate considred "low"

Category 2: Moderate

The pattern of activity to be classified as "moderate" is either of the following criteria:

a). 3 or more days of vigorous-intensity activity of at least 20 minutes per day

OR

b). 5 or more days of moderate-intensity activity of at least 30 minutes per day

OR

c). 5 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum of at least 600 MET-min/week.

Individuals meeting at least one of the above criteria would be defined as accumulating a moderate level of activity.

<u>Category 3</u>: High

Any one of the following 2 criteria

a). vigorous-intensity activity on at least 3 days achieving a minimum of at least 1500 MET-min/week

OR

b). 7 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum of at least 3000 MET-min/week.

Examples

MET levels	**MET-minutes/week for 30 min/day, 5 days**			
Walking at work =3.3 METs	3.3*30*5	=	495	MET-minutes/week
Cycling for transportation=6.0 METs	6.0*30*5	=	900	MET-minutes/week
Moderate yard work =4.0 METs	4.0*30*5	=	600	MET-minutes/week
Vigorous intensity in leisure=8.0 METs	8.0*30*5	=	1,200	MET-minutes/week
TOTAL		=	3,195	MET-minutes/week

APPENDIX G:

PERMISSION DOCUMENT FOR USING THE INSTRUMENTS

Mayuree Leethong-in, MS.
Faculty of Nursing, Khon Kaen University
Khon Kaen, Thailand 4002
Tel: +66-4-320-2407 Fax: +66-4-334-8301
Email: Mayuree@kku.ac.th;
Mayuree.leethong-in@UCHSC.edu

September 28, 2007

Dr. James F. Sallis
Department of Psychology
San Diego State University
3900 Fifth Avenue, Suite 310
San Diego, CA 92103

Dear Dr. Sallis:

My name is Mayuree Leethong-in and I am a Ph.D Student in the Faculty of Nursing at Chulalongkorn University, Bangkok, Thailand. The title of my PhD. dissertation is "A causal model of regular physical activity in rural-dwelling older Thai people".

I am developing my dissertation proposal and I have decided to use the Social Support from Family & Friend for Exercise Survey developed by you and your colleagues. Your questionnaire is a very useful instrument to measure to measure social support for exercise which is one of the variables included in my study.

The Self the Social Support from Family & Friend for Exercise Survey was translated into the Thai language by Mr.Thanee Kaewthummanukul while he was a doctoral student in University of Alabama at Birmingham. He received permission from you to translate and use the scale; therefore, I would like to ask your permission to use it for my dissertation tool. Moreover, I would like to use the Thai version of the Social Support from Family & Friend for Exercise Survey and to adapt some of the items to increase their cultural relevancy for Thai respondents, in my study.

Thank you very much in advance. I look forward to hearing from you.

Sincerely,
Mayuree Leethong-in

Mayuree Leethong-in, MS.
Visiting Research Scholar
School of Nursing
University of Colorado at Denver and Health Science Center
Denver, CO 80262

Enclosed: A self-address return envelope

I had the pleasure of visiting your versity about 10 years ago.

Hello, Thank you for your interest! You are welcome to use the Social Support scales. Best wishes for a successful study
3 Oct '07
James Sallis

Mayuree Leethong-in, MS.
Faculty of Nursing, Khon Kaen University
Khon Kaen, Thailand 4002
Tel: +66-4-320-2407 Fax: +66-4-334-8301
Email: Mayuree@kku.ac.th;
Mayuree.leethong-in@UCHSC.edu

September 28, 2007

Dr. Barabara Resnick
University of Maryland School of Nursing
655 West Lombard Street, Room 375,
Baltimore, MD 21201.

Dear Dr. Resnick:

My name is Mayuree Leethong-in and I am a Ph.D Student in the Faculty of Nursing at Chulalongkorn University, Bangkok, Thailand. The title of my PhD.dissertation is "A causal model of regular physical activity in rural-dwelling older Thai people".

I am developing my dissertation proposal and I have decided to use the Self-efficacy for Exercise Scale and the Outcome Expectations for Exercise Scale-2 (OEE-2)developed by you and your colleagues. Your questionnaire is a very useful instrument to measure self-efficacy and outcome expectations exercise, which are two of the variables included in my study.

The Self-efficacy for Exercise and the Outcome Expectations Scale were translated into the Thai language by Ms. Teeranut Harnirattisai while she was a doctoral student in the School of Nursing at the University of Missouri. She received permission from you to translate and use the scale; therefore, I would like to ask your permission to use it for my dissertation tool. Moreover, I would like to use the Thai version of both the Self-efficacy and the Outcome Expectations of Exercise Scale, in my study. I would like to translate a negative part of OEE-2 from English to Thai and to adapt some of the items to increase their cultural relevancy for Thai respondents.

Thank you very much in advance. I look forward to hearing from you.

Sincerely,

Good luck!

Mayuree Leethongin.

Mayuree Leethong-in, MS.
Visiting Research Scholar
School of Nursing
University of Colorado at Denver and Health Science Center
Denver, CO 80262

Enclosed: A self-address return envelope

You have full permission to use the measures in any way you would like! Barbara Resnick

APPENDIX H:

PRELIMINARY ANALYSIS:

NORMALITY, LINEARLITY, AND HOMOSCEDASTICITY

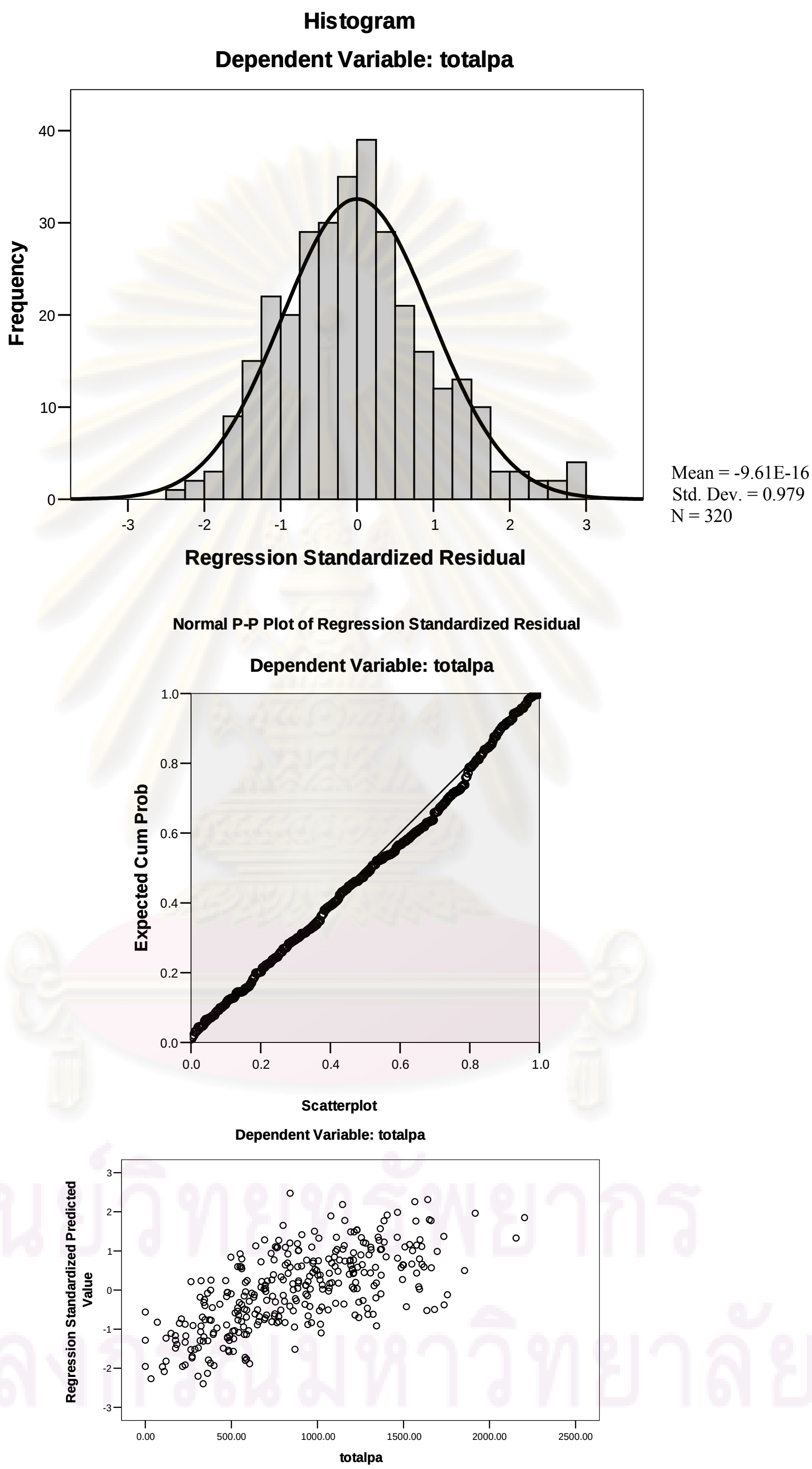
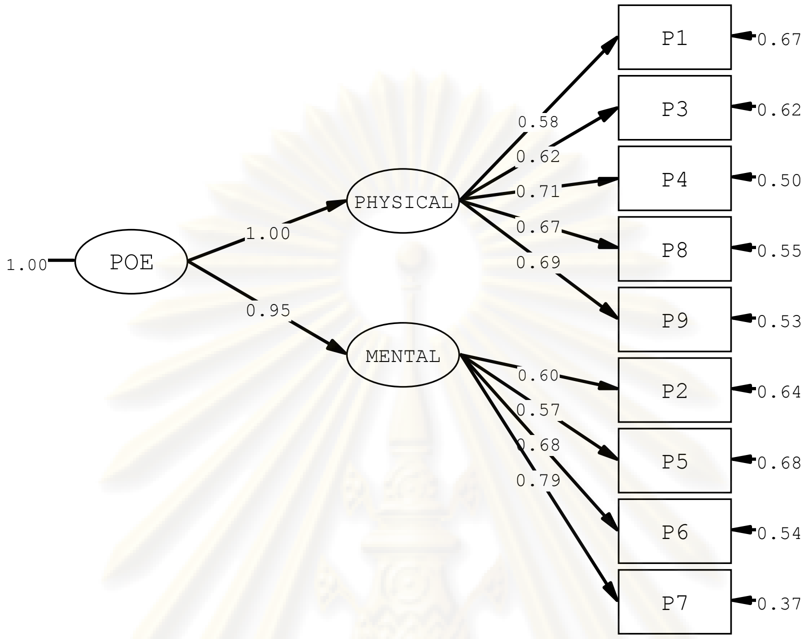


Figure 5 Assumption testing: Normality, linearity, and homoscedasticity

APPENDIX I:

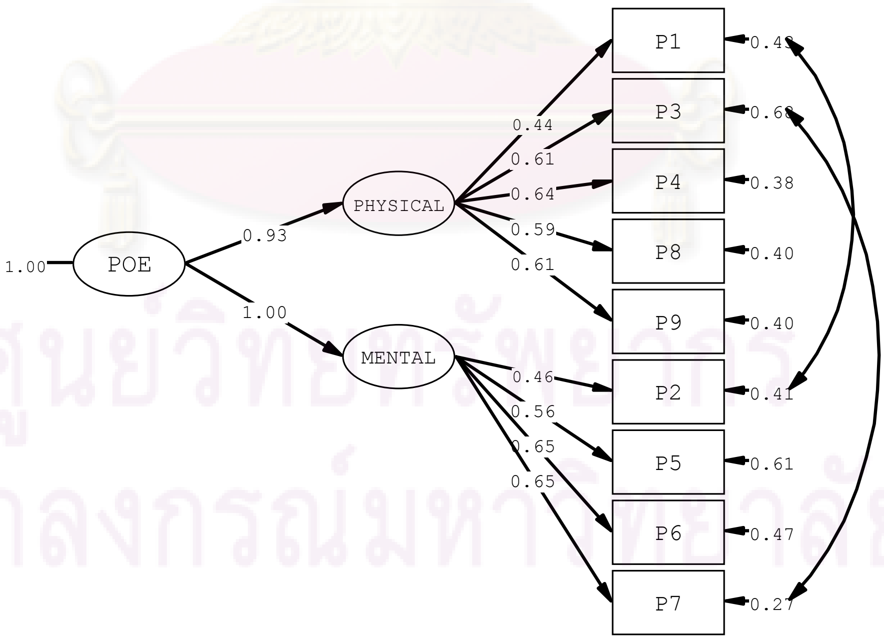
MEASUREMENT MODEL OF THE STUDY VARIABLES

Measurement model testing of positive outcome expectations for physical activity



χ^2 =54.34, *df*= 26, *p*= 0.00, χ^2 /*df*= 2.09, GFI= 0.96, RMSEA= 0.06, CFI= 0.99; NFI= 0.97

Figure 6 The measurement model of the POEPA: Original model



χ^2 =29.13, *df*=24, *p*= 0.21, χ^2 /*df* = 1.21, GFI= 0.98, RMSEA= 0.03, NFI=0.99, CFI=1.00

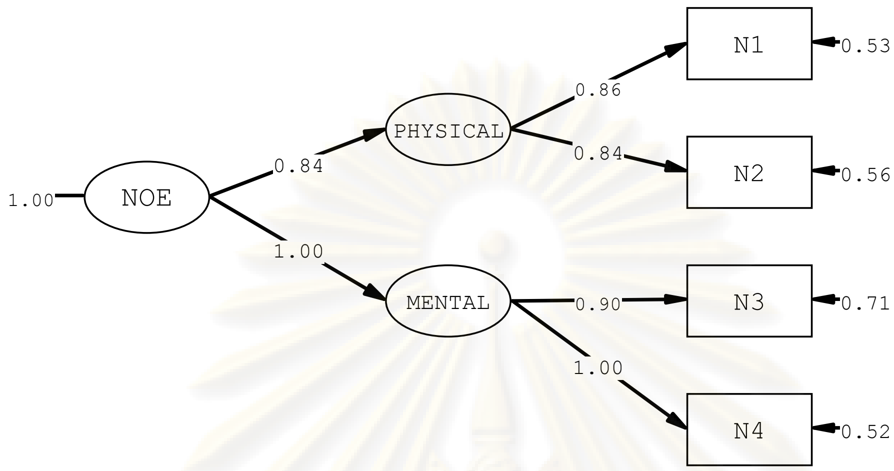
Figure 7 The measurement model of the POEPA: Revised model

Table 6 Analysis result for the POEPA measurement model

Latent variables and indicators	b	SE_b	b_{sc}	R^2	ρ_c
Physical					0.79
POE1	0.44*	-	0.56	0.31	
POE3	0.61*	0.08	0.59	0.35	
POE4	0.64*	0.07	0.72	0.52	
POE8	0.59*	0.07	0.68	0.46	
POE9	0.61*	0.07	0.70	0.48	
Psychological					0.76
POE2	0.46*	-	0.58	0.34	
POE5	0.56*	0.07	0.58	0.34	
POE6	0.65*	0.07	0.69	0.48	
POE7	0.65*	0.07	0.78	0.62	

Note: b = factor loading, SE_b = standard error, R^2=Square multiple correlation
b_{sc} = completely standardized factor loading, * = t-value p <.05
ρ_c = construct reliability

Measurement model testing of negative outcome expectations for physical activity



χ^2 =0.17, *df*=1, *p*= 0.67, χ^2 /*df*= 0.17, GFI= 1.00, RMSEA= 0.00, NFI= 1.00, CFI= 1.00

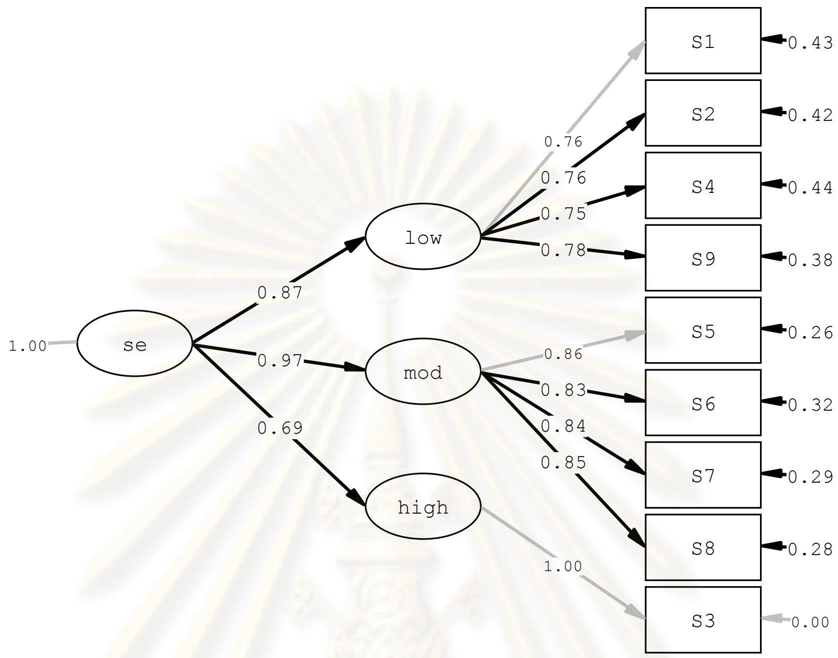
Figure 8 The measurement model of the NOEPA

Table 7 Analysis result for the NOEPA measurement model

Latent variables and indicators	b	SE_b	b_{sc}	R^2	ρ_c
Physical					0.73
NOE1	0.86*	-	0.76	0.58	
NOE2	0.84*	0.08	0.75	0.56	
Psychological					0.75
NOE3	0.90*	-	0.73	0.53	
NOE4	1.00*	0.09	0.81	0.66	

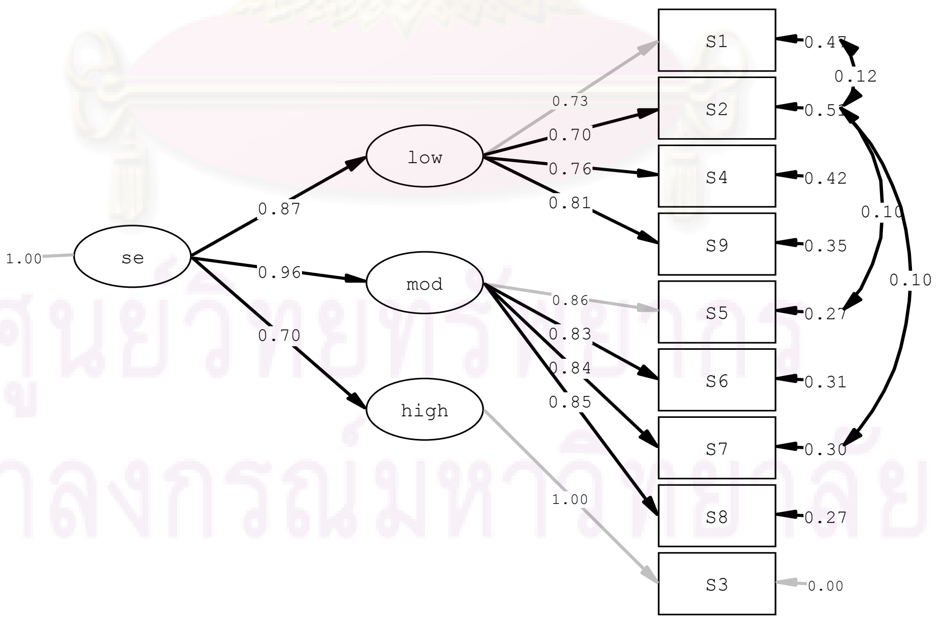
Note: b = factor loading, SE_b = standard error, R^2=Square multiple correlation
b_{sc} = completely standardized factor loading, * = t-value p <.05
ρ_c = Construct reliability

Measurement model testing of self-efficacy for physical activity



χ^2 =54.83, *df*= 25, *p*= 0.00, χ^2 /*df*= 2.19, GFI= 0.96, RMSEA= 0.06, NFI= 0.98, CFI= 0.99

Figure 9 The measurement model of SEPA: Original model



χ^2 =26.56, *df*= 22, *p*=.23 χ^2 /*df*= 1.21, GFI= 0.98, RMSEA= 0.03, NFI= 0.99, CFI= 1.00

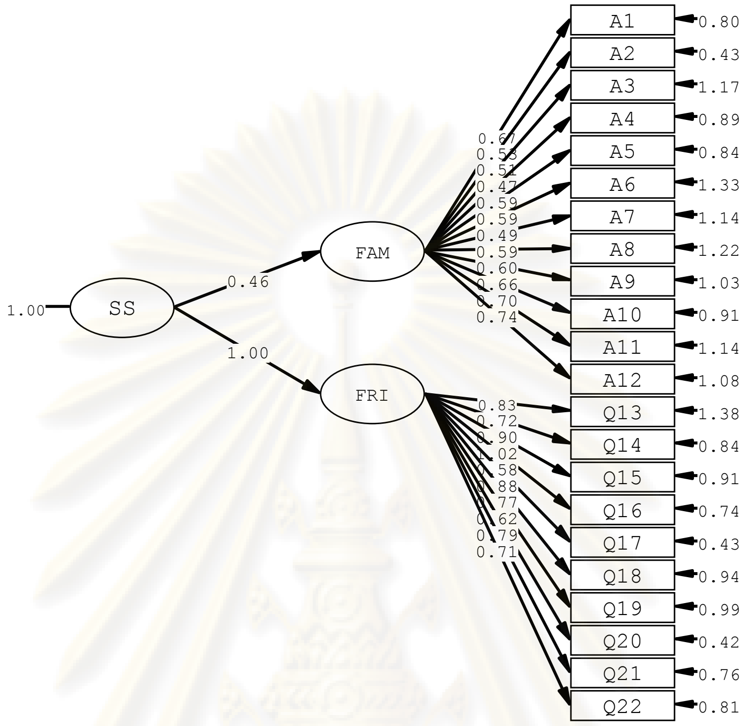
Figure 10 The measurement model of the SEPA: Revised model

Table 8 Analysis result for the SEPA measurement model

Latent variables and indicators	b	SE_b	b_{sc}	R^2	ρ_c
Low obstacles					0.84
SE1	1.87*	-	0.73	0.53	
SE2	1.81*	0.13	0.70	0.49	
SE4	1.89*	0.15	0.76	0.58	
SE9	2.23*	0.17	0.81	0.65	
Moderate obstacles					0.91
SE5	2.29*	-	0.86	0.73	
SE6	2.35*	0.13	0.83	0.69	
SE7	2.31*	0.12	0.84	0.70	
SE8	2.62*	0.14	0.85	0.73	
High obstacles					1.00
SE3	2.44*	-	1.00	1.00	

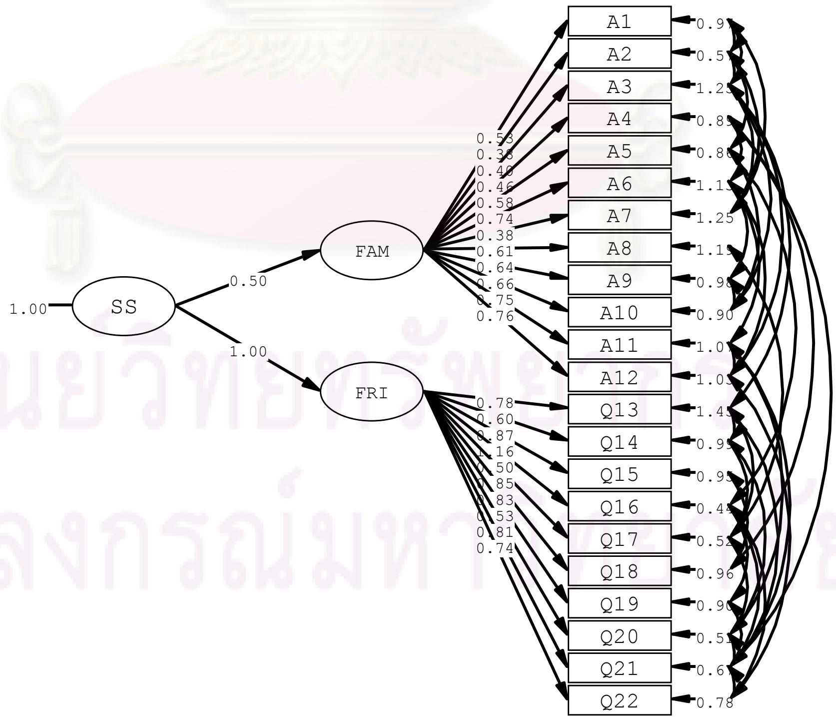
Note: b = factor loading, SE_b = standard error, R^2=Square multiple correlation
b_{sc} = completely standardized factor loading, * = t-value p <.05
ρ_c = Construct reliability

Measurement model testing of social support for physical activity



χ^2 =811.93, *df*= 208, *p*=.00, χ^2 /*df*= 3.90, GFI= 0.81, RMSEA= 0.095, NFI= 0.88,CFI= 0.91.

Figure 11 The measurement model of the SSPA: Original model



χ^2 =199.42, *df*= 171, p=.07, χ^2 /*df*= 1.17, GFI= 0.95, RMSEA= 0.02, NFI= 0.97, CFI= 0.99

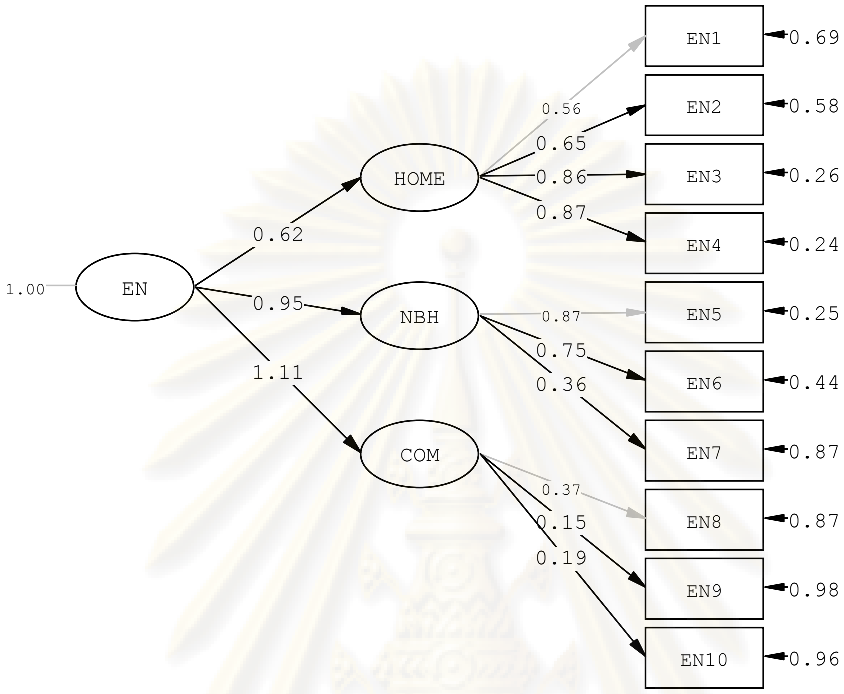
Figure 12 The measurement model of the SSPA: Revised model

Table 9 Analysis result for the SSPA measurement model

Latent variables and indicators	b	SE_b	b_{sc}	R^2	ρ_c
Family support					0.80
A1	0.53*	-	.47	0.22	
A2	0.38*	0.05	.45	0.20	
A3	0.40*	0.07	.34	0.11	
A4	0.46*	0.08	.44	0.19	
A5	0.58*	0.09	.53	0.28	
A6	0.74*	0.12	.57	0.33	
A7	0.38*	0.07	.32	0.10	
A8	0.61*	0.10	.49	0.24	
A9	0.64*	0.10	.55	0.30	
A10	0.66*	0.10	.57	0.32	
A11	0.75*	0.11	.59	0.34	
A12	0.76*	0.11	.60	0.36	
Friend support					0.88
Q13	0.78*	-	.54	0.30	
Q14	0.60*	0.06	.52	0.27	
Q15	0.87*	0.10	.67	0.45	
Q16	1.16*	0.12	.87	0.75	
Q17	0.50*	0.06	.57	0.33	
Q18	0.85*	0.09	.65	0.43	
Q19	0.83*	0.10	.66	0.43	
Q20	0.53*	0.06	.60	0.36	
Q21	0.81*	0.10	.71	0.50	
Q22	0.74*	0.09	.64	0.41	

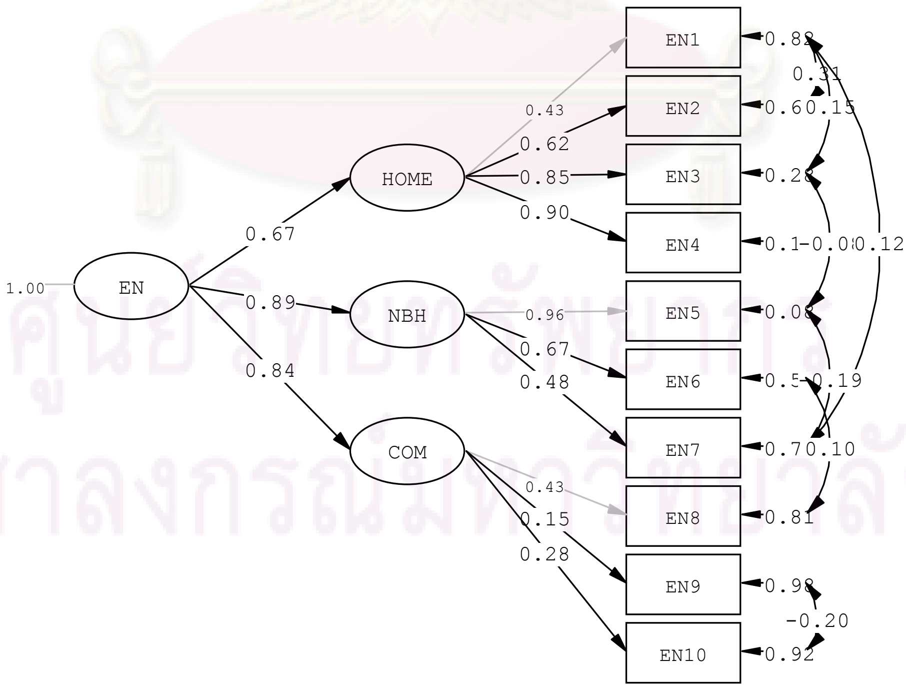
Note: b = factor loading, SE_b = standard error, R^2=Square multiple correlation
b_{sc} = completely standardized factor loading, * = t-value p <.05
ρ_c = Construct reliability

Measurement model testing of Thai environment supports for physical activity



χ^2 = 138.13, *df*= 32, *p*= .00, χ^2 /*df*= 4.32, GFI= 0.92, RMSEA= 0.10, NFI= 0.90, CFI= 0.92

Figure 13 The measurement model of the TESPA: Original model



χ^2 =33.27, *df*= 25, *p*=.13, χ^2 /*df*= 1.33, GFI= 0.98, RMSEA= 0.03, NFI= 0.98, CFI= 0.99

Figure 14 The measurement model of the TESPA: Revised model

Table 10 Analysis result for the TESPA measurement model

Latent variables and indicators	b	SE_b	b_{sc}	R^2	ρ_c
Home environment					.45
EN1	0.39*	-	.43	0.18	
EN2	0.63*	0.07	.62	0.39	
EN3	0.90*	0.11	.85	0.72	
EN4	1.05*	0.14	.90	0.82	
Neighborhood environment					.78
EN5	1.00*	-	.96	0.92	
EN6	0.81*	0.09	.67	0.44	
EN7	0.54*	0.08	.48	0.23	
Community environment					.71
EN8	0.57*	-	.43	0.19	
EN9	0.15*	0.08	.15	0.02	
EN10	0.37*	0.11	.28	0.08	

Note: b = factor loading, SE_b = standard error, R^2=Square multiple correlation
b_{sc} = completely standardized factor loading, * = t-value p <.05
ρ_c = Construct reliability,

APPENDIX J:

LISREL PRINTOUT FOR MODEL TESTING OF THE STRUCTURAL EQUATION MODEL

```
                         DATE:  9/ 9/2009
                           TIME: 13:20


                         L I S R E L  8.52

                                BY

                   Karl G. J”reskog & Dag S”rbom


              This program is published exclusively by
              Scientific Software International, Inc.
                 7383 N. Lincoln Avenue, Suite 100
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     Copyright by Scientific Software International, Inc., 1981-2002
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                       Website: www.ssicentral.com

 The following lines were read from file D:\DATA
ANALYSIS\PAMODEL.LS8:

 TI Physical Activity in older Thai people
 !DA NI=14 NO=320 NG=1 MA=CM
 SY='D:\DATA ANALYSIS\PAMODEL.dsf' NG=1
 SE
 1 2 3 4 5 6 7 8 9 10 11 12 13 14 /
 MO NX=6 NY=8 NK=3 NE=4 LY=FU,FI LX=FU,FI BE=FU,FI GA=FU,FI PH=SY,FR
PS=DI,FR TE=FU,FI TD=FU,FI
 LE
 PA POE NOE SE
 LK
 SS EN AG
 FR LY(1,1) LY(2,2) LY(3,2) LY(4,3) LY(5,3) LY(6,4) LY(7,4) LY(8,4)
LX(1,1)
 FR LX(2,1) LX(4,2) LX(5,2) BE(1,2) BE(1,3) BE(1,4) BE(2,4) BE(3,4)
GA(1,2)
 FR GA(1,3) GA(4,1)
 VA 1.00 LX(3,2) LX(6,3)
 FR TE 2 2 TE 3 3 TE 4 4 TE 5 5 TE 6 6 TE 7 7 TE 8 8
 FR TD 3 3 TD 2 2 TD 4 4 TD 5 5
 FI TD 1 1 TE 1 1 TD 6 6
 FR TE 7 4 TH 1 6 TH 4 6 TE 5 2 TE 4 2 TE 4 3 TE 5 3 TH 3 2
 FR TH 4 2 TD 2 1 TH 2 6 TH 3 8 TH 1 4 TH 1 5 TH 5 5 TH 6 6
 FR TH 3 3 TH 4 3 TH 3 7 TH 3 6 TH 3 5 TH 3 4 TH 4 4 TH 4 5
 FR TH 4 7 TH 4 8 TD 3 1 TD 5 4 TD 4 1 TD 6 1
 PD
 OU ME=ML AM RS EF FS SS SC IT=1000 AD=OFF

 TI Physical Activity in older Thai people

Number of Input Variables 14
Number of Y - Variables    8
Number of X - Variables    6
Number of ETA - Variables  4
Number of KSI - Variables  3
```

Number of Observations 320

TI Physical Activity in older Thai people

Covariance Matrix

	PA	PPOE	MPOE	PNOE	MNOE	LOWSE
PA	192398.09					
PPOE	107.87	0.43				
MPOE	104.58	0.32	0.44			
PNOE	-170.11	-0.29	-0.27	1.00		
MNOE	-210.47	-0.31	-0.25	0.68	1.21	
LOWSE	506.86	0.56	0.51	-0.66	-0.86	4.64
MODSE	628.86	0.61	0.54	-0.65	-1.13	3.99
HISE	481.26	0.56	0.48	-0.60	-0.79	2.94
FAM	294.19	0.22	0.25	0.81	0.52	6.29
FRI	-169.84	-0.41	-0.24	0.94	1.18	0.75
HOME	398.88	1.06	0.83	-0.90	-1.11	2.41
NBH	354.02	0.64	0.54	-0.77	-0.76	0.97
COM	193.56	0.28	0.29	-0.34	-0.56	0.69
AGE	-682.65	-0.96	-1.06	0.95	0.70	-2.92

Covariance Matrix

	MODSE	HISE	FAM	FRI	HOME	NBH
MODSE	6.31					
HISE	3.91	5.97				
FAM	5.06	4.58	63.11			
FRI	-1.37	-0.68	26.16	69.30		
HOME	2.88	2.85	2.20	1.61	11.56	
NBH	1.79	1.51	-0.48	0.50	4.71	7.38
COM	0.91	0.66	-0.26	-0.04	2.11	2.26
AGE	-2.66	-2.04	0.58	1.66	-1.60	-0.22

Covariance Matrix

	COM	AGE
COM	4.74	
AGE	-0.56	46.37

TI Physical Activity in older Thai people

Parameter Specifications

LAMBDA-Y

	PA	POE	NOE	SE
PA	0	0	0	0
PPOE	0	0	0	0
MPOE	0	1	0	0
PNOE	0	0	0	0
MNOE	0	0	2	0
LOWSE	0	0	0	0
MODSE	0	0	0	3
HISE	0	0	0	4

LAMBDA-X

	SS	EN	AG
FAM	5	0	0
FRI	6	0	0
HOME	0	0	0
NBH	0	7	0
COM	0	8	0
AGE	0	0	0

BETA

	PA	POE	NOE	SE
PA	0	9	10	11
POE	0	0	0	12
NOE	0	0	0	13
SE	0	0	0	0

GAMMA

	SS	EN	AG
PA	0	14	15
POE	0	0	0
NOE	0	0	0
SE	16	0	0

PHI

	SS	EN	AG
SS	0		
EN	17	18	
AG	19	20	21

PSI

PA	POE	NOE	SE
22	23	24	25

THETA-EPS

	PA	PPOE	MPOE	PNOE	MNOE	LOWSE
PA	0					
PPOE	0	26				
MPOE	0	0	27			
PNOE	0	28	29	30		
MNOE	0	31	32	0	33	
LOWSE	0	0	0	0	0	34
MODSE	0	0	0	35	0	0
HISE	0	0	0	0	0	0

THETA-EPS

	MODSE	HISE
MODSE	36	
HISE	0	37

THETA-DELTA-EPS

	PA	PPOE	MPOE	PNOE	MNOE	LOWSE
FAM	0	0	0	38	39	40
FRI	0	0	0	0	0	41
HOME	0	44	45	46	47	48
NBH	0	53	54	55	56	57
COM	0	0	0	0	62	0
AGE	0	0	0	0	0	65

THETA-DELTA-EPS

	MODSE	HISE
FAM	0	0
FRI	0	0
HOME	49	50
NBH	58	59
COM	0	0
AGE	0	0

THETA-DELTA

	FAM	FRI	HOME	NBH	COM	AGE
FAM	0					
FRI	42	43				
HOME	51	0	52			
NBH	60	0	0	61		
COM	0	0	0	63	64	
AGE	66	0	0	0	0	0

TI Physical Activity in older Thai people

Number of Iterations = 71

LISREL Estimates (Maximum Likelihood)

LAMBDA-Y

	PA	POE	NOE	SE
PA	432.26	- -	- -	- -
PPOE	- -	0.60	- -	- -
MPOE	- -	0.54 (0.05) 10.13	- -	- -
PNOE	- -	- -	0.72	- -
MNOE	- -	- -	0.91 (0.10) 8.68	- -

```
 LOWSE         - -         - -         - -        1.78

 MODSE         - -         - -         - -        2.25
                                                 (0.13)
                                                 17.39

  HISE         - -         - -         - -        1.72
                                                 (0.13)
                                                 13.50


     LAMBDA-X

                SS          EN          AG
            --------    --------    --------
   FAM        7.96         - -         - -
            (0.31)
             25.90

   FRI       -1.45         - -         - -
            (0.74)
             -1.97

  HOME         - -        1.00         - -

   NBH         - -        0.83         - -
                        (0.17)
                          4.80

   COM         - -        0.20         - -
                        (0.06)
                          3.17

   AGE         - -         - -        1.00


     BETA

                PA         POE         NOE          SE
            --------    --------    --------    --------
    PA         - -        0.10       -0.24        0.49
                        (0.06)      (0.06)      (0.07)
                          1.73       -3.84        6.77

   POE         - -         - -         - -        0.49
                                                (0.06)
                                                  7.95

   NOE         - -         - -         - -       -0.52
                                                (0.08)
                                                 -6.79

    SE         - -         - -         - -         - -

     GAMMA

                SS          EN          AG
            --------    --------    --------
    PA         - -        0.19       -0.02
                        (0.04)      (0.01)
```

```
                    5.47      -2.09

 POE       - -       - -       - -

 NOE       - -       - -       - -

  SE      0.32       - -       - -
        (0.06)
          5.78


   Covariance Matrix of ETA and KSI

             PA       POE       NOE        SE        SS        EN
         --------  --------  --------  --------  --------  --------
   PA      1.00
  POE      0.39      1.00
  NOE     -0.50     -0.26      1.00
   SE      0.64      0.49     -0.52      1.00
   SS      0.12      0.16     -0.17      0.32      1.00
   EN      0.84     -0.12      0.12     -0.24     -0.75      5.20
   AG     -1.31     -0.50      0.52     -1.01     -3.17      0.39

   Covariance Matrix of ETA and KSI

             AG
         --------
   AG     46.24

   PHI

             SS        EN        AG
         --------  --------  --------
   SS      1.00

   EN     -0.75      5.20
         (0.23)    (1.28)
          -3.23      4.05

   AG     -3.17      0.39     46.24
         (1.21)    (0.99)    (3.66)
          -2.63      0.40     12.64


   PSI
   Note: This matrix is diagonal.

             PA       POE       NOE        SE
         --------  --------  --------  --------
           0.35      0.76      0.73      0.90
         (0.07)    (0.11)    (0.12)    (0.10)
           4.91      7.00      5.89      9.09


   Squared Multiple Correlations for Structural Equations

             PA       POE       NOE        SE
         --------  --------  --------  --------
           0.65      0.24      0.27      0.10

   Squared Multiple Correlations for Reduced Form
```

PA	POE	NOE	SE
0.21	0.02	0.03	0.10

Reduced Form

	SS	EN	AG
PA	0.21 (0.04) 5.60	0.19 (0.04) 5.47	-0.02 (0.01) -2.09
POE	0.16 (0.03) 5.02	--	--
NOE	-0.17 (0.03) -5.03	--	--
SE	0.32 (0.06) 5.78	--	--

THETA-EPS

	PA	PPOE	MPOE	PNOE	MNOE	LOWSE
PA	--					
PPOE	--	0.07 (0.03) 2.31				
MPOE	--	--	0.15 (0.03) 5.33			
PNOE	--	-0.16 (0.03) -4.97	-0.16 (0.03) -4.76	0.46 (0.06) 7.14		
MNOE	--	-0.15 (0.03) -4.47	-0.11 (0.03) -3.12	--	0.35 (0.09) 3.99	
LOWSE	--	--	--	--	--	1.49 (0.17) 8.75
MODSE	--	--	--	0.18 (0.07) 2.77	--	--
HISE	--	--	--	--	--	--

THETA-EPS

	MODSE	HISE
MODSE	1.27 (0.21) 5.95	
HISE	- -	3.04 (0.27) 11.08

Squared Multiple Correlations for Y - Variables

PA	PPOE	MPOE	PNOE	MNOE	LOWSE
1.00	0.83	0.66	0.53	0.70	0.68

Squared Multiple Correlations for Y - Variables

MODSE	HISE
0.80	0.49

THETA-DELTA-EPS

	PA	PPOE	MPOE	PNOE	MNOE	LOWSE
FAM	- -	- -	- -	1.16 (0.34) 3.45	1.12 (0.36) 3.10	2.21 (0.64) 3.47
FRI	- -	- -	- -	- -	- -	1.81 (0.64) 2.81
HOME	- -	1.10 (0.14) 7.81	0.86 (0.14) 6.29	-0.95 (0.20) -4.85	-1.14 (0.22) -5.25	2.65 (0.45) 5.94
NBH	- -	0.63 (0.10) 6.14	0.52 (0.10) 5.10	-0.72 (0.15) -4.85	-0.72 (0.16) -4.38	1.05 (0.33) 3.21
COM	- -	- -	- -	- -	-0.25 (0.10) -2.56	- -
AGE	- -	- -	- -	- -	- -	-0.50 (0.53) -0.94

THETA-DELTA-EPS

	MODSE	HISE
FAM	- -	- -
FRI	- -	- -
HOME	3.36 (0.53)	3.06 (0.50)

	6.36	6.16
NBH	1.97	1.53
	(0.39)	(0.37)
	5.04	4.18
COM	- -	- -
AGE	- -	- -

THETA-DELTA

	FAM	FRI	HOME	NBH	COM	AGE
FAM	- -					
FRI	37.02	67.12				
	(6.92)	(5.56)				
	5.35	12.06				
HOME	8.75	- -	6.05			
	(2.30)		(1.15)			
	3.80		5.25			
NBH	4.86	- -	- -	3.45		
	(1.78)			(0.77)		
	2.73			4.45		
COM	- -	- -	- -	0.84	4.54	
				(0.33)	(0.36)	
				2.58	12.63	
AGE	27.54	- -	- -	- -	- -	- -
	(9.92)					
	2.78					

Squared Multiple Correlations for X - Variables

FAM	FRI	HOME	NBH	COM	AGE
1.00	0.03	0.46	0.51	0.04	1.00

Goodness of Fit Statistics

Degrees of Freedom = 39
Minimum Fit Function Chi-Square = 53.98 (P = 0.056)
Normal Theory Weighted Least Squares Chi-Square = 51.80 (P = 0.082)
Estimated Non-centrality Parameter (NCP) = 12.80
90 Percent Confidence Interval for NCP = (0.0 ; 35.63)

Minimum Fit Function Value = 0.17
Population Discrepancy Function Value (F0) = 0.040
90 Percent Confidence Interval for F0 = (0.0 ; 0.11)
Root Mean Square Error of Approximation (RMSEA) = 0.032
90 Percent Confidence Interval for RMSEA = (0.0 ; 0.054)

P-Value for Test of Close Fit (RMSEA < 0.05) = 0.91

Expected Cross-Validation Index (ECVI) = 0.58
90 Percent Confidence Interval for ECVI = (0.54 ; 0.65)
ECVI for Saturated Model = 0.66
ECVI for Independence Model = 8.75

Chi-Square for Independence Model with 91 Degrees of Freedom = 2762.85
Independence AIC = 2790.85
Model AIC = 183.80
Saturated AIC = 210.00
Independence CAIC = 2857.61
Model CAIC = 498.51
Saturated CAIC = 710.67

Normed Fit Index (NFI) = 0.98
Non-Normed Fit Index (NNFI) = 0.99
Parsimony Normed Fit Index (PNFI) = 0.42
Comparative Fit Index (CFI) = 0.99
Incremental Fit Index (IFI) = 0.99
Relative Fit Index (RFI) = 0.95

Critical N (CN) = 369.90

Root Mean Square Residual (RMR) = 542.28
Standardized RMR = 0.065
Goodness of Fit Index (GFI) = 0.98
Adjusted Goodness of Fit Index (AGFI) = 0.94
Parsimony Goodness of Fit Index (PGFI) = 0.36

TI Physical Activity in older Thai people

Fitted Covariance Matrix

	PA	PPOE	MPOE	PNOE	MNOE	LOWSE
PA	186846.33					
PPOE	99.65	0.43				
MPOE	90.59	0.32	0.45			
PNOE	-158.12	-0.27	-0.26	0.99		
MNOE	-197.92	-0.29	-0.23	0.66	1.17	
LOWSE	489.40	0.52	0.48	-0.67	-0.84	4.67
MODSE	618.29	0.66	0.60	-0.67	-1.06	4.02
HISE	472.69	0.51	0.46	-0.65	-0.81	3.07
FAM	400.02	0.74	0.68	0.21	-0.08	6.73
FRI	-72.71	-0.14	-0.12	0.17	0.22	0.99
HOME	361.35	1.03	0.80	-0.86	-1.02	2.23
NBH	301.26	0.57	0.46	-0.65	-0.63	0.69
COM	71.38	-0.01	-0.01	0.02	-0.23	-0.08
AGE	-565.25	-0.30	-0.27	0.38	0.48	-2.30

Fitted Covariance Matrix

	MODSE	HISE	FAM	FRI	HOME	NBH
MODSE	6.35					
HISE	3.88	6.00				
FAM	5.71	4.37	63.41			

FRI	-1.04	-0.79	25.50	69.21		
HOME	2.82	2.65	2.78	1.09	11.25	
NBH	1.53	1.19	-0.12	0.91	4.34	7.06
COM	-0.11	-0.08	-1.18	0.21	1.03	1.70
AGE	-2.27	-1.74	2.30	4.59	0.39	0.33

Fitted Covariance Matrix

	COM	AGE
COM	4.74	
AGE	0.08	46.24

Fitted Residuals

	PA	PPOE	MPOE	PNOE	MNOE	LOWSE
PA	5551.76					
PPOE	8.22	0.00				
MPOE	13.99	0.00	0.00			
PNOE	-11.99	-0.01	-0.01	0.01		
MNOE	-12.55	-0.02	-0.02	0.02	0.04	
LOWSE	17.45	0.03	0.03	0.01	-0.02	-0.03
MODSE	10.56	-0.06	-0.06	0.02	-0.06	-0.03
HISE	8.57	0.06	0.02	0.05	0.02	-0.13
FAM	-105.83	-0.53	-0.42	0.60	0.60	-0.44
FRI	-97.14	-0.27	-0.12	0.77	0.96	-0.24
HOME	37.53	0.03	0.03	-0.05	-0.09	0.18
NBH	52.76	0.07	0.08	-0.12	-0.14	0.28
COM	122.18	0.29	0.30	-0.36	-0.33	0.77
AGE	-117.41	-0.67	-0.79	0.57	0.23	-0.63

Fitted Residuals

	MODSE	HISE	FAM	FRI	HOME	NBH
MODSE	-0.03					
HISE	0.03	-0.03				
FAM	-0.65	0.21	-0.30			
FRI	-0.33	0.11	0.66	0.09		
HOME	0.06	0.21	-0.58	0.52	0.31	
NBH	0.27	0.32	-0.36	-0.41	0.37	0.32
COM	1.02	0.74	0.92	-0.25	1.08	0.56
AGE	-0.39	-0.30	-1.72	-2.93	-1.99	-0.55

Fitted Residuals

	COM	AGE
COM	0.00	
AGE	-0.63	0.13

Summary Statistics for Fitted Residuals

```
Smallest Fitted Residual = -117.41
  Median Fitted Residual =    0.01
 Largest Fitted Residual = 5551.76
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Stemleaf Plot

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        Standardized Residuals

                  PA       PPOE       MPOE       PNOE       MNOE      LOWSE
            --------   --------   --------   --------   --------   --------
      PA      3.76
    PPOE      1.93      -1.02
    MPOE      2.42      -0.97      -0.92
    PNOE     -1.83      -1.76      -1.67       1.18
    MNOE     -2.30      -2.78      -2.83       2.27       3.84
   LOWSE      0.92       0.98       0.88       0.14      -0.28      -0.56
   MODSE      0.64      -2.07      -2.09       0.54      -1.35      -0.45
    HISE      0.29       1.11       0.40       0.61       0.27      -1.47
     FAM     -0.95      -2.11      -1.62       2.49       2.46      -1.05
     FRI     -0.50      -0.91      -0.40       1.69       1.95      -0.35
    HOME      1.46       1.20       0.98      -1.01      -2.01       1.53
     NBH      2.77       2.22       2.31      -2.35      -2.92       2.41
     COM      2.55       3.68       3.71      -2.96      -3.74       2.95
     AGE     -2.28      -3.02      -3.43       1.63       0.62      -1.95

        Standardized Residuals

               MODSE       HISE        FAM        FRI       HOME        NBH
            --------   --------   --------   --------   --------   --------
   MODSE     -0.61
    HISE      0.48      -0.70
     FAM     -1.04       0.27      -0.27
     FRI     -0.32       0.11       0.59       0.63
    HOME      0.44       1.41      -0.81       0.36       2.63
     NBH      2.11       2.30      -0.64      -0.36       3.25       3.24
     COM      3.34       2.49       1.06      -0.25       3.56       4.08
     AGE     -0.87      -0.45      -1.46      -1.56      -2.48      -0.95

        Standardized Residuals

                 COM        AGE
            --------   --------
     COM     -0.23
     AGE     -0.79       0.84

Summary Statistics for Standardized Residuals

Smallest Standardized Residual =   -3.74
  Median Standardized Residual =    0.14
 Largest Standardized Residual =    4.08

Stemleaf Plot

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Largest Negative Standardized Residuals
Residual for     MNOE and     PPOE  -2.78
Residual for     MNOE and     MPOE  -2.83
Residual for      NBH and     MNOE  -2.92
Residual for      COM and     PNOE  -2.96
Residual for      COM and     MNOE  -3.74
Residual for      AGE and     PPOE  -3.02
Residual for      AGE and     MPOE  -3.43
Largest Positive Standardized Residuals
Residual for       PA and       PA   3.76
Residual for     MNOE and     MNOE   3.84
Residual for     HOME and     HOME   2.63
Residual for      NBH and       PA   2.77
Residual for      NBH and     HOME   3.25
Residual for      NBH and      NBH   3.24
Residual for      COM and     PPOE   3.68
Residual for      COM and     MPOE   3.71
Residual for      COM and    LOWSE   2.95
Residual for      COM and    MODSE   3.34
Residual for      COM and     HOME   3.56
Residual for      COM and      NBH   4.08

TI Physical Activity in older Thai people

                        Q plot of Standardized Residuals


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Standardized Residuals

TI Physical Activity in older Thai people

Modification Indices and Expected Change

Modification Indices for LAMBDA-Y

	PA	POE	NOE	SE
PA	- -	- -	- -	- -
PPOE	0.08	- -	0.49	0.49
MPOE	1.38	- -	0.49	0.49
PNOE	0.25	0.01	- -	0.01
MNOE	0.19	0.01	- -	0.01
LOWSE	0.28	2.49	0.04	- -
MODSE	0.12	5.74	0.76	- -
HISE	0.01	1.81	0.84	- -

Expected Change for LAMBDA-Y

	PA	POE	NOE	SE
PA	- -	- -	- -	- -
PPOE	-0.01	- -	0.17	0.11
MPOE	0.05	- -	-0.15	-0.10
PNOE	-0.06	0.05	- -	0.01
MNOE	0.06	-0.06	- -	-0.02
LOWSE	0.07	0.15	0.02	- -
MODSE	-0.05	-0.29	-0.12	- -
HISE	-0.02	0.17	0.13	- -

Standardized Expected Change for LAMBDA-Y

	PA	POE	NOE	SE
PA	- -	- -	- -	- -
PPOE	-0.01	- -	0.17	0.11
MPOE	0.05	- -	-0.15	-0.10
PNOE	-0.06	0.05	- -	0.01
MNOE	0.06	-0.06	- -	-0.02
LOWSE	0.07	0.15	0.02	- -
MODSE	-0.05	-0.29	-0.12	- -
HISE	-0.02	0.17	0.13	- -

Completely Standardized Expected Change for LAMBDA-Y

	PA	POE	NOE	SE
PA	- -	- -	- -	- -
PPOE	-0.02	- -	0.26	0.17
MPOE	0.08	- -	-0.23	-0.15
PNOE	-0.06	0.05	- -	0.01
MNOE	0.06	-0.05	- -	-0.01
LOWSE	0.03	0.07	0.01	- -
MODSE	-0.02	-0.11	-0.05	- -
HISE	-0.01	0.07	0.05	- -

Modification Indices for LAMBDA-X

	SS	EN	AG
FAM	- -	0.24	0.30
FRI	- -	1.20	2.52
HOME	0.10	- -	0.58
NBH	0.68	- -	1.09
COM	1.29	- -	0.87
AGE	0.22	- -	- -

Expected Change for LAMBDA-X

	SS	EN	AG
FAM	- -	-0.69	0.73
FRI	- -	0.29	-0.18
HOME	0.11	- -	-0.02
NBH	-0.24	- -	0.02
COM	0.13	- -	-0.01
AGE	-5.36	- -	- -

Standardized Expected Change for LAMBDA-X

	SS	EN	AG
FAM	- -	-1.57	4.97
FRI	- -	0.67	-1.19
HOME	0.11	- -	-0.14
NBH	-0.24	- -	0.15
COM	0.13	- -	-0.09
AGE	-5.36	- -	- -

Completely Standardized Expected Change for LAMBDA-X

	SS	EN	AG
FAM	- -	-0.20	0.62
FRI	- -	0.08	-0.14
HOME	0.03	- -	-0.04
NBH	-0.09	- -	0.06
COM	0.06	- -	-0.04
AGE	-0.79	- -	- -

Modification Indices for BETA

	PA	POE	NOE	SE
PA	- -	- -	- -	- -
POE	12.22	- -	- -	- -
NOE	0.02	- -	- -	- -
SE	12.72	0.19	0.02	- -

Expected Change for BETA

	PA	POE	NOE	SE
PA	- -	- -	- -	- -
POE	1.09	- -	- -	- -
NOE	-0.07	- -	- -	- -
SE	1.83	0.07	0.07	- -

Standardized Expected Change for BETA

	PA	POE	NOE	SE

PA	- -	- -	- -	- -
POE	1.09	- -	- -	- -
NOE	-0.07	- -	- -	- -
SE	1.83	0.07	0.07	- -

Modification Indices for GAMMA

	SS	EN	AG
PA	0.22	- -	- -
POE	0.19	4.47	2.75
NOE	0.02	0.29	0.05
SE	- -	8.72	5.26

Expected Change for GAMMA

	SS	EN	AG
PA	-0.08	- -	- -
POE	-0.02	0.12	-0.01
NOE	-0.02	-0.07	0.00
SE	- -	0.32	-0.07

Standardized Expected Change for GAMMA

	SS	EN	AG
PA	-0.08	- -	- -
POE	-0.02	0.27	-0.07
NOE	-0.02	-0.17	-0.01
SE	- -	0.73	-0.47

No Non-Zero Modification Indices for PHI

Modification Indices for PSI

	PA	POE	NOE	SE
PA	- -			
POE	- -	- -		
NOE	- -	- -	- -	
SE	0.22	0.19	0.02	- -

Expected Change for PSI

	PA	POE	NOE	SE
PA	- -			
POE	- -	- -		
NOE	- -	- -	- -	
SE	0.23	0.05	0.05	- -

Standardized Expected Change for PSI

	PA	POE	NOE	SE
PA	- -			
POE	- -	- -		
NOE	- -	- -	- -	
SE	0.23	0.05	0.05	- -

Modification Indices for THETA-EPS

PA PPOE MPOE PNOE MNOE LOWSE

PA	- -					
PPOE	0.49	- -				
MPOE	0.49	- -	- -			
PNOE	0.01	- -	- -	- -		
MNOE	0.01	- -	- -	- -	- -	
LOWSE	0.13	0.70	0.12	0.00	0.08	- -
MODSE	0.15	1.05	0.50	- -	0.88	0.22
HISE	- -	1.65	0.09	0.06	0.43	2.57

Modification Indices for THETA-EPS

	MODSE	HISE
MODSE	- -	
HISE	1.32	- -

Expected Change for THETA-EPS

	PA	PPOE	MPOE	PNOE	MNOE	LOWSE
PA	- -					
PPOE	-7.10	- -				
MPOE	6.45	- -	- -			
PNOE	-1.82	- -	- -	- -		
MNOE	2.28	- -	- -	- -	- -	
LOWSE	10.85	0.03	0.01	0.00	0.02	- -
MODSE	-13.91	-0.04	-0.03	- -	-0.08	0.11
HISE	- -	0.06	-0.01	0.02	0.06	-0.27

Expected Change for THETA-EPS

	MODSE	HISE
MODSE	- -	
HISE	0.27	- -

Completely Standardized Expected Change for THETA-EPS

	PA	PPOE	MPOE	PNOE	MNOE	LOWSE
PA	- -					
PPOE	-0.03	- -				
MPOE	0.02	- -	- -			
PNOE	0.00	- -	- -	- -		
MNOE	0.00	- -	- -	- -	- -	
LOWSE	0.01	0.02	0.01	0.00	0.01	- -
MODSE	-0.01	-0.02	-0.02	- -	-0.03	0.02
HISE	- -	0.03	-0.01	0.01	0.02	-0.05

Completely Standardized Expected Change for THETA-EPS

	MODSE	HISE
MODSE	- -	
HISE	0.04	- -

Modification Indices for THETA-DELTA-EPS

	PA	PPOE	MPOE	PNOE	MNOE	LOWSE
FAM	- -	1.09	0.00	- -	- -	- -
FRI	- -	0.08	0.25	0.50	1.39	- -

HOME	- -	- -	- -	- -	- -	- -
NBH	- -	- -	- -	- -	- -	- -
COM	0.13	0.27	1.07	1.34	- -	0.02
AGE	- -	0.40	2.63	0.49	0.85	- -

Modification Indices for THETA-DELTA-EPS

	MODSE	HISE
FAM	0.02	0.81
FRI	0.02	0.03
HOME	- -	- -
NBH	- -	- -
COM	0.89	0.03
AGE	0.24	0.02

Expected Change for THETA-DELTA-EPS

	PA	PPOE	MPOE	PNOE	MNOE	LOWSE
FAM	- -	-0.17	-0.01	- -	- -	- -
FRI	- -	-0.05	0.09	0.24	0.43	- -
HOME	- -	- -	- -	- -	- -	- -
NBH	- -	- -	- -	- -	- -	- -
COM	-16.15	0.03	0.06	-0.12	- -	0.02
AGE	- -	-0.10	-0.27	0.20	-0.28	- -

Expected Change for THETA-DELTA-EPS

	MODSE	HISE
FAM	-0.13	0.64
FRI	-0.11	0.15
HOME	- -	- -
NBH	- -	- -
COM	0.17	0.04
AGE	0.39	0.09

Completely Standardized Expected Change for THETA-DELTA-EPS

	PA	PPOE	MPOE	PNOE	MNOE	LOWSE
FAM	- -	-0.03	0.00	- -	- -	- -
FRI	- -	-0.01	0.02	0.03	0.05	- -
HOME	- -	- -	- -	- -	- -	- -
NBH	- -	- -	- -	- -	- -	- -
COM	-0.02	0.02	0.04	-0.06	- -	0.01
AGE	- -	-0.02	-0.06	0.03	-0.04	- -

Completely Standardized Expected Change for THETA-DELTA-EPS

	MODSE	HISE
FAM	-0.01	0.03
FRI	-0.01	0.01
HOME	- -	- -
NBH	- -	- -
COM	0.03	0.01
AGE	0.02	0.01

Modification Indices for THETA-DELTA

	FAM	FRI	HOME	NBH	COM	AGE
FAM	- -					
FRI	- -	- -				
HOME	- -	1.43	- -			
NBH	- -	0.06	0.75	- -		
COM	0.01	0.01	1.16	- -	- -	
AGE	- -	2.54	0.87	1.26	0.38	- -

Expected Change for THETA-DELTA

	FAM	FRI	HOME	NBH	COM	AGE
FAM	- -					
FRI	- -	- -				
HOME	- -	1.63	- -			
NBH	- -	-0.25	-2.20	- -		
COM	0.08	-0.07	0.59	- -	- -	
AGE	- -	-7.22	-1.17	1.11	-0.47	- -

Completely Standardized Expected Change for THETA-DELTA

	FAM	FRI	HOME	NBH	COM	AGE
FAM	- -					
FRI	- -	- -				
HOME	- -	0.06	- -			
NBH	- -	-0.01	-0.25	- -		
COM	0.00	0.00	0.08	- -	- -	
AGE	- -	-0.13	-0.05	0.06	-0.03	- -

Maximum Modification Index is 12.72 for Element (4, 1) of BETA

TI Physical Activity in older Thai people

Factor Scores Regressions

ETA

	PA	PPOE	MPOE	PNOE	MNOE	LOWSE
PA	0.00	0.00	0.00	0.00	0.00	0.00
POE	0.00	1.56	0.50	0.21	0.12	0.03
NOE	0.00	0.17	0.10	0.46	0.57	0.04
SE	0.00	0.42	0.01	-0.12	0.00	0.12

ETA

	MODSE	HISE	FAM	FRI	HOME	NBH
PA	0.00	0.00	0.00	0.00	0.00	0.00
POE	0.04	0.05	-0.01	0.01	-0.17	-0.09
NOE	-0.08	-0.02	-0.02	0.01	0.08	0.07
SE	0.23	0.09	0.00	0.00	-0.16	-0.08

ETA

	COM	AGE
PA	0.00	- -
POE	0.07	0.01

NOE	-0.01	0.00
SE	0.06	0.01

KSI

	PA	PPOE	MPOE	PNOE	MNOE	LOWSE
SS	0.00	0.11	-0.05	-0.26	-0.13	-0.21
EN	0.00	-1.43	-0.03	0.51	0.30	0.09
AG	0.00	0.63	0.20	0.70	0.38	1.16

KSI

	MODSE	HISE	FAM	FRI	HOME	NBH
SS	0.05	0.02	0.18	-0.08	-0.09	-0.05
EN	-0.36	-0.18	-0.10	0.03	0.52	0.47
AG	0.06	0.06	-0.67	0.23	-0.04	-0.06

KSI

	COM	AGE
SS	0.05	-0.07
EN	-0.14	0.01
AG	-0.09	1.06

TI Physical Activity in older Thai people

Standardized Solution

LAMBDA-Y

	PA	POE	NOE	SE
PA	432.26	- -	- -	- -
PPOE	- -	0.60	- -	- -
MPOE	- -	0.54	- -	- -
PNOE	- -	- -	0.72	- -
MNOE	- -	- -	0.91	- -
LOWSE	- -	- -	- -	1.78
MODSE	- -	- -	- -	2.25
HISE	- -	- -	- -	1.72

LAMBDA-X

	SS	EN	AG
FAM	7.96	- -	- -
FRI	-1.45	- -	- -
HOME	- -	2.28	- -
NBH	- -	1.90	- -
COM	- -	0.45	- -
AGE	- -	- -	6.80

BETA

	PA	POE	NOE	SE
PA	- -	0.10	-0.24	0.49
POE	- -	- -	- -	0.49
NOE	- -	- -	- -	-0.52
SE	- -	- -	- -	- -

GAMMA

	SS	EN	AG
PA	- -	0.44	-0.10
POE	- -	- -	- -
NOE	- -	- -	- -
SE	0.32	- -	- -

Correlation Matrix of ETA and KSI

	PA	POE	NOE	SE	SS	EN
PA	1.00					
POE	0.39	1.00				
NOE	-0.50	-0.26	1.00			
SE	0.64	0.49	-0.52	1.00		
SS	0.12	0.16	-0.17	0.32	1.00	
EN	0.37	-0.05	0.05	-0.10	-0.33	1.00
AG	-0.19	-0.07	0.08	-0.15	-0.47	0.03

Correlation Matrix of ETA and KSI

	AG
AG	1.00

PSI
Note: This matrix is diagonal.

PA	POE	NOE	SE
0.35	0.76	0.73	0.90

Regression Matrix ETA on KSI (Standardized)

	SS	EN	AG
PA	0.21	0.44	-0.10
POE	0.16	- -	- -
NOE	-0.17	- -	- -
SE	0.32	- -	- -

TI Physical Activity in older Thai people

Completely Standardized Solution

LAMBDA-Y

	PA	POE	NOE	SE
PA	1.00	- -	- -	- -
PPOE	- -	0.91	- -	- -
MPOE	- -	0.81	- -	- -
PNOE	- -	- -	0.73	- -
MNOE	- -	- -	0.84	- -
LOWSE	- -	- -	- -	0.83
MODSE	- -	- -	- -	0.89
HISE	- -	- -	- -	0.70

LAMBDA-X

SS	EN	AG

FAM	1.00	- -	- -
FRI	-0.17	- -	- -
HOME	- -	0.68	- -
NBH	- -	0.72	- -
COM	- -	0.21	- -
AGE	- -	- -	1.00

BETA

	PA	POE	NOE	SE
PA	- -	0.10	-0.24	0.49
POE	- -	- -	- -	0.49
NOE	- -	- -	- -	-0.52
SE	- -	- -	- -	- -

GAMMA

	SS	EN	AG
PA	- -	0.44	-0.10
POE	- -	- -	- -
NOE	- -	- -	- -
SE	0.32	- -	- -

Correlation Matrix of ETA and KSI

	PA	POE	NOE	SE	SS	EN
PA	1.00					
POE	0.39	1.00				
NOE	-0.50	-0.26	1.00			
SE	0.64	0.49	-0.52	1.00		
SS	0.12	0.16	-0.17	0.32	1.00	
EN	0.37	-0.05	0.05	-0.10	-0.33	1.00
AG	-0.19	-0.07	0.08	-0.15	-0.47	0.03

Correlation Matrix of ETA and KSI

	AG
AG	1.00

PSI
Note: This matrix is diagonal.

PA	POE	NOE	SE
0.35	0.76	0.73	0.90

THETA-EPS

	PA	PPOE	MPOE	PNOE	MNOE	LOWSE
PA	- -					
PPOE	- -	0.17				
MPOE	- -	- -	0.34			
PNOE	- -	-0.25	-0.24	0.47		
MNOE	- -	-0.21	-0.15	- -	0.30	
LOWSE	- -	- -	- -	- -	- -	0.32
MODSE	- -	- -	- -	0.07	- -	- -
HISE	- -	- -	- -	- -	- -	- -

THETA-EPS

	MODSE	HISE
MODSE	0.20	
HISE	- -	0.51

THETA-DELTA-EPS

	PA	PPOE	MPOE	PNOE	MNOE	LOWSE
FAM	- -	- -	- -	0.15	0.13	0.13
FRI	- -	- -	- -	- -	- -	0.10
HOME	- -	0.50	0.38	-0.28	-0.31	0.37
NBH	- -	0.36	0.29	-0.27	-0.25	0.18
COM	- -	- -	- -	- -	-0.11	- -
AGE	- -	- -	- -	- -	- -	-0.03

THETA-DELTA-EPS

	MODSE	HISE
FAM	- -	- -
FRI	- -	- -
HOME	0.40	0.37
NBH	0.29	0.23
COM	- -	- -
AGE	- -	- -

THETA-DELTA

	FAM	FRI	HOME	NBH	COM	AGE
FAM	- -					
FRI	0.56	0.97				
HOME	0.33	- -	0.54			
NBH	0.23	- -	- -	0.49		
COM	- -	- -	- -	0.15	0.96	
AGE	0.51	- -	- -	- -	- -	- -

Regression Matrix ETA on KSI (Standardized)

	SS	EN	AG
PA	0.21	0.44	-0.10
POE	0.16	- -	- -
NOE	-0.17	- -	- -
SE	0.32	- -	- -

TI Physical Activity in older Thai people

Total and Indirect Effects

Total Effects of KSI on ETA

	SS	EN	AG
PA	0.21	0.19	-0.02
	(0.04)	(0.04)	(0.01)
	5.60	5.47	-2.09
POE	0.16	- -	- -
	(0.03)		
	5.02		

```
 NOE      -0.17        - -         - -
         (0.03)
          -5.03

  SE       0.32        - -         - -
         (0.06)
           5.78


   Indirect Effects of KSI on ETA

                SS          EN          AG
           --------    --------    --------
  PA       0.21        - -         - -
         (0.04)
           5.60

 POE       0.16        - -         - -
         (0.03)
           5.02

 NOE      -0.17        - -         - -
         (0.03)
          -5.03

  SE        - -        - -         - -


   Total Effects of ETA on ETA

                PA         POE         NOE          SE
           --------    --------    --------    --------
  PA        - -         0.10       -0.24        0.67
                       (0.06)      (0.06)      (0.05)
                        1.73       -3.84       12.16

 POE        - -         - -         - -         0.49
                                               (0.06)
                                                7.95

 NOE        - -         - -         - -        -0.52
                                               (0.08)
                                               -6.79

  SE        - -         - -         - -         - -

 Largest Eigenvalue of B*B' (Stability Index) is   0.779
```

Indirect Effects of ETA on ETA

	PA	POE	NOE	SE
PA	- -	- -	- -	0.17 (0.05) 3.36
POE	- -	- -	- -	- -
NOE	- -	- -	- -	- -
SE	- -	- -	- -	- -

Total Effects of ETA on Y

	PA	POE	NOE	SE
PA	432.26	42.12 (24.35) 1.73	-103.47 (26.98) -3.84	287.65 (23.65) 12.16
PPOE	- -	0.60	- -	0.29 (0.04) 7.95
MPOE	- -	0.54 (0.05) 10.13	- -	0.27 (0.04) 7.07
PNOE	- -	- -	0.72	-0.38 (0.06) -6.79
MNOE	- -	- -	0.91 (0.10) 8.68	-0.47 (0.06) -7.75
LOWSE	- -	- -	- -	1.78
MODSE	- -	- -	- -	2.25 (0.13) 17.39
HISE	- -	- -	- -	1.72 (0.13) 13.50

Indirect Effects of ETA on Y

	PA	POE	NOE	SE
PA	- -	42.12 (24.35) 1.73	-103.47 (26.98) -3.84	287.65 (23.65) 12.16
PPOE	- -	- -	- -	0.29 (0.04) 7.95
MPOE	- -	- -	- -	0.27 (0.04) 7.07
PNOE	- -	- -	- -	-0.38 (0.06) -6.79
MNOE	- -	- -	- -	-0.47 (0.06) -7.75
LOWSE	- -	- -	- -	- -
MODSE	- -	- -	- -	- -
HISE	- -	- -	- -	- -

Total Effects of KSI on Y

	SS	EN	AG
PA	91.58 (16.35) 5.60	83.21 (15.22) 5.47	-6.66 (3.18) -2.09
PPOE	0.09 (0.02) 5.02	- -	- -
MPOE	0.09 (0.02) 4.77	- -	- -
PNOE	-0.12 (0.02) -5.03	- -	- -
MNOE	-0.15 (0.03) -5.32	- -	- -
LOWSE	0.57 (0.10) 5.78	- -	- -

```
   MODSE       0.72         - -         - -
              (0.12)
               6.15

    HISE       0.55         - -         - -
              (0.09)
               5.83


TI Physical Activity in older Thai people

Standardized Total and Indirect Effects

        Standardized Total Effects of KSI on ETA


                 SS          EN          AG
            --------    --------    --------
      PA       0.21        0.44       -0.10
     POE       0.16         - -         - -
     NOE      -0.17         - -         - -
      SE       0.32         - -         - -

        Standardized Indirect Effects of KSI on ETA

                 SS          EN          AG
            --------    --------    --------
      PA       0.21         - -         - -
     POE       0.16         - -         - -
     NOE      -0.17         - -         - -
      SE        - -         - -         - -

        Standardized Total Effects of ETA on ETA

                 PA         POE         NOE          SE
            --------    --------    --------    --------
      PA        - -        0.10       -0.24        0.67
     POE        - -         - -         - -        0.49
     NOE        - -         - -         - -       -0.52
      SE        - -         - -         - -         - -

        Standardized Indirect Effects of ETA on ETA

                 PA         POE         NOE          SE
            --------    --------    --------    --------
      PA        - -         - -         - -        0.17
     POE        - -         - -         - -         - -
     NOE        - -         - -         - -         - -
      SE        - -         - -         - -         - -

        Standardized Total Effects of ETA on Y

                 PA         POE         NOE          SE
            --------    --------    --------    --------
      PA     432.26       42.12     -103.47      287.65
    PPOE        - -        0.60         - -        0.29
    MPOE        - -        0.54         - -        0.27
    PNOE        - -         - -        0.72       -0.38
    MNOE        - -         - -        0.91       -0.47
   LOWSE        - -         - -         - -        1.78
   MODSE        - -         - -         - -        2.25
```

HISE	- -	- -	- -	1.72

Completely Standardized Total Effects of ETA on Y

	PA	POE	NOE	SE
PA	1.00	0.10	-0.24	0.67
PPOE	- -	0.91	- -	0.45
MPOE	- -	0.81	- -	0.40
PNOE	- -	- -	0.73	-0.38
MNOE	- -	- -	0.84	-0.44
LOWSE	- -	- -	- -	0.83
MODSE	- -	- -	- -	0.89
HISE	- -	- -	- -	0.70

Standardized Indirect Effects of ETA on Y

	PA	POE	NOE	SE
PA	- -	42.12	-103.47	287.65
PPOE	- -	- -	- -	0.29
MPOE	- -	- -	- -	0.27
PNOE	- -	- -	- -	-0.38
MNOE	- -	- -	- -	-0.47
LOWSE	- -	- -	- -	- -
MODSE	- -	- -	- -	- -
HISE	- -	- -	- -	- -

Completely Standardized Indirect Effects of ETA on Y

	PA	POE	NOE	SE
PA	- -	0.10	-0.24	0.67
PPOE	- -	- -	- -	0.45
MPOE	- -	- -	- -	0.40
PNOE	- -	- -	- -	-0.38
MNOE	- -	- -	- -	-0.44
LOWSE	- -	- -	- -	- -
MODSE	- -	- -	- -	- -
HISE	- -	- -	- -	- -

Standardized Total Effects of KSI on Y

	SS	EN	AG
PA	91.58	189.75	-45.27
PPOE	0.09	- -	- -
MPOE	0.09	- -	- -
PNOE	-0.12	- -	- -
MNOE	-0.15	- -	- -
LOWSE	0.57	- -	- -
MODSE	0.72	- -	- -
HISE	0.55	- -	- -

Completely Standardized Total Effects of KSI on Y

	SS	EN	AG
PA	0.21	0.44	-0.10
PPOE	0.14	- -	- -

MPOE	0.13	- -	- -
PNOE	-0.12	- -	- -
MNOE	-0.14	- -	- -
LOWSE	0.26	- -	- -
MODSE	0.28	- -	- -
HISE	0.22	- -	- -

Time used: 0.063 Seconds

BIOGRAPHY

Mayuree Leethong-in was born in 1964. Sh e received a Bachelor of Science (Nursing) from nursing from Khon Khan Univ ersity in 1986. She got a Master of Nursing Science (Adult Nursing), Khon Khan University in 1993. Mayuree had 5 year of clinical experience in acute and chronic care nursing (Surgery Department) and 13 years of working as an instructor in the field of Adul t Nursing at Faculty of Nursing, Khon Khan University. She attend study Philosophy Program in Nursing Science, Faculty of Nursing, Chulalongkorn University since 2005-2009.