School of Occupational Therapy

Fear of Falling and Fall Circumstances in Thailand

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DECLARATION

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

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ABSTRACT

Numerous Thai older people fall each year. Although it has been shown that only 3.1% of fallers sustained fractures (Nevitt, Cumming, Kidd, & Black, 1989), injuries in older people are often more serious. For example, hospital charges for older adult fall injuries are about US $2,000 per person higher than for young fallers (Ellis & Trent, 2001). Moreover, falling can lead to social isolation, physical restraint, disability and institutionalisation (Donald & Bulpitt, 1999; Tideiksaar, 1994). Therefore falling in old age results in a considerable burden on, not only the individual concerned, but also the whole society.

Internationally, a successful falls prevention program usually employs a multidimensional approaches (Alexander & Edelberg, 2002; Mosley, Galindo-Ciocon, Peak, & West, 1998). However, limited information about fall prevention has been reported in Thailand. A survey indicated that Thai elderly fall outside their homes which is different from the findings in Western countries (Jitapunkul et al., 1998). This suggests that adoption of fall prevention strategies from Western countries might not be successful in Thailand. Prior to this study, details of fall circumstances in terms of location, time, associated activity, hazards and type of falls in Thai older people were not available. Moreover, there was no information about fear of falling and activity restriction. These are important fall consequences that impact on quality of life and themselves are risk factors for falls.

The purpose of this study was to determine the prevalence of fear of falling, and to describe activity restriction in fallers and non-fallers, and the circumstances associated with falls in Thailand. No fear of falling measurement tools for Thai older people were available prior to the study. Therefore the Survey of Activities and Fear of Falling in the elderly (SAFE) has been modified for use with Thai elderly people.

The SAFE was translated to Thai by a certified translator, checked for cultural relevance and back-translated by a second translator; reliability testing then took

place in Thailand. Face validity and cultural appropriateness were tested with a sample of convenience of 10 bilingual Thai elderly people living in Perth, Australia. After translation into Thai, 4 items showed less than 80% agreement and required adjustment to capture the equivalent meaning of the original version. The 'take a shower/wash yourself with a basin of water' was added because the participants reported that taking a tub bath is not common or traditional in Thailand. However, the item 'take a tub bath' was retained until the examination in the main study confirmed that less than 1% of Thai older persons had taken a tub bath and inclusion of the item confounded actual fear of falling results.

Interrater reliability was tested; nine 4th year occupational therapy students and 15 older persons living in the Chiang Mai community were recruited. The intraclass correlation coefficient of fear of falling of activities done, activities not done and activity restriction scores were .9845, .9236 and .9718 respectively ($p < 0.001$). Four raters and 50 older community dwellers participated in the intrarater and test-retest reliability tests. The results showed that intrarater reliability of all raters exceed 0.8 in every scores ($p < .001$). The test-retest also demonstrated good reliability: .9960, .9376 and .9849 ($p < 0.0001$) for fear of falling of activities done, activities not done and activity restriction scores respectively.

Five hundreds and forty six Thai older adults were then recruited by multistage random sampling. Fall history, fall circumstances, fear of falling and activity restriction data were obtained by structured interview and using the Thai version of the SAFE. The results demonstrated that prevalence of falls, fear of falling and activity restriction in Thai older people were 21%, 48% and 18%, respectively. Comparison between fallers and non-faller showed that fallers were more likely to be older ($p < .001$), female [χ^2 (1, N = 546) = 6.133; p = .013], not married [χ^2 (4, N = 546) = 61.102; p = .001], living alone [χ^2 (1, N = 546) = 4.313; p = .04], rated their health as poorer [χ^2 (4, N = 546) = 13.232; $p < .001$], had fear of falling [χ^2 (1, N = 546) = 6.265; p = .015] and activity restriction [χ^2 (1, N = 546) = 5.488; p = .027]. Older persons with a fear of falling tended to be older (p = .005), lower educated ($p < .001$), female [χ^2 (1, N = 546) = 29.602; p = .001],

rated their health as poorer [χ^2 (4, N = 546) = 69.70; p < .001], had fallen [χ^2 (1, N = 546) = 6.265; p = .015] and had activity restriction [χ^2 (1, N = 546) = 23.267; p < .001]. Older adults who curtailed their activities tended to be married [χ^2 (1, N = 546) = 6.188; p = .013], rated their health as poorer [χ^2 (4, N = 546) = 14.302; p = .006], have a fall history [χ^2 (1, N = 546) = 5.488; p = .027] and have a fear of falling [χ^2 (1, N = 546) = 23.267; p < .001]. Using Chi-square test, the results showed that there were significant associations between falls and fear of falling χ^2 (1, N = 546) = 6.265; p = .015], falls and activity restriction [χ^2 (1, N = 546) = 5.488; p = .027] and fear of falling and activity restriction [χ^2 (1, N = 546) = 23.267; p < .001].

Fall circumstances of 114 falls demonstrated that most falls took place outdoors (65%), were associated with work (40%), involved environmental hazards (76%), occurred during the daytime (90%). Moreover most falls were falls on the same level from slipping, tripping or stumbling (61%).

Logistic regression analysis indicated that risk factors for fear of falling in Thai older people were age (odds ratio = 1.025), unmarried-female (odds ratio = 5.979), married female (odds ratio = 1.903), poor self perceived health (odds ratio = 3.383) and more than 2 falls experience (odds ratio = 7.202). The protective factors were unmarried marital status for men (odds ratio = 0.344) and level of education (odds ratio = 0.933 2 or less falls and = 0.5625 if more than 2 falls in 12 months). The logistic model also provided a logistic equation for individual prediction of probability of fear of falling. To calculate the probability of having fear of falling, 6 parameters are required: age, gender, marital status, level of education, self-perceived health and number of falls in the past 12 months. The equation predicts with 70% accuracy and can be used for screening fear of falling in Thai elderly people.

In conclusion, this study has modified a measurement tool (the SAFE Thai version) and developed a screening tool (logistic equation) for fear of falling. Both of them appear to be appropriate to further examine FOF in Thai elderly. The survey results showed a considerably number of Thai elderly people have fall experiences, fear of falling and activity restriction. The predisposing factors

for each problem have been identified. The association between 3 problems implicated that fear of falling and activity restriction interventions are necessary for fall prevention. The fall circumstances data show that conditions of falls in Thai elderly people were similar and dissimilar to those in Western countries. The preventive efforts to reduce falls should consider these distinctive fall circumstances.

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CHAPTER 1: INTRODUCTION

Falls are the most common problem for the older population. In Western countries, approximately one-third of community dwelling elderly adults fall each year (Campbell, Borrie, & Spears, 1989; Downton, 1993; Sattin, 1992; A. Tromp et al., 2001). As in many other countries, falls are also common among Thai older persons. A national survey has reported around 20% of Thai older people have fallen (Jitapunkul et al., 1998).

It has been shown that falls lead to minor injuries, fractures, hospitalisation, disability, nursing home placement, decreasing quality of life and premature death (Arfken, Lach, Birge, & Miller, 1994; Ho, Woo, Chan, Yuen, & Sham, 1996; Lanchman et al., 1998; Nevitte, Cumming, Kidd, & Black, 1989; Sattin, 1992). However, falls in elderly adults are, in many cases, avoidable. Internationally, interventions to prevent falls includes treating underlying diseases and fall-associated risk factors (Alexander & Edelberg, 2002). Effective interventions usually employ multi-dimensional approaches including educational programs, exercise programs, balance training, endurance and resistant training, home visits and home modifications (Alexander & Edelberg, 2002; Auriemma, Faust, Sibrian, & Jimenez, 1999; Mosley et al., 1998; Stuck, Egger, Hammer, Minder, & Beck, 2001; van Haastregt et al., 2001). Fear of falling (FOF) is a serious consequence of falls, and is itself a risk factor for falls (Friedman, Munoz, West, Rubin, & Fried, 2002; Lawrence et al., 1998). Consequently, the prevention of FOF is also included in prevention programs (Tideiksaar, 1994).

Although it is known that Thai elderly adults fall, little research is available on which to base treatment or public health campaigns. Fall circumstances in Thai elderly are unknown. In Western countries, the majority of falls occur in the home (Department of Trade and Industry, 2000; Downton, 1993; Ellis & Trent, 2001); kitchen, living room and bedroom are common places for falls. Although there are no details of fall circumstances in Thailand, the national survey revealed that 65% of falls in Thai elderly occurred outside (Jitapunkul et al., 1998). Therefore, the

effectiveness of falls prevention programs based on Western models is questionable as fall circumstances and FOF may differ in Thailand.

To date, there is no information concerning fear of falling and fall related activity restriction amongst Thai older adults. These are major fall consequences that increase probability of recurrent falls and decrease quality of life for the elderly (Cumming, Salkeld, Thomas, & Szonyi, 2000; Friedman et al., 2002; Lawrence et al., 1998; Suzuki, Ohyama, Yamada, & Kanamori, 2002). Further information on fear of falling and activity restriction is required in order to develop effective falls prevention programs for Thai older adults.

The overall objective of this study is to investigate the prevalence of FOF, activity restriction in fallers and non-fallers, and the circumstances associated with falls. However, no measurement tool for FOF is available in Thailand. Therefore, the Survey of Activities and Fear of Falling in the Elderly (SAFE) was modified for use with Thai older people. Because the SAFE was developed within a Western culture, it required adaptation and testing in order to be used in Thailand. Following validation, the survey was used to investigate the prevalence of fear of falling, activity restriction and to describe fall circumstances in Thailand. The time, location, activities associated with falls and fall types were explored. Next the association between falls, fear of falling and activity restriction were investigated. As the results indicated that older persons who had a fear of falling and no fear of falling differed on many attributes, a screening tool was developed.

This study can be divided into three parts: adaptation of the measurement tool including validity and reliability of the SAFE (Thai version); FOF, activity restriction and fall circumstances survey; and FOF screening tool development. Therefore, the thesis is organised into three sections to address the three separate research questions. A brief review of related research is presented in the first chapter. Each subsequent chapter has an introduction, containing related theory and scientific background. This introduction is designed to provide the context for that chapter and includes a related literature review, the research questions and plans for each part of the study. Because each chapter contains a related literature review, chapter 1 remains brief. Following the introduction, the purpose of the chapter is described. The methodology, results and discussion of each research

question are presented next. At the end of each chapter is a summary that reviews the findings of the research presented. A brief orientation to chapter 2 to 6 follows.

Chapter 2 reviews the literature on falls, FOF and activity restriction. Falls prevention strategies currently used in Western cultures are also detailed in this chapter.

Chapter 3 addresses adaptation and validity of the SAFE Thai version; a tool for measuring FOF. The introduction reviews the measurement tools for FOF and issues related to cross-cultural measurement tool modification. Next, the methodology and results of the modification procedure are explained. The chapter ends with the discussion and summary of the validity of the SAFE Thai version.

Chapter 4 reports on the reliability testing of the SAFE Thai version. Methodological issues of reliability measurement are reviewed. Methodology for intrarater, interrater and test-retest reliability testing is described. The results, discussion and summary are included at the end of this chapter.

Chapter 5 reports on the main research question. The introduction includes a review of literature on falls in Thailand, followed by a description of the methodology used for the main survey of 546 elderly adults in Thailand. As there are methodological issues related to use of the SAFE Thai version, these issues are discussed before data analysis. Next, the results are then presented. The chapter ends with the discussion and conclusion of the main study.

Chapter 6 reports on the development of the FOF screening tool based on the main study data. The logistic regression was used for analysis and screening tool development. Thus, logistic regression background theory is reviewed in the introduction. The methodology, results, discussion and summary are included in the chapter.

Chapter 7 is the overall discussion and summary of the study.

CHAPTER 2: LITERATURE REVIEW

2 Introduction

Falls are a serious problem for elderly people. The tendency of older people to fall is widely recognised with thirty to forty percent of elderly people falling each year in the United States of America (Downton, 1993; Sattin, 1992; A. Tromp et al., 2001), Australia (Lord, Ward, Williams, & Anstey, 1993), and New Zealand (Campbell et al., 1989). Fall prevalence studies show significant medical, social and economics consequences (Arfken et al., 1994; Ho et al., 1996; Lanchman et al., 1998; Nevitt et al., 1989; Sattin, 1992; Tideiksaar, 1998). The consequences of falls range from minor physical injury or immobility to psychological trauma or a morbid fear of falling. It is also known that falls-related deaths increase gradually with age. Even though falls are generally considered an accident, one study has shown that the incidence of falls was statistically different from incidents of poisoning (Evans, 1990). Evan proposed that falls do not occur by chance. Several risk factors for falls have been investigated in order to prevent falls (Close et al., 1999). A complex relationship between many risk factors has been established leading to the conclusion that falls are probably caused by an interaction of many risk factors specific to each individual (Downton, 1993; Tinetti et al., 1994a; Tinetti & Speechley, 1989). Although many interventions have been developed which have been found to reduce the incidence of falls (Henkel, 2002; Moreland et al., 2003), it is also clear that, due to the complexity of falls, different groups of elderly are likely to require different assessments and interventions. This chapter examines the epidemiology of falls in community dwelling older persons. Definition of falls, ascertainment of falls, incidence of falls, fall risk factors, fall consequences and fall prevention strategies are described in this chapter. Fear of falling and activity retraction are also reviewed.

2.1 Definitions and Classifications of Falls

The fact that falls occur at all stages of life, on one hand, means they are unremarkable. For this reason, many early studies related to falls and the elderly failed to clarify an adequate definition of falls. For example, some studies focused on accidents. Although a large proportion of accidents involving elderly

adults are falls, "accidents" also include non-fall accidents (Downton, 1993). In 1987, The Kellogg International Work group defined a fall as:

> "*an event which results in a person coming to rest inadvertently on the ground or other lower level and other than as a consequence of the following: sustaining a violent blow; loss of consciousness; sudden onset of paralysis, as in a stroke; or an epileptic seizure*" (Sattin, 1992).

Following this, most fall studies have used this fall definition or a very similar definition of a fall (Lord, Sherrington, & Menz, 2001; Sattin, 1992).

However, some fall definitions remain clinical or research-oriented and require a different interpretation for each study. For instance, O' Loughlin, Robitaille, Boivin, and Suissa (1993) defined a fall as an event which results in a person's coming to rest inadvertently on the ground or other level. All unintentional falls onto a chair or bed and falls against objects during which participants did not come to rest on the ground, and sport related falls were excluded. Whereas Boulgarides, McGinty, Willett, and Barnes (2003) defined falls as any disturbance of balance during routine activity that resulted in a person's trunk, knee, or hand unintentionally coming to rest on the ground, wall, table, chair or some other surface and sport related falls were included by this definition.

In contrast, some studies have addressed cardiovascular causes of falls such as syncope, postural hypotension and transient ischemic attack. Therefore, they used a definition to include falls caused by these symptoms.

The conclusions drawn from these definitions are difficult in terms of application and comparison across studies. Additionally, these definitions of falls require an extensive interview or subjective measurements to identify the falls or must be based on patients' medical records about fall circumstances. Therefore, they are not only subject to recall and interview bias that might lead to inconsistency but are also likely to miss a substantial number of falls (Sattin, 1992).

Once falls are defined, they are usually further classified into subtypes of falls. There are three types of fall classification. Firstly, number of falls over a period of time is used for classification: no falls, one fall, multiple falls or recurrent falls. Most fall studies have counted the number of falls over the same period of time but some have provided a more restricted definition for recurrent falls by counting falls within a shorter period of time for example, recurrent fallers were defined as participants who fell at least two times within six months whereas other falls were counted over a 1 year period (van Schoor, Smit, Pluijim, Jonker, & Lips, 2002). Secondly, falls are classified by aetiology (Sattin, 1992) because of the multifaceted and multifactorial nature of falls. Recent research has demonstrated that falls are the result of a complex interaction between underlying diseases (e.g. cardiovascular and neuromuscular diseases) and environments (Downton, 1993; Myers, Young, & Langlois, 1996; Sattin, 1992). In general, two categories have been used for fall aetiology classification: intrinsic and extrinsic factors. Intrinsic factors vary depending on the particular study and researcher's interests e.g. dizziness, balance impairment, cardiovascular diseases and other medical episodes (Downton, 1993). The extrinsic group consists of environmental causes of falls for example slips and trips (Downton, 1993). They can be further coded according to the external causes of the injuries as defined by the International Classification of Diseases, (ICD10) (National Centre for Classification in Health, 1998). Finally, falls are classified by their consequences. As falls might lead to injury such as fracture or traumatic brain injuries (Sattin, 1992), specific types of falls related to the injury are classified in order to create an effective intervention programme. These classifications are used variously depending on researcher's interest.

2.2 Fall Ascertainment

Fall ascertainment is the way that falls are counted. It is another important issue to be considered in fall studies. Falls data collection can be performed by retrospective or prospective designs. Each method has advantages and disadvantages in terms of accuracy, cost, data collection time, participation and dropout rates (Downton, 1993; Lord et al., 2001).

In retrospective designs, older persons are asked whether and/or how many times they have fallen in a past period – 3, 6 or 12 months. This method has the advantage of being low cost and easy to apply. However, accuracy and reliability problems of a retrospective design are unavoidable, because it depends on participants' memory. In the case of falls, it has been shown that a person with cognitive impairment is more likely to fall (Clark, Lord, & Webster, 1993; Tinetti, 1988). Therefore people who are most at risk are least likely to accurately remember their falls. The accuracy of retrospective recall of falls has been investigated and, it has been shown that 13% of older persons with documented falls over a 12 month period fail to recall their falls (Cumming, Nevitte, & Kidd, 1988). Unexpectedly, the inaccurate recall rate was higher when the recall period was 3 and 6 months (Cumming et al., 1988). However, a recent study reported a good concordance of prospective and 12 months retrospective fall records (Kappa = 0.70) with 79.5% sensitivity and 91.4% specificity (Peel, 2000).

A prospective design follows participants for a period to determine actual falls. The advantage of this method is accuracy. The accuracy, however, depends on researchers contacting participants regularly. There are a number of methodologies to record falls in the prospective follow up period e.g. mail-out questionnaires(Lord, Ward, William, & Anstey, 1994), fall calendars (Tinetti, 1988), and/or periodic telephone interview (O'Loughlin et al., 1993) have been used. For community dwellers, the only possible way to monitor falls is by self-report (Lord et al., 2001). Therefore, it is still possible that some falls will escape reporting. Furthermore, compared to the retrospective design, this method requires greater effort on the part of participants. Those who are illiterate or who have low levels of education may not be able to accurately report their falls by mail-out questionnaires or fall calendars. A telephone interview is a possible way to record falls, but may require many calls to contact older persons. Additionally, telephone networks may not be available in remote/rural areas of all countries. Because of the burden on participants, prospective studies are usually compromised by high drop out rates or positive bias.

2.3 Epidemiology of Falls

2.3.1 Fall prevalence

Although fall definitions varied and participants were more or less randomly selected, studies of falls in Western countries provide a similar annual fall prevalence rate. Extensive reviews have shown that one third of older adults aged 65 and over fall each year (Downton, 1993; Sattin, 1992). Prospective studies report slightly higher rates of approximately 40-45% in older community dwellers (Boulgarides, McGinty, Willett, & Barnes, 2003; Mackenzie, Byles, & Higginbotham, 2002; Nevitt et al., 1989; Tinetti, 1988). For those who live in institutions, the fall rate increases from 40-66% (Downton, 1993; Lord et al., 2001). Once older people fall, they are more likely to fall again (Nevitt et al., 1989). Fall rates also increase with advancing age (Lord et al., 2001; Tideiksaar, 1998). The highest fall rate has been demonstrated in the 80-89 year old group (Luukinen, Koski, Hiltunen, & Kivela, 1994).

Interestingly, the fall prevalence appears to be lower in Asian countries. Hong Kong, Japan and Thailand have reported around a 20% fall rate in older adults (Aoyagi et al., 1998; Ho et al., 1996; Jitapunkul et al., 1998). Nevertheless, it should be noted that in Thailand, only falls that occurred within the 6 months prior to that study were counted and the older adults were people aged 60 and over. Most Western studies were conducted in people aged 65 and over and falls in the previous year were recorded. One study reported a 12.9% and 16.5% fall prevalence in Japanese aged 40-59 years and aged 60-79 years respectively (Niino, Tsuzuku, Ando, & Shimokata, 2000). For those who lived in nursing care facilities, the incidence of falls was 20.8% in Japan (Izumi, Makimoto, Mayumi, & Tomoko, 2002). However, the falls incidence was monitored for only a 3 months period in this study. Thus, even though methodological differences exist between Western and Asian studies falls appears to be important problem in older adults across studies.

2.3.2 Fall circumstances

In Western countries, between half and three quarters of falls occur in or around the home, two thirds of these occurring inside the house (Downton, 1993; Ellis & Trent, 2001; Lord et al., 2001; Parker, Twemlow, & Pryor, 1996). Three quarters

of falls inside the house happen in the kitchen, living room or bedroom. The main hazards involved in falls are stairs and internal steps, carpet or underlay fitted or not fitted, floor, concrete surface and stairs or step outdoors (Department of Trade and Industry, 2000). Only one Australian study has reported that the majority of falls occurred outdoors (Hill, Schwarz, Flicker, & Carroll, 1999). However, one of the inclusion criteria of that study was going outside regularly. Falls occurring away from home are more common for healthy elderly and the risk of injury is higher than for falls in and around the home (Speechley & Tinetti, 1991).

In terms of time of day, most falls occur during the daytime (Allander et al., 1998; Downton, 1993; Lord et al., 2001). Only approximately 20% of falls occur between 9 p.m. to 7 a.m. (Campbell et al., 1990). Mobility ("walking") is the activity most frequency associated with falls (Mackenzie et al., 2002; Nevitt et al., 1989). One study has shown that in falls that result in fractures, more than two-thirds occurred where falling on the same level (Allander et al., 1998). Slipping accounted for almost half of falls whereas tripping on rugs comprised less than 10% (Allander et al., 1998). However, this study was conducted in 14 centres in 6 countries in southern Europe, and the results demonstrated a wide range between centres. This might suggest variability in the fall circumstances due to geographic, cultural and social differences. Weather and/or seasonal factors have certainly been shown to play a role in falls (Parker & Martin, 1994; Pedrazzoni, Alfano, Malvi, Ostanello, & Passeri, 1993).

As with prevalence rates, differences appear to exist in Asian countries as compared to North America and Europe. For example, studies in Hong Kong and Japan reported that more than half of the falls occur outside the home (Ho et al., 1996; Niino et al., 2000). In Thailand, although elderly people included in a qualitative study emphasized both in home and community environment risk factors (Bunrayong, Apikomonkon, & Rattakorn, 2002), the one national survey indicated that 65% of Thai elderly people fell outside (Jitapunkul et al., 1998). The similarity of findings with those in Hong Kong and Japan may again indicate important geographic or cultural differences. With fewer studies reported in Asia,

it is difficult to come to a strong conclusion but the evidence does suggest a need for close examination.

2.4 Risk Factors for Falls

There are many published studies on the subject of falls risk factors. However, results differ depending on the nature of participants, factors under investigation and the definition of falls used. Trade-offs between reliability of data collected (retrospective versus prospective recall bias) and the expense of data collection and burden to participants may explain why some findings are contradictory. Nevertheless, there are many factors that have been found to be consistently associated with falls.

It is generally agreed that the risk of falling depends on an interaction of many factors: intrinsic and extrinsic. Additionally, the interaction may be different at different ages and activity levels. For example, because of age-related physiological changes, the ability of older people to negotiate risky environments decreases (Tideiksaar, 1998). Therefore, falls in older people are more likely caused by combination of factors rather than a single intrinsic or extrinsic factor.

2.4.1 Intrinsic factors

There are a number of intrinsic factors associated with falls. These factors fall into two categories: age-related physiological changes; and medication, acute and chronic diseases.

2.4.1.1 Age-related physiological changes

Advancing age has been proven to be one of the main factors associated with falls (Blake et al., 1988; Campbell et al., 1989; Cwikel, 1992; Haga, Shibata, Shichita, Matsuzaki, & Hatano, 1986; Herala et al., 2000; Moreland et al., 2003; Myers et al., 1996; Nevitt et al., 1989; Prudham & Evans, 1981; Tinetti, 1988). With advancing age, many systems gradually decline in function. This affects ability to maintain upright posture during ambulation or transfer. The following are age-related changes known to influence the risk of falling.

- Sensory changes

Among all sensory systems, vision plays an important role in fall causation. Eyes of older people require more time to adjust to varying levels of light and darkness; have greater sensitivity to glare; have a restricted visual field; have less visual acuity and loose of contrast sensitivity (Lord et al., 2001). Because of these changes, older people have difficulty seeing objects in the environment. Falls associated with visual impairment have been shown in both cross-sectional studies (Ivers, Cumming, Mitchell, & Attebo, 1998; Klein, Klein, Lee, & Cruickshanks, 1998) and a cohort study (Klein, Moss, Klein, Lee, & Cruickshanks, 2003). Additionally, multiple fallers are known to have poor vision: including both depth perception and contrast sensitivity (Lord & Dayhew, 2001). Moreover, one study demonstrated that older adults had incorrect perception of floor slipperiness and this incorrect perception increased the likelihood of them slipping and falling (Lockhart, Woldstad, Smith, & Ramsey, 2002).

Other sensory impairments that have been identified as fall risk factors are auditory (Brauer, Burns, & Galley, 2000; Tinetti, Inouye, Gill, & Doucette, 1995) and somatosensory impairments (Brauer et al., 2000; Lord, Clark, & Webster, 1991; Lord et al., 1994; Moreland et al., 2003). These sensory functions have a major contribution to balance control.

- Balance and gait changes

Ability to maintain balance depends on an intact central nervous system, muscular function and adequate sensory inputs (visual, vestibular and proprioceptive). However, an association between vestibular function and falls has not been found (Lord et al., 2001). This suggests adequate compensation by other sensory domains such as vision and peripheral senses. As mentioned above, sensory function diminishes as people age. When the capabilities of proprioception decline, postural sway increases (Tideiksaar, 1998). To compensate for the declining function, vision is a chief support. Older people look down to ensure proper foot placement, view their seats before sitting and so on. However, visual input is also diminished by age. The vestibular system works in conjunction with the visual and

proprioceptive systems to maintain balance, so deprivation in one system can be counteracted with another input. Nevertheless, if two or more have sufficient decline, the balance threshold is lowered and the risk of falling increases.

Age-related changes in gait also might occur to compensate for declined balance (Lord et al., 2001). These changes include decreases in speed, step length and step height. Compared to non-falling older adults, fallers have a significantly smaller step length and longer duration of double support phase (Mbourou, Lajoie, & Teasdale, 2003). The changes are different between the genders. Women are more likely to develop a narrow base of walking and standing, take small steps and exhibit a pelvic waddle when walking. On the other hand, men tend to adopt a wide standing and walking base and exhibit a shuffling gait (Lord et al., 2001). However, these alterations in gait themselves do not increase the tendency to fall, and to some extent they improve stability (Downton, 1993). Regardless of stability, the lowered step height during swing phase may account for the tendency to trip. Moreover, it has been demonstrated that there are age-related changes in preserving stability in response to unpredictable perturbations (McIlroy & Maki, 1996). For older persons who require assistance in Activity of Daily Living (ADL), impaired gait is associated with injurious falls (odds ratio 2.2) (Koski, Luukinen, Laippala, & Kivela, 1998).

In summary, despite the complexity most studies have indicated that gait and balance abnormality are risk factors for falls (Bergland, Pettersen, & Laake, 2000; Campbell et al., 1989; Clark et al., 1993; Davis, Ross, Nevitt, & Wasnich, 1999; Herala et al., 2000; Ho et al., 1996; Lord et al., 1994; Moreland et al., 2003; Myers et al., 1996; Nevitt et al., 1989; O'Loughlin, Robitaille, Boivin, & Suissa, 1993; Tinetti, 1988; Vellas, Wayne, Garry, & Baumgartner, 1998).

- Musculoskeletal changes

Age-related changes in the musculoskeletal system affect capacity to maintain balance while ambulating and transferring. The changes consist of muscle atrophy, calcification of tendons and ligaments, and increased curvature of spine (Lord et al., 2001). These can cause postural changes and difficulties in

maintaining balance. However, in falls studies, only upper and lower extremity weakness or disability (Campbell et al., 1989; Moreland et al., 2003; Myers et al., 1996; Nevitt et al., 1989; Tinetti, 1988) were found to be falls related risk factors. The weakness of the lower extremity may impair the ability to exert maximum force for initiating transfers and maintaining balance during ambulation. Weakness of the upper extremity may decrease ability to provide optimal leverage during transfer and extra support to maintain balance. Moreover, in nearly all fall situations, older people usually regain their balance using upper extremities (Tideiksaar, 1998).

2.4.1.2 Medication and acute and chronic diseases

Although physiological age-related changes are known to be associated with falls, it is also suggested that underlying diseases such as neurological diseases, cardiovascular diseases, cataracts, diabetes etc. are also associated with an increased tendency to fall (Downton, 1993). Because these diseases e.g. cataracts and stroke (Klein, Klein, & Lee, 2002) are more common in old age, it is difficult or impossible to obtain older participants who do not have additional diseases. Therefore, it is necessary to identify fall-associated diseases.

A fall can be an indication of underlying acute illness or unstable chronic disease. These illnesses, for example syncope, hypotension, cardiac arrhythmias, seizures, stroke, etc cause falls by interfering with postural control (Lord et al., 2001). Underlying diseases can be further divided into fall-associated diseases where consciousness is lost and those where it is not. Acute illness associated with falls has not been considered in most fall studies as the falls normally cease after treatment of underlying acute diseases. Chronic diseases and their associated impairments have more impact on falls. They create a high risk of falls by causing persistent physical or mental conditions that impair mobility. As can be surmised from previous sections, the most common fall related diseases originate in the visual, neurological and musculoskeletal systems (Lord et al., 2001). Eye diseases such as cataracts, macular degeneration, and glaucoma interfere with the ability to detect environmental hazards and predispose older people to falling. Neurological disorders induce falls in three ways. First, they affect postural control directly. For example, Parkinson's Disease causes a loss

of autonomic postural reflexes and gait changes (short stepping, shuffling, barely clearing the ground) that lead to balance impairments and an increased risk of falling. Second, for instance neuropathy (associated with lower extremity weakness) or stroke (causes hemiplegia or paresis), chronic diseases can affect the musculoskeletal system. These increase the risk of loss of balance. Third, they can impair cognitive function. For example, dementia and Alzheimer disease are often associated with ataxia, apraxia, visual perception in object recognition and so on. These lead to misinterpretation of environmental conditions, reduced ability to avoid hazards, resulting in trips or slips and falls. Other diseases and symptoms that have been shown to increase the risk of falls are depression, urinary incontinence, orthostatic or post prandial hypotension, arthritis, dizziness, vertigo, and gastrointestinal disorder (Moreland et al., 2003; Myers et al., 1996). Poor self-perceived health in general is also associated with falls in elderly adults (Ryynanen, 1994).

Moreover, older persons who suffer from illnesses might incur the risk of falls secondary to the use of some medications, such as psychotropic, neuroleptic, cardiac and analgesic drugs (Leipzig, Cumming, & Tinetti, 1999a, 1999b). A systematic review and meta-analysis demonstrated that there is a small but consistence association between the use of psychotropic drugs and falls (Leipzig et al., 1999b). Older persons who take more than one psychotropic drug were more likely to fall. Concerning cardiac and analgesic drugs, a weak association exists between Digoxin, type IA antiarrhythmic, and diuretic use and falls in older adults (Leipzig et al., 1999a). Older persons taking more than three or four medications were also more likely to fall recurrently. Other classes of the medication are associated with falls. A recent study reported that seven specific medication classes were associated with falling in old age: such as narcotics, anti-convulsants, anti-depressants, anti-psychotics, sedatives, anti-parkinsonian and anti-cogulant agents (Kelly et al., 2003).

2.4.2 Extrinsic factors

In addition to internal factors, environmental hazards also play an important role in falls in older persons. Approximately 45% of older people living in the community

have reported falls associated with external hazards (Boulgarides et al., 2003; Mackenzie et al., 2002; Nevitt et al., 1989; Tinetti, 1988).

Because, in Western countries, most falls occur in the home (Department of Trade and Industry, 2000; Downton, 1993; Mackenzie et al., 2002), in-home environmental hazards have been extensively investigated. Generally, environmental hazards and inappropriate assistive devices and footwear have been shown to be related to falls (Alexander & Edelberg, 2002; Harrison, Booth, & Algase, 2001; Pinto et al., 1997). Many specific environmental situations have been associated with falls such as throw rugs, poor lighting, slippery or uneven flooring, obstacles in pathways, inappropriate furniture height and placement, stairs, steps and lack of grab bars (Downton, 1993; Lord et al., 2001). A prospective study demonstrated that the risk of multiple falls increased among older persons who reported one or more environmental hazards interfering with their abilities to carry out activities of daily living (ADL) in their home (Nevitt et al., 1989). Moreover, it has been demonstrated that management of these extrinsic factors is effective in decreasing the rate of falls (Mosley et al., 1998).

However, among frail older persons, environmental hazards play a less important role. It has been shown that vigorous older persons were the most likely to have falls associated with external causes (53%), compared to transitional (36%) or frail (29%) older people (Speechley & Tinetti, 1991). Another study showed only a small relationship between fall rates among frail people and environmental hazards (Northridge, Nevitt, Kelsey.J.L., & Link, 1995). In fact, changing the environment may even have detrimental effects. Northridge et al. (1995) demonstrated that the introduction of safety features in the bathroom was associated with an increase rather than a decrease in falls in the frail elderly. Despite the general consensus that environmental hazards are implicated in falls, there have been a few contrasting reports. For instance, a cohort study of 336 older adults failed to demonstrate any association between environmental hazards and falling (Tinetti, 1988). A case control study of 270 older persons who had fall related injuries and 691 sex and age-matched control subjects showed that fallers did not have significantly different fall hazards when compared to the non-fallers (Sattin, Rodriguez, DeVito, & Wingo, 1998).

On the whole, however, the evidence suggests that the risk of falling is based upon both environmental factors and personal factors. In 1980, a model of the interaction between physical ability and environmental demand was proposed (Lawton, 1980). The model indicates that the higher the demands that exist in the environment, the higher the competence level that is required for coping effectively. Lord et al (2001) employed the model to explain the roles of environmental hazards in falls. Older persons with high physical competence can live with environmental hazards without falling. However, if the hazards provide an extreme challenge, they may fall. Those with moderate physical abilities may only be able to withstand a few challenges or hazards. Those with very poor abilities may fall regardless of there being limited environmental hazards.

Not surprisingly, recent studies have questioned fall prevention programs based on general environmental modification alone. For example, Sattin (1998) noted that the universal prevention by removing all environmental hazards is less effective than expected and the necessity of some equipment, such as grab bars, is questioned.

In Thailand, a national survey has indicated that about one-fifth of elderly people have fallen (Jitapunkul et al., 1998). However, the study demonstrated that most Thai elderly fall outside their homes, which is different from the findings in Western countries. Thai fallers were more likely to live in traditional Thai style houses in rural areas where there was no electrical supply (Choprapawon, 1995; Jitapunkul et al., 1998). At this time, however there is no information on fall circumstances or specific risk factors. Further study is thus needed to investigate the circumstance of falls (location, time of day, activity) in order to create a suitable prevention program.

2.4.3 Demographic characteristics

In addition to intrinsic and extrinsic factors, some demographic characteristics have been shown to be falls risk factors. These characteristics are age, race, gender, social network and living situation. Older people living in the community are twice as likely to fall if they are age 79 or 80 and over (Nevitt et al., 1989;

Tinetti, 1988). Both Western and Eastern studies indicate that the risk of falls increases with age (Haga et al., 1986; Liu, Topper, Reeves, Gryfe, & Maki, 1995; Prudham & Evans, 1981). This supports the idea that decreasing physical abilities (e.g. sensory) with advancing age is associated with falling. It has been shown that being Caucasian is also a risk factor for falls: odds ratio = 18.4 (CI 7.5 -44.6) for major injury falls, odd ratio = 2.0 (CI 1.0 – 3.7) for minor injury falls. (Nevitt, Cumming, & Hudes, 1991; Nevitt et al., 1989). Older women tend to fall more than men (Blake et al., 1988; Campbell et al., 1990; Haga et al., 1986). There is no direct explanation for why the Caucasian race or women are more likely to fall. There was a hypothesis that the differences in fall incidents might be a result of differences in neuromuscular performance (Davis et al., 1999). A comparison of neuromuscular performance between Japanese and Caucasian women showed that Japanese women performed better in speed and balance while Caucasian women had greater strength and reported fewer functional disabilities (Davis et al., 1999). As reviewed in section 2.5.1, impaired balance and weakness of extremities are both risk factors for falls. Consequently both Japanese and Caucasian women should be equally at risk of falls. Davis et al (1999) demonstrated that Japanese and Caucasian women have different advantages and limitations in terms of neuromuscular functions. However, after adjusting for the neuromuscular function, the risk of falls for Caucasian women was still greater (odd ratio = 1.8; CI 1.5-2.1) (Davis et al., 1999). Therefore, there appears to be no obvious explanation why Caucasian older persons are more likely to fall. Racial and gender differences may be tied to bio-psycho-social differences which have life long consequences including health and it has been shown that the life expectancy of white people and women is higher (Keppel, Pearcy, & Wagener, 2002; WHO, 2000). Therefore, the reason might be simply because they live longer. In addition, older persons with less social contacts have been shown to be more likely to fall (Cwikel, 1992; Nevitt et al., 1989; Wickham, Cooper, Margetts, & Barker, 1989).

Currently unmarried marital status predisposes people to falls (Koski et al., 1998; Ryynanen, 1994). It has been shown that married persons have advantages in terms of greater financial, material and social supports (Goldman, Korenman, & Weinstein, 1995). Coupled with the fact that single older persons have to manage

independently living alone; the challenges relative to their abilities may be too great. Therefore, the probability of falling is higher than married older persons.

Fall history is a risk factor for falls in and of itself. Firstly, fallers are known to have poorer physical health (Bergland et al., 2000; Donald & Bulpitt, 1999). Secondly, falls have a strong psychological effect on elderly people. The fall and its circumstances often lead to FOF, activity restriction, social isolation, frailty and recurrent falls (Lanchman et al., 1998; Nevitte et al., 1989).

2.5 Fear of Falling (FOF)

As mentioned in the previous chapter, one psychological consequence of falls is fear of falling (FOF). This may be compounded because some fallers are unable to get up and must remain on the ground for at least 5 minutes (Nevitte et al., 1989). In addition, the getting up experience may be difficult with some fallers requiring assistance to get up (Porter, 1999). It has been propose that fear of falling is the most common concern among older persons, exceeding the fear of robbery or financial problems (Howland, Peterson, Pordon, & Bak, 1993). Although hypothetically derived, one researcher has estimated that, some older women would trade-off their life rather than experience fear of falling (time trade-off utility rate 0.67) (Salkeld et al., 2000). Although there is no standard method for assessing health value of older people, the results suggests that FOF may have a profound effect on elderly life.

Despite believing that FOF is a consequence of falls, FOF leads to avoiding activities because of fear (Tinetti, Mendes de Leon, Doucette, & Baker, 1994b) and associated with falls (Arfken et al., 1994; Friedman et al., 2002). FOF is, therefore, targeted for falls intervention. However, there is limited research examine FOF interventions. This section reviews current knowledge about FOF, including definition, prevalence, risk factors and consequences.

2.5.1 Definition of FOF

In 1982, fear of falling was first acknowledged as a problem in older adults: it was called 'ptophobia' (Bhala, O'Donnell, & Thoppil, 1982). It was described as high degrees of focal anxiety, phobic in nature and related to standing or walking but not related to any neuromuscular impairment that caused inability to walk (Bhala

et al., 1982). Since then, in order to evaluate the problem, various definitions have been proposed. One definition defines fear of falling as a general concept. It defines FOF as a state of fear/being afraid of falling. It has subsequently been suggested that the word 'fear' or 'afraid' represents too severe a degree of the problem and triggers underreporting, especially among male subjects (Legters, 2002; Tennstedt et al., 1998). Therefore, the word 'worried' was substituted. Some researchers believe the word 'fear' invokes a generalized state of fear rather than FOF (Lawrence et al., 1998).

A second definition refers to low fall-related efficacy or low confidence in avoiding falls (Cumming et al., 2000) when performing daily activities (Tinetti et al., 1994a; Tinetti, Richman, & Powell, 1990); or a loss of confidence in ones' own ability to balance (Maki, Holliday, & Topper, 1991; Tinetti, 1988). In 1990, the Fall Efficacy Scale (FES) was developed (Tinetti et al., 1990). The scale assesses fear of falling by measuring perceived self-efficacy or confidence in avoiding falls when performing 10 basic activities of daily living (e.g. get dressed). There are 2 disadvantages of using this scale. First, there is a limitation when used with older persons living in community. The 10 basic activities are too simple, relative to their abilities. It has been shown that scores of older persons in a high mobility group ranged from 90-98; the possible FES score range is from 0 -100 (Tinetti et al., 1990). This ceiling effect suggests requirement of more challenging activities for fear of falling assessment. Second, if older persons do not engage in the activities, the fear of falling is assessed hypothetically. Thus, the accuracy of the suppositional fear of falling is uncertain. There have been two attempts to improve the FOF measurement. Firstly, the Activity-specific Balance Confidence scale (Powell & Myers, 1995) and The University of Illinois at Chicago Fear of falling Measure (UIC FFM) (Velozo & Peterson, 2001) added items to the FES. The UIC FFM scale assesses FOF through a wider spectrum of 16 activities of increasing difficulty e.g. going for walk, visiting friends. A uni-dimensional construct of the 16 activities and equal intervals between units of measurement has been demonstrated (Velozo & Peterson, 2001). The scale provides a clinically relevant FOF score for intervention. However, there is an administration problem. Some older adults may not engage in the given activities. Therefore a hypothetical situation is present. Second, Lanchman et al. (1998) developed The Survey of

Activity and Fear of Falling in the Elderly (SAFE). This scale uses wider range of activities (ADL, social activity and exercise) and assesses activities engaged in and not engaged in separately.

The last definition defines FOF as a person's ability to control his or her own ability and environments to prevent and manage falls (Lawrence et al., 1998). The Perceived Control Over Falling and Perceived Ability to Manage Falls and Falling are FOF measurement tools derived from the definition (Lawrence et al., 1998). It has been demonstrated that a higher ability to manage falls is associated with low FOF (Lawrence et al., 1998). This reinforces the important of risk factor identification and intervention, however the psychometric properties of this tool have not been established at this time.

2.5.2 Prevalence of FOF

The prevalence of FOF among older persons living in the community ranges from 29% to 43% (Arfken et al., 1994; Murphy, Williams, & Gill, 2002; Tinetti et al., 1994b). One study that included older persons living in retirement units reported a FOF rate of 55% (Howland et al., 1998). In Japan, even though the fall rate is lower than in Western counties, FOF prevalence in older people living in the community was recorded as 60%; a higher rate than in Western studies. No other Asian studies are available for comparison, but as cultural differences appear to exist in fall rates, differences may also exist in FOF rates.

Fallers tend to have greater FOF than non- fallers (Cumming et al., 2000). Depending on the definition used, between 29 and 92% of older adults who have fallen report some degree of fear of falling (Legters, 2002). However, FOF among older adults who have not fallen is also reported (Burker et al., 1995; Lawrence et al., 1998; Maki et al., 1991; Tinetti, 1988; Tinetti et al., 1994b).

Previous studies show conflicting results with regard to the association between advancing age and FOF. Some studies demonstrated a correlation between increasing age and degree of FOF (Howland et al., 1998; Powell & Myers, 1995; Vellas, Wayne, Romero, Baumgartner, & Garry, 1997) whereas some studies showed no association between age and FOF (Howland et al., 1993; Kressing et al., 2001; Lawrence et al., 1998). Concerning gender difference, women have been

found to be consistently more likely to have FOF than men (Aoyagi et al., 1998; Arfken et al., 1994; Burker et al., 1995; Howland et al., 1998; Howland et al., 1993; Kressing et al., 2001; Maki et al., 1991; Tinetti et al., 1994b; Vellas et al., 1997).

In Thailand, there is no information about the prevalence or incidence of FOF. However, a qualitative study revealed that Thai elderly people use both positive and negative strategies to avoid falls; for example being watchful, walking more slowly, and/or restricting unnecessary activities (Bunrayong et al., 2002). In order to prevent falls and avoid negative consequences of falls prevention strategies (e.g. activity restriction, decrease quality of life), it is necessary to find out the actual situation of FOF and activity restriction in order to promote health in Thai elders.

2.5.3 FOF Risk factors

Originally, FOF was acknowledged as a consequence of falls. Fall experience is the first risk factor of FOF. Howland et al. (1998) reported that among older persons who had a FOF, 24% fell within the 3 months prior to the study, 45% fell and required medical attention in the last 5 years and 40% knew someone who had had a serious fall. Howland observed that only direct fall experiences could distinguish older persons who had FOF from those who did not. In addition, Lanchman (1998) reported statistical differences between FOF for fallers and non-fallers ($p < .001$) whereas vicarious fall experiences did not have significant effects. Furthermore, a cohort study in older women aged 72 and over demonstrated that falls were significantly associated with developing FOF (unadjusted relative risk = 1.7) (Murphy, Dubin, & Gill, 2003). On the other hand, one prospective study showed that falls are not associated with FOF after adjustment for confounders (Cumming et al., 2000) and that older people who had underlying balance problems but had no fall experiences were worried about being unable to get up after a fall (Tideiksaar, 1998). The older persons reported palpitations, dizziness and anxiety when they engaged in activities that might lead to falls. These suggest a complex relationship between falls and FOF. Another cross-sectional study revealed that falls and FOF share predictors, as a result older persons who have one problem are more likely to develop the other (Friedman et al., 2002).

Some medical conditions may also affect FOF. For example, a high rate of FOF was reported in older people with rheumatoid arthritis (50%) (Fessel & Nevitt, 1997) and dizziness (47%) (Burker et al., 1995). Recent studies indicated that those who had a FOF were more likely to have some specific health conditions such as 2 or more chronic conditions, stroke, chronic dizziness, be taking more than 5 medications, visual impairments, and using walking aids (Friedman et al., 2002; Howland et al., 1998; Murphy et al., 2003; Murphy et al., 2002).

Living situation also appears to influence FOF. Among older persons living in institutions, the prevalence of FOF can reach 50%-65% (Chandler, Duncan, Sanders, & Studenski, 1996; Franzoni, Rozzini, Boffelli, Frisoni, & Trabucchi, 1994; Liddle & Gilleard, 1995), as compared to 29% to 43% in the general community. This might be because those living in institutions are more likely to have more medical conditions, greater perceived risks and a higher fall history. However, among community dwellers, older persons with and without FOF did not differ in terms of living situation (Murphy et al., 2002). Nevertheless, less social contact has been found related to FOF (Howland et al., 1998). Moreover, older persons who have no available emotional supports are more likely to have a FOF (odds ratio = 2.64) (Murphy et al., 2003).

2.5.4 FOF consequences

Results from one prospective study has indicated that FOF increases risk of admission to an aged care institution, especially for non-fallers (Cumming et al., 2000). Furthermore FOF has an impact on depression and decreases quality of life (Arfken et al., 1994; Lanchman et al., 1998; Suzuki et al., 2002). However, the major consequence of FOF is activity restriction. A survey study reported that 56% of older persons with a FOF curtailed their activities (Howland et al., 1998). However, in the study, neither FOF nor fall experiences were associated with activity restriction. Indirect fall experiences e.g. knowing someone who had fallen and limited social supports were more important contributors for activity restriction (Howland et al., 1998). This might be because the study was conducted in public senior citizens housing residences. On the other hand, another study reported one quarter of falls caused activity restriction (Nevitt et al., 1991). Moreover, a cohort study of community dwellers aged 72 and over reported 19%

of activity restriction resulting from a FOF (Tinetti et al., 1994b). Both fallers (24%) and non-fallers (19%) acknowledged activity restriction (Tinetti et al., 1994b). Furthermore, it has been reported that FOF is associated with low levels of physical activity in healthy women (Bruce, Devine, & Prince, 2002).

In addition to FOF, an exploratory qualitative research study in Hong Kong revealed 3 major categories of psychosocial consequences of falling: powerlessness, fear and seeking care (Kong, Lee, Mackenzie, & Lee, 2002). The study was conducted with Chinese older adults who fell within 48 hours prior to the interviews and required medical treatment. It demonstrated that the older fallers lacked confidence in controlling falls. Moreover, the informants didn't limit their fear to repeat falls but also fear of being hurt, immobilized, decline in health, being hospitalized, unable to perform self-care and social activities, getting up from falls and death. A unique result of this study is that the informants were worried about being a burden to others after falls. They expressed both concern about being a burden to the family and being unable to fulfill usual role expectation. This might be explained by interdependence in the Chinese culture.

2.6 Multidimensional Nature of Fall Prevention

Normally, falls prevention programs employ a multidimensional approach to both underlying diseases and fall-associated risk factors (Alexander & Edelberg, 2002). Many specific intrinsic and extrinsic factors associated with falls are targeted. It has been demonstrated that management of these intrinsic and extrinsic factors is effective in decreasing the rate of falls (Moreland et al., 2003; Mosley et al., 1998; Tinetti et al., 1994a). A summary of fall risk factors that have been targeted and shown significant effects in reducing falls is shown in Table 2.1.

Table 2.1 Risk Factors Associated with Falls in Community Dwelling Older Persons

Risk factors	References
ADL/IADL impairments	Fabacher et al. (1994) Carpenter and Demopoulos (1990) Close et al. (1999)
Balance	Close et al. (1999) Fabacher et al. (1994) Tinetti et al. (1994a) Wolf et al. (1993) Wolfson et al. (1993)
Bath tub and toilet transfer	Tinetti et al. (1994a)
Environmental safety hazards	Cumming, R. G., Margaret, T., & George, S. (1999) Fabacher et al. (1994) Hornbrook et al. (1994) Tinetti et al. (1994a) Vetter, N. J., Lewis, P. A., & Ford, D. (1992)
Depression as measured by the Geriatric depression scale	Close et al. (1999) Fabacher et al. (1994)
Inappropriate use of alcohol	Wagner et al. (1994)
Lab test: CBC, blood chemistries, thyroid panel, urinanalysis, fecal occult blood	Fabacher et al. (1994)
Medical history	Close et al. (1999) Fabacher et al. (1994) Vetter et al. (1992)
Mental status	Close et al. (1999) Fabacher et al. (1994)
Multiple prescription of medication	Close et al. (1999) Tinetti et al. (1994a) Vetter et al. (1992) Wagner et al. (1994)
Muscle strength of the extremities	Fabacher et al. (1994) Tinetti et al. (1994a)
Physical activity level	Armstrong et al. (1996) Carpenter and Demopoulos (1990) Fabacher et al. (1994) Vetter et al. (1992) Wagner et al. (1994)
Postural hypotention	Close et al. (1999) Tinetti et al. (1994a)
Psychoactive medications	Campbell et al. (1999) Close et al. (1999) Tinetti et al. (1994a) Vetter et al. (1992) Wagner et al. (1994)
Range of joint motion	Fabacher et al. (1994) Tinetti et al. (1994a)
Vision/hearing	Close et al. (1999) Wagner et al. (1994)

However, a multidimensional approach is the key to the success of a falls prevention program. The falls prevention programs that did not employ a multidimensional approach failed to reduce falls in older community dwellers. Examples of the interventions that failed to reduce fall rate are shown in Table 2.2.

Table 2.2 Falls Prevention Programs that Failed to Reduce Fall Rate in Older Community Dwellers

Intervention	References
Cognitive behavioural approach to FOF plus small component of strength training	Tennstedt, S., Howland, J., Lachman, M. E., Perterson, E., Kasten, L., & Jette, A. (1998)
Educational program	Reinsch, S., MacRae, P., Lachenbruch, P. A., & Tobis, J. S. (1992)
Exercise	Buchner, D. M., Cress, M. E., Wagner, W., deLateur, B., Price, R., & Abrass, I. (1993) Lord, S. R., Ward, J., Willaim, P., & Strudwick, M. (1995) McMurdo, M. E. T., Mole, P. A., & Paterson, C. R. (1997) Reinsch, S., MacRae, P., Lachenbruch, P. A., & Tobis, J. S. (1992) Wolf, S., Kutner, N., Green, R., & McNeely, E. (1993) Wolfson, L., Whipple, R., Judge, J., Amerman, P., Derby, C., & King, M. (1993)
Home visit/assessment and education	El-Faizy and Reinsch (1994) Stevens, M., Holman, C. D. J., Bennett, N., & de Klerk, N. (2001) van Haastregt, J., Diederiks, J., van Rossum, E., de Witte, L., Voorhoeve, P., & Crebolder, H. (2000) van Rossum, E., Frederiks, C. M. A., Philipsen, H., Portengen, K., Wiskerke, J., & Knipschild, P. (1993)
Hormone replacement therapy	Armstrong, A. L., Oborne, J., Coupland, C. A. C., Macpherson, M. B., Bassey, E. J., & Wallace, W. A. (1996)
Practice on mobility obstacle course	Means, K. M., Rodell, D. E., O'Sullivan, & Cranford, L. A. (1996)

Moreover, previous studies show that another key to falls prevention is the identification of deficits followed by the provision of intervention targeted at those deficits. The interventions that did not assess for and target a specific deficit of participants demonstrated statistical insignificant results. For instance an exercise based rehabilitation program failed to statistically improve balance and mobility

functional performances of older people (Means et al., 1996), and a randomized controlled trial that targeted both bone mineral density and falls showed a positive impact on bone mineral but an increased fall rate (Ebrahim, Thompson, Baskaran, & Evans, 1997).

As mentioned earlier, FOF is associated with falls and leads to activity restriction, depression and decreased quality of life; FOF intervention is also an important fall prevention strategy. Generally, FOF interventions also provide information on and counselling for falls, fall related injuries, fear of falling, how to manage falls and fear of falling. FOF intervention includes the following techniques: videotapes, lectures, group discussions, mutual problem solving, role playing, exercise training, assertiveness training, home assessments and behaviour contracting (Legters, 2002; Tennstedt et al., 1998). It has been suggested that building fall-related efficacy is as important as physical training in reducing FOF (Powell & Myers, 1995). However, different interventions provide different outcomes. For example, in a comparison of two intervention groups an activity group to improve balance gained improved perceptions of health status (physical domain of the SF36) whereas an education group improved on the mental health domain of the SF 36 (Brouwer, Walker, Rydahl, & Culham, 2003). A randomized controlled trial showed that reversed activity restriction in social function and mobility could occur if there is a cognitive-behavioral change for FOF (Tennstedt et al., 1998).

In summary, it has been shown that falls prevalence in Eastern countries tend to be lower that those in Western countries. There is no evidence showing why Eastern elderly people are less likely to fall. Although the risk factors for falls are alike, it has been demonstrated that falls circumstances are varied. In Thailand, the fall prevalence and circumstances are similar to those in Eastern countries. However, knowledge about falls circumstances in Thai elderly people is limited. Information concerning FOF and activity restriction is also not available.

CHAPTER 3: ADAPTATION AND VALIDITY OF THE SAFE THAI VERSION

3 Introduction

The overall purpose of the present study is to investigate the prevalence of fear of falling (FOF) among community dwelling older people in Thailand. However, currently there are no measurement tools to assess FOF of Thai elderly people. Therefore, the first step in this process was to select and modify an instrument for use with Thai elderly persons.

3.1 Fear of Falling Measurement Tools

Although no tools are available in Thailand, assessment tools to measure FOF have been developed internationally over the past few decades. Initially, FOF was measured using a dichotomous question "are you afraid of falling?"(Howland et al., 1993; Legters, 2002). Although it is an easy and straightforward way to estimate the prevalence, it cannot detect variability in the degree of FOF, nor can it be used to effectively measure change over time. Moreover, self-reports of fear may not reflect changes in actual behaviour (Bandura, 1982). For example, participants in a focus group who reported being "worried about falling" did not describe themselves as "afraid of falling" (Tennstedt et al., 1998). Thus, there are some questions about the validity of the dichotomous question, its sensitivity and its correlation with altered behaviour.

In 1990, the Falls Efficacy Scale (FES) was developed in order to measure fall related efficacy while performing everyday activities (Tinetti et al., 1990). The scale development was based on Bandura's self-efficacy framework. It was designed to assess the degree of perceived efficacy at avoiding falls during performance of 10 non-hazardous activities of daily living e.g. getting dressed and undressed. The activities were identified and checked by 2 groups of 10 health professionals (physical therapists, occupational therapists, rehabilitation nurses and physicians) (Tinetti et al., 1990). The test-retest correlation and agreement with the dichotomous questions were tested in a sample of convenience of 18 older persons

(Tinetti et al., 1990). The FES showed good reliability (Pearson's correlation 0.71). Agreement between the FES and "are you afraid of falling?" and "has fear made you avoid any activities?" were 0.66 and 0.36 (Kappa statistic), respectively (Tinetti et al., 1990). A second study was undertaken with 56 older persons from a seniors' centre and elderly housing units in order to compare the FES scores with self-reported fear of falling (Tinetti et al., 1990). The results showed that the total score and scores on most individual items had a tendency to increase across three groups: participants who did not have fear of falling; participants who were afraid but did not avoid activity; and participants who avoided activity because of fear.

In the FES first version, fall efficacy was assessed on a 10-point scale with the lower score representing higher confidence. After it was modified in 1994 (Tinetti et al., 1994b), a lower score became equivalent to lower efficacy therefore the score reflects fear of falling directly. Furthermore, the item "get in and out of bed" was excluded and the item "going up and down stairs" was added. More recently scale was again revised (Tennstedt et al., 1998; Tinetti et al., 1994a); the degree of confidence ranged from 1 (not at all sure) to 4 (very sure), with higher scores indicating greater confidence. Although the FES has good psychometric properties and allows more differentiated assessment than the dichotomous tool, it is more appropriate for homebound or elderly with low mobility because it assesses only simple indoor activities (Legters, 2002).

Subsequently, the Activities-Specific Balance Confidence (ABC) scale was developed for assessing more active persons (Powell & Myers, 1995). The 16 activities in this scale were identified by both therapists and older persons. Moreover, the activities were purposefully selected to represent activities with a wide range of difficulty or hazard. Compared to the FES, the ABC describes fall-efficacy in more detail by using a 0-100 visual analog scale from 0 (no confidence) to 100 (complete confidence). The psychometric properties were tested with a larger sample of 60 community seniors, 30 in the low mobility group and 30 in the high mobility group. The results showed that the ABC has high internal consistency (Cronbach's alpha = .96), reliability ($r = 0.92$), and convergent and criterion validity when compare with the Physical Self-Efficacy Scale (PSES) and the FES ($p < .001$) (Powell & Myers, 1995). Both the ABC

and the FES were able to distinguish between low and high mobility groups, but the ABC had more efficiency for the following reasons. First, the ABC is more reliable over a two-week period. The ABC reported r = .92 (Powell & Myers, 1995) whereas the FES reported r = .71 (Tinetti et al., 1990). Second, the ABC showed a stronger cumulative ordering. The ABC score ranged from 5-84% and 36-95%, for the low and high mobility groups respectively (Powell & Myers, 1995). On the other hand, the FES score ranged from 44-84% in the low mobility group and 90-98% in the high mobility group (Tinetti et al., 1990). This marked skewing indicates that the FES is not suitable for people with good mobility. All in all, the ABC is more appropriate for older community-dwellers who have various levels of functioning. However, it is not a suitable instrument for Thai older persons because the ABC contains many items that are uncommon for Thai elderly e.g. walking on icy sidewalks and using escalators. In addition, Thai older people, especially those with no or limited education (Social Statistic Division. National Statistical Office. Office of the Prime Minister, 2003) are known to have difficulty responding to 100-point scales.

In the late 1990's, the Survey of Activities and Fear of Falling in the Elderly (SAFE) was created for FOF evaluation (Lanchman et al., 1998). It evaluates FOF during performance of activities of daily living, exercise and social activities in order to detect the early onset of FOF. The activities were first selected from existing disability instruments, and then 22 non-overlapping activities were selected by 3 expert judges. The SAFE (first version) was tested for psychometric properties with a sample of 270 residents of a public seniors' housing development. The instrument uses a 4-point ordinal scale to identify the degree of FOF. Fear is assessed on activities that are performed and not performed. For the activities that are not done, the tool allows assessment of activity restriction. Forward regression procedures were used to reduce the items. Then, item to total correlation and alpha coefficients were examined. In the final version, there are 11 activities, including both basic and instrumental activities of daily living, mobility tasks and social activities (coefficient alpha was .91)(Lanchman et al., 1998). Convergent validity was tested by examining the relationship between the SAFE, the FES and the one item dichotomous question. The SAFE score was significantly correlated with the FES (-.76) and the one-item question (-.59) (Lanchman et al.,

1998). The 270 participants were classified into three groups: 1) not afraid of falling, 2) afraid of falling but do not limit activities and 3) afraid of falling and do limit activities. The results demonstrated that the SAFE score was able to differentiate both level of fear and activity restriction ($F(2,263) = 92.10$, $p < .001$) (Lanchman et al., 1998). Therefore, it has been shown that the SAFE has good internal consistency (coefficient alpha = .91) as well as both concurrent and criterion validity (Lanchman et al., 1998). Several questions were also used to clarify whether respondents avoided each activity because of FOF or for other reasons. Two total scores (FOF and activity restriction scores) were calculated; the individual rationale for avoiding activities was also recorded. It has been shown to be effective in differentiating those who were expected to be afraid and not afraid of falling (Lanchman et al., 1998).

The dichotomous question "are you worried about falling?" and the SAFE were selected for use in this study. Although the dichotomous question cannot measure degree of FOF (Legters, 2002), it can be used for initial screening (Powell & Myers, 1995). The SAFE has been shown to have both good reliability and validity. It can detect the early onset of both FOF and activity restriction (Lanchman et al., 1998), therefore, it is more appropriate for the target group of this study who are community dwellers. In addition, it assesses FOF on a 4-point ordinal scale, which is easier for older people who have limited education. With these tools, not only the prevalence of FOF can be described, but also the degree of FOF in community dwellers can be quantified. Furthermore, the SAFE can indicate if the participants restrict their activities because of FOF. However, the SAFE was developed in English and based on Western culture. Thus, translation and cultural relevance examination were needed.

3.2 Cross Cultural Adaptation of Measurement Tools

A question of cultural bias is always raised in the measurement of psychosocial variables such as attitudes, behaviours, value and knowledge. It can exist in the both content of tools and process of administration. A guideline for cross-cultural adaptation process has been proposed (Guillemin, Bombardier, & Beaton, 1993). It includes 5 processes: 1) translation 2) back-translation, 3) committee review of

those translations and back-translations, 4) pre-testing for equivalence and 5) re-examination of the weighing of scores, if relevant.

The use of a qualified translator was suggested for translations and back-translations. Although most studies use one translation (Guillemin et al., 1993), producing several translations allows for the detection of errors and divergent interpretations of ambiguous items in the original. Committee review and pre-testing by bilingual lay people is recommended for checking equivalence in source and final version. The adaptation process also suggests adapting the scoring method to the cultural context.

3.3 Cross-Cultural Use of the SAFE

The original SAFE scale format used a 4-point rating scale (Lanchman et al., 1998). Although no administration problem was identified with the SAFE used in face-to-face interview conducted with older adults of moderate educational background (Lanchman et al., 1998), the administration procedure might need to be adapted for Thai older adults because of cultural and educational background differences.

It is known that cultural bias can affect the process of test taking and the format response to instrument (Flaskerud, 1998). There are three known culturally difference responses to Likert scales: 1) the likelihood of difficulty in responding to the range of choices or leaving more questions unanswered 2) the likelihood of providing answers outside the range of responses 3) the likelihood of responding in different patterns. (for example, members in some cultures might avoid selecting extreme responses). In addition reliability varies by culture and construct validity might be restricted to specific cultures (Lee, Jones, Mineyama, & Zhang, 2002). It has been shown that participants in some cultures are unable to make a choice and preferred to use 'yes' or 'no' answer (Flaskerud, 1998). However, these biases are less in respondents with more exposure to Western culture and higher education (Flaskerud, 1998; Lee et al., 2002).

In the SAFE original version, the scores ranged from 0 (not at all) to 3 (very worried) (Lanchman et al., 1998), which is different from a typical Likert scale in two ways. First, the lowest score is 0; that means 'not at all'. This 0 score can

substitute for the 'no' answer and reduce the out of range responses. Second, the extreme score (3 – very worried) reflects a negative response. Therefore, the tendency to endorse positive item responses found in Asian cultures (Iwata, Roberts, & Kawakami, 1995; Iwata, Saito, & Roberts, 1994) can be avoided. Additionally, the SAFE original version was administrated by a face-to-face interview (Lanchman et al., 1998). Therefore, interviewers gave instructions and used prompts. Nevertheless, it was demonstrated that although respondents could ask the investigator for clarification of instructions, majority of both literate and illiterate groups had difficulty with the Likert format (Flaskerud, 1998). The difficulty might also be found in Thai older people. A visual aid to represent the numerical points on the scale is suggested to increase understanding of Likert type formats (Bernal, Wooley, & Schensul, 1997) This kind of tool might be useful for administration of the SAFE Thai version administration.

3.4 Methodology

3.4.1 Purpose

In order to meet the overall goals of the project, measurement tools appropriate for Thai older people were required. As mentioned above, the SAFE is more appropriate for the target group who are community dwellers and have limited education. However, both translation and cultural relevance examination for use with Thai older persons were required. The purpose of this phase of the research was to modify the SAFE for use with Thai older adults. The process involved three sequential steps:

1. Translation of the SAFE into Thai language
2. Examination of cultural relevance
3. Back-translation of the SAFE Thai version

Translation thus occurred twice: translating the SAFE to Thai language and back-translating the modified version to English. Both translation and back-translation were performed by translators certified by the Ministry of Foreign Affairs, Thailand. The SAFE translation procedure focused on conceptual equivalence with the original version. The cultural relevance was examined between the translation

and back-translation. The back-translation was undertaken to ensure that no changes in the intent of the instrument had occurred. The translations are shown in Tables 3.1 and 3.2. The process of examining cultural relevance was undertaken between the two translations and will be described below.

3.4.2 Cultural relevance and modification of the SAFE

3.4.2.1 Design

Following translation, a survey research design employing an expert panel was used to examine face validity and cultural relevance.

3.4.2.2 Ethical considerations

Before conducting the study, ethics approval was granted by the Human Research Committee at Curtin University (HR129/2002). Prior to inclusion in the study, letters explaining the study and consent forms (Appendix A) were given to potential elderly participants. The interviewer also verbally explained the study and gave further information as requested by potential participants. Participants were informed that all information was only identifiable by a code number and would be kept in a secure place by the researcher for a period of five years, then shredded. Only the researcher and supervisor had access to the names of participants, and the "key" to the codes was locked in a separate location to the coded data, therefore, maintaining anonymity and ensuring confidentiality.

3.4.3 Participants

To test the face validity and cultural relevance of the SAFE, a sample of convenience of 10 Thai elderly people (over age 60) who live in Perth were recruited. They were selected using the following criteria:

1. Age 60 or over;
2. Currently or previously of Thai nationality; and
3. Have lived in Australia for 10 years or longer.

The first and second criteria were set to ensure that the potential participants and the target group in the major study were of similar age and grew up in the same culture. The third criterion was used to guarantee the competence of potential participants as bilingual. According to Abudarham (1987), the definition of 'bilingualism' depends on a variety of criteria. It can be defined as native-like

control of two languages or used to describe persons who can understand, speak, read or write a second language, even to a minimal degree. However, very few individuals achieve native proficiency in a second language. People who speak a second language are considered functionally bilingual if they can cope with a restricted set of activities in a second language (Abudarham, 1987). By these criteria, the 10 Thai older people who have lived in Australia for at least 10 years were considered to meet the need for bilingualism and cultural equivalence even though they were chosen by convenience sampling.

The majority of participants were contacted through the Buddhist Centres in Perth, WA. Other avenues of recruitment included contact via Thai videotape rental shops and personal connections with the participants recruited via the Buddhist Centres (snowball sampling). The eligibility was determined either in-person or via a telephone call. Once consent was given and eligibility was established, an appointment was made for a structured face-to-face interview at their homes or at the Buddhist centres.

3.4.4 Procedure

Ten bilingual Thai elders reviewed the SAFE Thai version item by item to determine the quality of translation and cultural relevance. There were two outcomes of interest: the agreement between English and Thai versions in terms of meaning and cultural understanding. A questionnaire to compare the meaning of the SAFE English and Thai versions was developed based on guidelines by Thorn & Deitz, (1989) (see Appendix B). Because the SAFE can be divided into two parts, instructions and a list of 11 activities, the questionnaire contained 24 items: 13 items for instructions and 11 for activities. The participants were asked to rate the degree of agreement for the 24 items from 1 (totally disagree) to 5 (totally agree). The higher score indicated greater agreement. If their opinion of any item was rated as fair, disagree or totally disagree, further details of their opinions and suggestions for corrections were requested. Next, they determined whether there was any cross-cultural difference that might have an effect on communication with Thai elderly people and provided suggestions where there was a cultural effect.

3.4.5 Statistical analysis

For analysis, the scores were collapsed to two categories: agree and disagree. Ratings of totally agree and agree were counted as agreement whereas the fair, disagree and totally disagree ratings were considered to be disagreement. This provided a dichotomous score that could be used to calculate percentage agreement for each item across all 10 participants. Agreement of 80% was considered acceptable for adoption of an item. Any item with percentage of agreement less than 80 was examined in the light of the comments and the content was changed as per provided suggestions.

3.5 Results

Participants were Thai older adults living in Perth, Australia, aged between 60 and 80. As shown in Table 3.3, the majority of respondents were female (90%). A national survey in Thailand has shown that generally Thai older persons have low education (Social Statistic Division. National Statistical Office. Office of the Prime Minister., 2003). The educational level of the selected group was higher than the expected target group. However, the participants grew up in the same culture as the target group before migration to Australia. Thus, they can rate the quality of translation for both clarity (is it understandable?) and conceptual equivalence.

Table 3.1 Demographic Data of Bilingual Older People

Demographic data	%
Age (yr.)	
- 60-64	50.00
- 65-69	20.00
- 70-74	20.00
- 75-80	10.00
Gender	
- Male	10.00
- Female	90.00
Education	
- No education	10.00
- Primary school	30.00
- Secondary school	20.00
- Bachelor degree or more	40.00

By using 80% agreement as the acceptable criteria, three activities required examination and modification and 1 activity was added to the SAFE-Thai version

(Table 3.4). All other items achieved the 80% agreement and the translation was accepted.

The three modified activities are described below.

1. *'Go to store'* - The concept of '*Go to store'* is to go to buy something. The first translator translated this as 'ไปตลาด'. In general, ตลาด or market is a place that people go for trading. However, 50% of participants did not agree that the translation had an equal meaning. Thus, the level of agreement did not meet the 80% agreement criteria. They thought 'ไปตลาด' expressed too narrow a meaning. Generally, Thai people go to ตลาด to buy things. In rural areas, this will therefore not cause confusion because there is only one market and all stores are normally in this area. Nevertheless, in urban areas, 'ตลาด' usually implies a fresh food market particularly the main market in that area. The word 'ตลาด' does not include small neighbourhood stores and other forms of trading for example hawkers. Therefore, use of the term 'ตลาด' implies both a narrower meaning and greater effort to perform this activity. Most participants suggested using 'ไปซื้อของ' which means 'go shopping' as a substitute. This latter phrase was therefore adopted.

2. *'Prepare simple meal'* – In this item, the translator used the term 'ทำกับข้าวเอง' which means prepare dishes. Normally, Thai people have rice with a few dishes that are served separately. Therefore, in Thai 'prepare a meal' usually means 'prepare some dishes to have with rice'. The majority of the participants (60%) thought the translation had equivalent meaning. However, preparing Thai dishes can be both complicated and simple. Forty percent of participants suggested adding the word 'ง่ายๆ' which means simple to ensure that the effort it takes to prepare dishes would not be greater than it should be. The term 'ง่ายๆ' was adopted in the modified version in order to capture the original concept.

3. *'Walk several blocks outside'* – As in many non-English speaking countries, Thai people do not describe a walking distance as a *block*. The first translator used 'เดินไกลๆ' to give an idea of the effort for doing this activity. Although 60% of the participants agreed that the quality of translation was acceptable, 40% of the participants indicated that the translation was not understandable. They suggested using a measurement to give a picture of the equivalent distance of several blocks.

   A standard of several hundred meters and one hundred meters has been adopted for several blocks and one block, respectively. This standard was used for translation of the SF-36 (Wagner et al., 1998). However, a word that has equal meaning to 'several' does not exist in Thai language. 'Several' means more than one but fewer than many. Normally, 'หลาย' is used as an alternative but it can mean many things. Therefore, the item '*Walk several blocks outside*' was modified into 'เดินระยะทาง 200-300 เมตร' or walk 200-300 meters.

All participants considered that the item 'take a tub bath' was inappropriate even though no one objected to the equivalence of translation or semantic equivalence. While 'take a tub bath' is quite a common activity in Western countries, it is rather uncommon for the great majority of Thai people. They usually use a basin for washing or take a shower. Thus, 'take a shower or use a basin for washing' was suggested as a substitute. After careful consideration, both items ('take a tub bath' and 'take a shower or use a basin for washing') were included in the Thai version. There were two reasons for this. First, a tub bath might be becoming more common because of rapid social changes in Thailand during the past decades. As the participants in this study have not lived in Thailand recently, they would be unaware of trends. Second, the SAFE also identifies whether activities are engaged in or not. During the development of the original SAFE, both 'take a tub bath' and 'take a shower' were included. However, 'take a shower' was excluded because of overlap between these items and 'take a tub bath' was considered one of the most frightening activities for older adults (Lanchman et al., 1998). Thus, both items were included with the intention to assess the frequency of participation in the

activity in a large-scale study. This inclusion of both items, with subsequent analysis was considered a feasible strategy.

After the SAFE modifications for meaning and relevance were completed, the second certified translator back-translated the modified SAFE. When compared to the original version, there was no change in the context (Table 3.2 and 3.3).

Table 3.2 Translation and Modification of SAFE: Instructional Items

SAFE (original version)	SAFE (first Thai version)	SAFE (modified Thai version)	**Back-translated version**
1. Do you currently do it? (Yes/No)	1.ปัจจุบันนี้ คุณทำสิ่งนี้อยู่ไหม(ทำ/ ไม่ทำ)	1.ปัจจุบันนี้ คุณทำสิ่งนี้อยู่ไหม(ทำ/ไม่ทำ)	1. Are you doing the above activities at present? (Yes/No)
2. If you do the activity, when you do it how worried are you that you might fall? - Not at all - A little worried - Somewhat worried - Very worried	2. ถ้าคุณยังทำอยู่ ขณะที่คุณทำ คุณเป็นห่วงว่าจะหกล้ม หรือไม่ - ไม่เลย - ห่วงนิดหน่อย - เป็นห่วง - เป็นห่วงมาก	2. ถ้าคุณยังทำอยู่ ขณะที่คุณทำ คุณเป็นห่วงว่าจะหกล้ม หรือไม่ - ไม่เลย - ห่วงนิดหน่อย - เป็นห่วง - เป็นห่วงมาก	2. If you are doing them do you worry about falling down? - Not worried - A little worried - Worried - Very worried
3. If you do not do the activity, do you not do it because you are worried that you might fall?	3.ถ้าคุณไม่ทำสิ่งนี้ คุณไม่ทำเพราะว่า คุณเป็นห่วงว่าจะหกล้ม หรือไม่	3. ถ้าคุณไม่ทำสิ่งนี้ คุณไม่ทำเพราะว่า คุณเป็นห่วงว่าจะหกล้ม หรือไม่	3. If you are not doing these activities, is it because you are worried about falling down?
4. If you do not do the activity because of worry, are there also other reasons that you do not do it (if yes, specify)	4. ถ้าคุณไม่ทำสิ่งนี้ เพราะว่า คุณเป็นห่วงว่าจะหกล้ม คุณมีเหตุผลอื่นๆ อีกหรือไม่ (โปรดระบุ)	4. ถ้าคุณไม่ทำสิ่งนี้ เพราะว่า คุณเป็นห่วงว่าจะหกล้ม คุณมีเหตุผลอื่นๆอีกหรือไม่ (โปรดระบุ)	4. If you are not doing these things because you are worried about falling down, are there any other reasons you have for not doing them? (Please specify)
5. For those not worried, what are the reasons that you do not do it	5. ถ้าการที่คุณไม่ทำสิ่งนี้ ไม่ใช่เพราะว่า คุณเป็นห่วงว่าจะหกล้ม คุณไม่ทำ เพราะอะไร	5. ถ้าการที่คุณไม่ทำสิ่งนี้ ไม่ใช่เพราะว่า คุณเป็นห่วงว่าจะหกล้ม คุณไม่ทำ เพราะอะไร	5. If you are not doing these things and are not worried about falling down, what are your reasons for not doing them?
6. Compare to 5 years ago would you say that you do it - More than you used to - About the same - Less than you used to	6. เปรียบเทียบกับ 5 ปีก่อน คุณทำสิ่งนี้ - มากกว่าที่เคยทำ - เหมือนเดิม - น้อยกว่าที่เคยทำ	6. เปรียบเทียบกับ 5 ปีก่อน คุณทำสิ่งนี้ - มากกว่าที่เคยทำ - เหมือนเดิม - น้อยกว่าที่เคยทำ	6. Compare with five years ago are you doing these activities - More - The same - Less

Table 3.3 Translation and Modification of SAFE: Activities Items

SAFE (original version)		SAFE (first Thai version)		SAFE (modified Thai version)		**Back-translated version**	
1.	Go to the store	1.	ไปตลาด	1.	ไปซื้อของ	1.	Shopping
2.	Prepare simple meal	2.	ทำกับข้าวเอง	2.	ทำกับข้าวง่ายๆเอง	2.	Basic cooking
3.	Take a tub bath	3.	อาบน้ำโดยใช้อ่างอาบน้ำ	3.	อาบน้ำโดยใช้อ่างอาบน้ำ	3.	Take a bath
				4.	อาบน้ำโดยใช้การตักอาบหรือฝักบัว	4.	Take a shower/wash yourself with a basin of water
4.	Get out of bed	4.	ลุกขึ้นจากเตียงนอนด้วยตนเอง	5.	ลุกขึ้นจากเตียงนอนด้วยตนเอง	5.	Get out of bed by your own/ Wake up by your self
5.	Take a walk for exercise	5.	ไปเดินออกกำลัง	6.	ไปเดินออกกำลัง	6.	Take a walk for exercise
6.	Go out when slippery	6.	ออกจากบ้านเมื่อพื้นลื่น	7.	ออกจากบ้านเมื่อพื้นลื่น	7.	If the ground is slippery, leave the house
7.	Visit a friend or relative	7.	ไปเยี่ยมเพื่อนๆหรือญาติ	8.	ไปเยี่ยมเพื่อนๆหรือญาติ	8.	Go to visit friends or relatives
8.	Reach over head	8.	เอื้อมหยิบของเหนือศีรษะ	9.	เอื้อมหยิบของเหนือศีรษะ	9.	Reach to get something above you
9.	Go to place with crowd	9.	ไปในที่ที่มีคนหนาแน่น	10.	ไปในที่ที่มีคนหนาแน่น	10.	Go to a crowded place
10.	Walk several block outside	10.	เดินไกลๆ	11.	เดินระยะทาง 200-300 เมตร	11.	Walk 200-300 meters
11.	Bend down	11.	ก้มตัว	12.	ก้มตัว	12.	Bend down

Table 3.4 Percentage of Agreement between English and Thai Translation of the SAFE

Items	Agreement (%)					Total % of Agreement*
	Totally disagree	Disagree	Fair	Agree	Totally agree	
1. Go to the store	-	50.00	-	50.00	-	50.00
2. Prepare simple meal	-	10.00	30.00	60.00	-	60.00
3. Take a tub bath	-	-	-	60.00	40.00	100.00
4. Get out of bed	-	10.00	-	40.00	50.00	90.00
5. Take a walk for exercise	-	-	-	30.00	70.00	100.00
6. Go out when slippery	-	-	-	60.00	40.00	100.00
7. Visit a friend or relative	-	-	-	30.00	70.00	100.00
8. Reach over head	-	10.00	10.00	40.00	40.00	80.00
9. Go to place with crowd	-	-	-	40.00	60.00	100.00
10. Walk several block outside	-	10.00	30.00	60.00	-	60.00
11. Bend down	-	-	-	30.00	70.00	100.00
12. Do you currently do it (yes/no)	-	-	10.00	30.00	60.00	90.00
13. If you do the activity, when you do it how worried are you that you might fall?	-	-	-	50.00	50.00	100.00
14. Not at all	-	-	-	-	100.00	100.00
15. A little worried	-	-	-	20.00	80.00	100.00
16. Somewhat worried	-	-	10.00	50.00	40.00	90.00
17. Very worried	-	-	-	30.00	70.00	100.00
18. If you do not do the activity, do you not do it because you are worried that you might fall?	-	-	10.00	40.00	50.00	90.00

Items	Agreement (%)					Total % of Agreement*
	Totally disagree	Disagree	Fair	Agree	Totally agree	
19. If you do not do the activity because of worry, are there also other reasons that you do not do it (if yes, specify)	-	-	10.00	40.00	50.00	90.00
20. For those not worried, what are the reasons that you do not do it	-	-	10.00	40.00	50.00	90.00
21. Compare to 5 years ago would you say that you do it	-	-	-	70.00	30.00	100.00
22. More than you used to	-	-	-	10.00	90.00	100.00
23. About the same	-	-	-	10.00	90.00	100.00
24. Less than you used to	-	-	-	10.00	90.00	100.00

* Total % of agreement = % agree + % totally agree

3.6 Discussion

The Survey of Activities and Fear of Falling in the elderly (SAFE) is a standard tool to measure fear of falling and activity restriction in older adults. However, it was developed in the English language for use with English speaking populations. The SAFE modification process therefore targeted conceptual equivalence of the translation. The purpose of this study was to create the SAFE Thai version that contains both the original concepts and culturally appropriate expression.

It has been shown that the qualifications and characteristics of translators affect translation quality (Brislin, 1970; Guillemin et al., 1993). There are 3 factors that affect the translation quality: translators' familiarity with the source language (in this case English), translators' experience and the target language. The translation quality is better when the translator has more familiarity with the source language and experience in translation. Furthermore, if the translators' native language is the target language, they are more aware of the objectives underlying the material to be translated and offer a more reliable restitution of the intended measurement. In the translation process of this study, the translation and back-translation were each performed by independent translators. Both of them are qualified translators certified by the Ministry of Foreign Affairs, Thailand, providing some assurance that they had enough experience and were familiar with both Thai and English language. Because the first translation was done in Australia and the second translation was performed in Thailand, translators translated from their mother tongue to target language. Although the translators did not translate into their mother tongue, the cultural relevance examination was completed by a group of 10 bilingual older adults. This group of bilingual adults was culturally representative of the target population. The bilingual committee review method has been suggested as a pre-testing method for improving cross-cultural adaptation (Guillemin et al., 1993). Moreover, a scoring method was employed for the cultural context (Thorn & Deitz, 1989). By using this method, the cultural relevance was examined by a mathematical approach, which is the best way of aggregating information. The 80% agreement criterion was used to modify or generate new items. This assured a good quality of the modification process of the SAFE.

In addition, a source questionnaire that is more difficult to read is more difficult to translate. It has been suggested that questionnaires that are written for translation purposes should use mostly simple sentences, nouns rather than pronoun, specific rather than general terms, active rather than passive voice and avoid hypothetical phrasing, metaphors, colloquialisms and subjunctive mode (Guillemin et al., 1993; Werner & Campbell, 1970). Although the SAFE was not developed with translation in mind, it seems to follow most of these rules. Thus, the SAFE meets the requirements for an easily translatable questionnaire.

It has been suggested that measurement tools developed in the United States may lack culture relevance for other cultures (Guyatt, 1993). The cultural relevance examination demonstrated that three items in the SAFE were not conceptually equivalent: 'go to store', 'prepare simple meal' and 'walk several blocks outside'. All of them were modified in order to express the original concepts in Thai culture. Additionally, it has been identified that the target population might not be likely to find one item 'take a tub bath' relevant. Therefore, the 'take a shower/wash yourself with a basin of water' was generated. However, the 'take a tub bath' item was not discarded at this stage. Both 'take a tub bath' and 'take a shower/wash yourself with a basin of water' were included in the SAFE Thai version with the intention of later examination. Results from the back-translation showed that the final version maintains content validity. This suggests that the SAFE Thai version has not only cultural appropriateness, but also comparability of content.

As mentioned earlier the administration procedure for the SAFE needed adaptation for the cultural context. The SAFE-Thai version was conducted by a face-to-face interview as was the original version. Therefore, three of the possible culturally different responses (leaving questions unanswered, providing answers outside the range of responses and responding in different patterns) can be avoided. However, Thai older persons generally have low education (Social Statistic Division. National Statistical Office. Office of the Prime Minister., 2003). And they may have difficulty rating their fear of falling. A ladder chart that represents the numerical points of the scale was used as an aid in the case when Thai older participants showed difficulty rating their degree of fear of falling.

3.7 Summary

As there was no measurement tool for fear of falling in Thailand, translation and cultural adaptation of the Survey of Activities and Fear of Falling (SAFE) were performed. Both translation and back-translation were performed by certified translators. Based on an item-by-item consideration 10 bilingual older adults provided both their opinions concerning agreement between Thai and English versions and suggestions if they did not agree with the translation. Using an 80% agreement criterion, three items of the content of the first translation were changed and one activity was added. The back-translation showed that the original and modified versions were comparable and there was no change in the context. In conclusion, the modified SAFE is culturally appropriate for Thai older people and comparable to the original version.

CHAPTER 4: RELIABILITY OF THE SAFE-THAI VERSION

4 Introduction

The SAFE original version showed good internal consistency (coefficient alpha = .91) (Lanchman et al., 1998). This study translated and modified it for use with Thai older adults. The back-translation showed no change in the content compared to the original version. Three items were modified and only one item was added. Fear of falling and activity restriction is measured as per the original version with the addition of the item 'take a shower/wash yourself with a basin of water'. The item 'take a tub bath' will be examined further in the main study. Due to the similarity of the items, internal consistency of the SAFE Thai version was not tested. However, because the SAFE was developed in a Western country, it cannot be assumed that all Thai older people are as adept at self-reflection or self-assessment as Western older people. It has been noted that when scales are applied to another culture they can be unreliable – about half of them are notoriously unreliable with values, as low as 0.5 for test-retest coefficients with intervals as short as one day to at most one week (Merenda, 1994). A second reason to further test the SAFE Thai version is the addition of a visual aid (a ladder chart) used to assist Thai older adults to rate their feelings. Thus the test-retest reliability needed to be investigated to ensure the reproducibility of the SAFE Thai version. Moreover, the rater reliability also needed to be examined to ensure consistent results. This chapter describes intrarater, interrater and test-retest reliability.

4.1 Reliability

Reliability is the reproducibility of a measurement (Portney & Watkins, 2000). As all instruments and humans are fallible to some extent, any given measurement has an error. The measurement error can be divided into systemic and random errors (Portney & Watkins, 2000).

Systemic errors are predictable errors of measurement. For cross-cultural and international studies, one such critical factor is social desirability. This is the

systematic tendency to respond to surveys, questionnaires, standardized tests, and other self-report measures on the basis of social approval or acceptance rather than the content of the specific item (Arnold & Feldman, 1981). It has been reported that Asian cultures exhibit significantly higher levels of social desirability than European and North American cultures. A cross-national study of influencing factors and socially desirable response bias demonstrated that Malaysians exhibited higher levels of social desirability than American and French nationals, ($p < 0.001$) whereas there was no significant difference between American and French people (Keillor, Owens, & Pettijohn, 2001). The influencing factors were also different. Malaysians reported a higher level of influence from family and friends; French were influenced by culture and society whereas the main influencing factor for Americans was mass media (Keillor, Owens, & Pettijohn, 2001). Recognition of differing social desirability bias and influencing factors across cultures is important to correctly interpret results and understand actual behaviours.

Random errors are unpredictable errors, which can affect a subject's score from trial to trial. It occurs from unpredictable factors for example fatigue, distraction or simple mistakes. Normally, reliability focuses on the degree of random errors.

4.2 Reliability Measurements

One requirement in the development or modification of a measurement tool is to maximize the reliability or ensure consistent application and scoring. Reliability is measured as reliability coefficients. Generally, the reliability can be estimated based on the statistical concept of variance (Portney & Watkins, 2000). However, there are many reliability coefficients, each based on different designs and types of data. Moreover, there are three factors that cause random measurement error: the raters, the measuring instrument and variability of characteristics being measure (Portney & Watkins, 2000).

Reliability coefficients range between 0 to 1, with 0 indicating no reliability and 1 indicating perfect reliability. Nevertheless reliability coefficients of 1 are rare. In general, coefficients below 0.5 represent poor reliability, the coefficients from 0.5 to 0.75 are moderate and coefficients that are greater than 0.75 are considered

to have good reliability (Dawson & Trapp, 2001; Portney & Watkins, 2000). However, the reliability coefficients are also dependent on the measured variables and type of reliability test (Portney & Watkins, 2000). Thus acceptable reliability is normally judged by researchers or clinicians who understand the nature of the measured variables.

Many reliability coefficients are based solely on measurement of correlation. Correlation shows the degree of association between two sets of data or the consistency of position within two distributions. Although the correlation between two tests shows the relationship to each other, it does not show the agreement. Therefore a statistical approach for testing the agreement should also be included in reliability testing.

Intrarater reliability is defined as the ability of an investigator who takes the measurement to obtain the same result on more than one occasion (Batavia, 2001). Many researchers assume that intrarater reliability is automatically achieved if experienced raters take the measurements. This however is not a guarantee for good intrarater reliability or a substitute for testing psychometric properties of the test. For example, one possible rater bias is the influence of memory of the first score (Portney & Watkins, 2000).

As mentioned in Chapter 2, there are three possible culturally different responses to psychometric problems for rating scales: 1) the likelihood of difficulty in responding to the range of choices or leaving more questions unanswered 2) the likelihood of providing answers outside the range of responses 3) the likelihood of responding in different patterns. (For example, members in some cultures might avoid selecting extreme responses). In addition reliability varies by culture and construct validity might be restricted to specific cultures (Lee, Jones, Mineyama, & Zhang, 2002). The SAFE Thai version uses a face-to-face interview to avoid the first three possibilities. This means the raters should be trained to provide appropriate instruction and use probes. Intrarater reliability testing is necessary to guarantee the consistency of a rater after a training session.

Interrater reliability is the variation between two or more raters who measure the same group of subjects (Batavia, 2001). If raters' measurements lack correspondence, the measurement taken during the study may be inconsistent because of the variation. The reliability is best assessed when all raters are able to measure each subject during a single trial. In this way, they all observe a subject simultaneously and rate the subject independently. However the SAFE Thai version, conducted by face-to-face interview, requires interaction between raters and subjects. Thus this method cannot be employed. Alternatively, some researchers repeat the measurement on some of the subjects. Comparing the inter-observer variability can identify the interrater reliability (Dawson & Trapp, 2001).

Test-retest reliability refers to the measuring ability of tools on two separate occasions (Batavia, 2001). The time interval between the tests should be far enough apart to avoid fatigue, learning and memory effects, but close enough to avoid genuine change in the measured characteristics (Portney & Watkins, 2000).

Generally, reliability testing uses correlation coefficients, Pearson correlation for continuous data and Spearman Rho for ordinal data (Dawson & Trapp, 2001). If the measurements are nominal, the kappa statistic will be used (Dawson & Trapp, 2001). However, correlations are bivariate; only two ratings or raters can be tested at one time. In addition, the correlation coefficients do not provide information concerning agreement. Some researchers use other statistical approaches, for example t-test and ANOVA to assess the agreement between two or more data sets.

Recently, the intraclass correlation coefficient (ICC) has been suggested for reliability testing. It can assess both correlation and agreement (Portney & Watkins, 2000). Additionally, it can be used to assess two or more ratings, requires the same number of raters for each subject and is designed primarily for use with interval/ratio data. These give it both flexibility and broad clinical application (Portney & Watkins, 2000). The ICC has distinguished three models based on how raters are chosen and assigned to subjects (Portney & Watkins,

2000; Shout & Fleiss, 1979). In Model 1, raters are randomly selected from a larger group and each subject is assessed by a different set of *k* raters. In Model 2 each subject is assessed by the same raters and the raters are randomly chosen from a larger group. Because the raters are randomly selected, the results can be generalized to other raters who have the same characteristics. This model is often used for interrater reliability studies. In Model 3, each subject is assessed by the same raters as in Model 2, but the raters are considered as the group of interest. This model has been suggested for testing intrarater reliability. Next, each model can be divided into two forms, using a single rating score or mean score (Portney & Watkins, 2000; Shout & Fleiss, 1979).

4.3 Methodology

4.3.1 Purpose

As mentioned above, the SAFE was modified for use with Thai older adults. In order to ensure the reproducibility of the SAFE- Thai version, the reliability of the measurement tool was investigated. The purpose of this chapter is to examine the test-retest, inter-ratter and intra-ratter reliabilities of the SAFE Thai version.

This chapter reports on three studies of reliability: the test-retest, inter-ratter and intra-ratter reliabilities studies. Due to use of the same sample for the intrarater and test-retest reliability studies, these will be reported together. First, however, interrater reliability will be examined.

4.3.2 Ethical consideration

Prior to conducting the studies, ethics was granted by the Human Research Committee at Curtin University of Technology (HR 129/2002) and Chiang Mai Provincial Public Health Office. Prior to the data collection, interviewers explained the study both verbally and in writing (Appendix A) to the potential elderly participants and obtained consent. The interviewers also gave further information as requested by potential participants. Only consenting volunteers were interviewed.

4.4 Interrater Reliability Study

This section examines the interrater reliability of the SAFE Thai version (nine raters).

4.4.1 Participants

There were 2 groups of participants in this study, raters and subjects.

1. Raters - Nine 4th year occupational therapy students at Chiang Mai University volunteered to act as raters. As 4th year students of occupational therapy, they had clinical knowledge related to general testing procedures. None, however, had previous knowledge or experience with the SAFE.
2. Subjects - Fifteen community dwelling older people living in Chiang Mai, Thailand, aged 60 years and over, with good memory and orientation, ability to communicate in Thai and who provided consent were involved in the interrater reliability study. Details of Inclusion criteria and screening methods were described in section 5.4.3.

Both groups of participants were recruited using a sample of convenience. Potential participants were contacted through the occupational therapy school and clubs for elderly people in Chiang Mai. An announcement for raters was posted at the school for one week. Students who volunteered were contacted for training and interviews arranged. The leaders of the clubs were contacted and asked to post announcements seeking volunteers. Following the announcements, the interviewers went to the clubs during their normal activities to contact the volunteers. Subjects (15 adults over 60 years) were provided information about the study indicating that participants would be interviewed several times within 2 weeks for the inter-rater reliability study. Eligibility was determined in person. When the eligibility was established and consent was obtained, appointments were made for interviews. The interviews were performed in their homes or at another location of their choosing.

4.4.2 Procedure

The inter-rater reliability study took place during September 2002. The raters received a one-day training and practice session. During this training, each

interviewer undertook six practice interviews. For the study, the elderly participants were randomly assigned to the raters. Inter-rater reliability testing was undertaken and examined using intra-class correlations ICC (2,1). As the raters were selected from a larger group, the study design met the criteria of using ICC (2,1) (Nichols, 1998; Portney & Watkins, 2000b).

4.4.3 Administration procedure for the SAFE Thai version

All elderly participants were interviewed using face-to-face interviews. The SAFE Thai version includes 12 activities. For each activity, the participants were asked several questions as shown in Figure 4.1 (Lanchman et al., 1998).

In cases where the participants had difficulty rating their level of worry, a ladder chart was used to improve their rating capacity (Figure 4.2).

Figure 4.1 Questions for Each Activity of the SAFE Thai Version

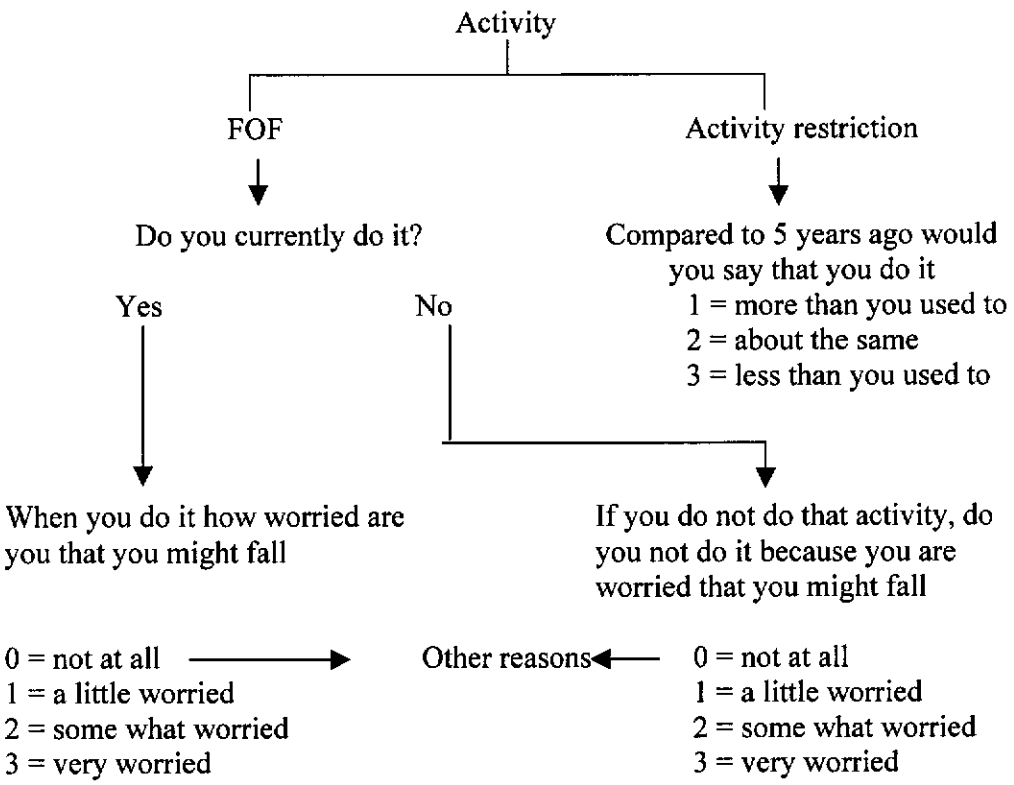
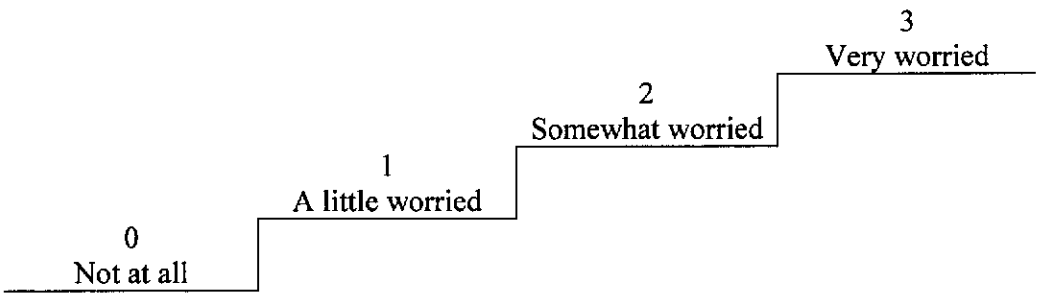


Figure 4.2 Ladder Chart



The FOF score was determined by calculating the mean FOF score across 12 activities (range per activity = 0 – 3). Higher scores indicate greater fear of falling. The fear of falling score for both activities done and activities not done was also calculated. Activity restriction was calculated using the mean response to each activity (Figure 4.1). The possible scores range from 1 to 3. A high score indicates greater activity restriction.

4.4.4 Statistical analysis

Nunnally (1978) indicated that if the number of ordered categories is relatively large (at least 10), the scores can be aggregated without loss of information. The SAFE Thai version, the measure of central tendency of fear of falling and activity restriction was calculated across 12 activities. Therefore the exemption was adopted; the mean score of fear of falling and activity restriction was calculated even though the scale of the SAFE Thai version is an ordinal scale. This is consistent with the original scoring method. The interrater reliability testing of the SAFE Thai version was undertaken and examined using intraclass correlations ICC (2,1). As the raters were selected from a larger group (the 4th year occupational therapy class), ICC model 2 was applied. Additionally a single score from each rater was used for calculation, so the single measurement form of the ICC was employed.

4.4.5 Results

Fifteen community dwellers and nine interviewers participated in this study. After the one-day training session, each interviewer was scheduled to interview 6 older adults. However, many participants withdraw from the study prior to completion of all 6 interviews because they were too busy to continue their participation. Two

participants volunteered to undergo additional interviews to substitute for missing participants. On average, each participant was interviewed by 4 interviewers (range from 1 to 9). The intraclass correlation coefficient for the three scores (FOF for activities done, FOF for activities not done and activity restriction) were .9845, .9236 and .9718 respectively ($p < 0.001$).

4.5 Intrarater and Test-retest Reliability Study

4.5.1 Participants

The study sample consisted of community dwellers in Chiang Mai, Thailand who were aged 60 years and over, had good memory and orientation, were able to communicate in the Thai language and consented to participate in this study. The participants were recruited using a sampling of convenience. The processes to contact potential participants, determine eligibility and obtain consent were performed by the same method described in the interrater reliability study. Four raters who conducted the intrarater and test-retest reliability studies undertook the data collection.

4.5.2 Procedure

Each participant was interviewed twice by the same rater with a one-week interval. Data from both interviews were used to examine intrarater and test-retest reliability. As noted previously, all 4 raters had undergone training. All interviews occurred at the participant's home or other convenient location.

4.5.3 Statistical analysis

The mean score for FOF – activities done and activities not done and activity restriction were calculated as described in the interrater reliability study. The scores were subjected to intrarater and test-retest reliability tests using intraclass correlation coefficient: ICC (3,1) and ICC (1,1) respectively. The ICC model 3 is a suggested model for intrarater reliability testing (Portney & Watkins, 2000). In this case, the single measurement of the first and the second interviews were compared for each rater. Furthermore, the ICC model 1 was used for the test-retest reliability study because the interviews were conducted by 4 raters. Using ICC (1,1), the variability and agreement of score from trial to trial as well as rater errors can be detected.

4.5.4 Results

This study was conducted by 4 trained raters. To guarantee the consistency of performance among the raters, the interrater reliability of the rater was calculated using data from the interrater reliability study. The intraclass correlation coefficient of FOF for activities done, FOF for activities not done and activity restriction of these 4 raters were .9845 ($p < 0.0001$), .9289 ($p = 0.0068$) and .95 ($p = 0.0003$) respectively.

4.5.4.1 Descriptive data of Thai older adults

A total of 50 Thai older adults between the ages of 60 and 90 (Mean age = 68.94, SD = 6.87) participated this study. Forty-two percent were male and 58% were female. The majority of participants were married (66%) and lived with others (94%). Eighty four percent of participants spent 4 or fewer years in school. There were only 16 % who did more than 4 years of education (mean years in school = 3.78, SD = 4.54). Sixty-two percent of participants perceived that their health was good or better and 14% had had fall experiences. The details of the demographic data are shown in Table 4.1

Table 4.1 Demographic Data of Elderly Community Dwellers in Chiang Mai. (n = 50)

	Frequency	Percent (%)
Age (years)		
- 60-64	12	24.0
- 65-69	19	38.0
- 70-74	9	18.0
- 75-79	4	8.0
- 80-84	5	10.0
- 85-90	-	-
- 90 and over	1	2.0
Mean ± SD	68.94 ± 6.87	
Gender		
- Male	21	42.0
- Female	29	58.0
Marital status		
- Single	3	6.0
- Married	33	66.0
- Widowed	13	26.0
- Divorced	1	2.0
- Separated	-	-
Education (years in school)		
- 0-4	42	84
- More than 4	8	16
Mean ± SD	3.78 ± 4.54	
Living situation		
- Live alone	3	6.0
- Do not live alone	47	94.0
Self perceived health		
- Excellent	5	10.0
- Very good	3	6.0
- Good	23	46.0
- Fair	17	34.0
- Poor	2	4.0
Fall history		
- No fall	43	86.0
- 1 fall	3	6.0
- 2 falls	2	4.0
- More than 2 falls	2	4.0

The SAFE Thai version records participation in 12 specific activities. The number of activities each person did ranged from 4 to 11 (trial 1 mean = 9.18, SD = 1.66 and trial 2 mean = 9.14, SD = 1.64). On average, the participants engaged in 9 of the 12 activities on the SAFE Thai-version. None of the participants took a tub bath. The percentage of participants who engaged in each activity are shown in Table 4.2.

Table 4.2 Frequency and Percentage of Participation in the activities

Activities	Number of those who did each activity	% Who did activities
1. Shopping	34	76
2. Basic cooking	42	84
3. Take a bath	0	0
4. Take a shower/wash yourself with a basin of water	50	100
5. Get out of bed on your own/ Wake up by your self	50	100
6. Take a walk for exercise	35	70
7. If the ground is slippery, leave the house	30	60
8. Go to visit friends or relatives	42	84
9. Reach to get something above you	41	82
10. Go to a crowded place	41	82
11. Walk 200-300 meters	42	84
12. Bend down	46	92

4.5.4.2 Intrarater reliability

Four raters were involved in this study. Raters number 1, 2 and 3 interviewed 10 older adults each and rater number 4 interviewed 20 older adults. The intrarater reliability for each rater was analysed using ICC (3,1) and are shown in Table 4.3.

Table 4.3 Intrarater Reliability

Rater	FOF of activities done		FOF of activities not done		Activity restriction	
	ICC	p	ICC	p	ICC	p
No.1	.9995	<.0001	1	<.0001	.9445	<.0001
No.2	.9993	<.0001	.9183	.0003	1	<.0001
No.3	.9741	<.0001	.9208	.0002	.9718	<.0001
No.4	.9995	<.0001	.8260	.0001	.9876	<.0001

4.5.4.3 Test-retest Reliability

The test-retest reliability was determined by intraclass correlation coefficient ICC (1,1). The ICC (1,1) for FOF of activities done, FOF of activities not done and activity restriction were .9960, .9376 and .9849 ($p < 0.0001$) respectively. The SAFE scores for activities done, activities not done and activity restriction across 12 activities is shown in Table 4.4.

Table 4.4 Fear of Falling and Activity Restriction Score

SAFE Score	Range	Minimum	Maximum	Mean	Std. Deviation
Fear of falling score for activities done					
Trial 1	3.00	.00	3.00	1.3758	1.1030
Trial 2	3.00	.00	3.00	1.3942	1.0881
Fear of falling score for activities not done					
Trial 1	2.50	.00	2.50	.3950	.6611
Trial 2	2.50	.00	2.50	.4350	.6701
Activity restriction score					
Trial 1	1.58	1.33	2.92	2.2900	.3508
Trial 2	1.58	1.33	2.92	2.2917	.3596

4.6 Discussion

The SAFE Thai version, a measure of fear of falling for Thai older adults, presented no administration problems. Although most Thai older participants had limited educational background, they responded to the SAFE scale format without difficulty during the face-to-face interview using the ladder chart as a visual aid. However, future study is needed to determine whether the SAFE Thai version can be used successfully with different populations or with other modes of administration e.g. a face-to–face interview without the ladder chart or a telephone interview. Although the SAFE is a type of self-report instrument, the SAFE Thai version was conducted by face-to-face interviews. The raters clarified the questions and provided more information if it was requested. Different modes of administration might affect the reliability of the SAFE Thai version.

4.6.1 Interrater reliability

The purpose of the first section of this study was to identify the interrater reliability of the SAFE Thai version. The results demonstrated that the SAFE Thai version had a high level of interrater reliability. The results showed that all of the intraclass correlation coefficients were greater than 0.90; which is greater than the suggested acceptable ICC for health science research (Portney & Watkins, 2000b). The interrater reliability was investigated in 9 raters after one day training. All 9 raters in this study were selected from 4th year occupational therapy students. Although these students had some general evaluation skills, they were students who had limited clinical experience. Therefore the one-day training session of the SAFE Thai version is appropriate training for using the SAFE Thai version for those who have equal clinical experience. This result can be generalized to raters who have the same characteristics. Moreover, for those who have greater experience such as occupational therapist, the interrater reliability is expected to be better and the training needs lower.

A limitation of this study is possible recall bias. Because all interviews were conducted within 2 weeks, the participants might have recalled previous answers. Nevertheless FOF in the elderly is caused by both direct and indirect fall experiences, and FOF can change over a short period of time. Because the SAFE Thai version is a type of self-report measurement tool, the recall bias was considered to be less important compared to the change of FOF over a period of time. Thus the time frame was limited to two weeks. However, it will be important for a future interrater reliability study to determine whether participants report changes in FOF when recall bias is controlled for extending the time interval between each interview.

4.6.2 Intrarater reliability

The results showed that all raters were consistent. All of the ICCs were greater than 0.9, except the ICC for the activities not done recorded by one rater which was 0.82. Because the rater conducted more interviews (20 participants) than the other raters (10 participants), the random error might be greater in this case. Moreover, only the reliability of fear of falling of activities not done was less than 0.9. Because participants did not do those activities anymore, rating fear of

falling for these activities might be more difficult and less consistent than the activities they currently do.

4.6.3 Test-retest reliability

The test-retest reliability study was conducted using a group of raters whose interater reliability was greater than 0.9 for both fear of falling and activity restriction measurements. This indicates their consistency and agreement using the SAFE Thai version. The test-retest reliability of fear of falling of those who did and did not do the activity and activity restriction were also greater that 0.9 significantly. This shows that the SAFE Thai version is reliable over one week interval.

4.6.4 Pilot Testing

In addition to the reliability of the SAFE Thai version, preliminary data on FOF in Thailand was obtained. The mean score of fear of falling of Thai older adults who did the activities (trial 1 1.38±1.1, trial 2 1.39±1.08) (Table 4.3) was greater than the mean score of American older persons (Lanchman et al. reported M = .51, SD = .57 in young-old group and M = .80, SD = .76 in old-old group). Although no statistical analysis could be undertaken, it should be noted that the American older adults in Lanchman's study were older (Mean age = 76.16, SD = 7.91), more often female (78%), less often currently married (10%) and rated their health as good or better (57%) (Lanchman et al., 1998). In addition, 17% of them had fall experiences in the last 3 months. All of these factors are risk factors for falls and fear of falling (Alexander & Edelberg, 2002; Ho et al., 1996; Legters, 2002). It is possible that the difference might be influenced by cultural background. According to Hofstede (1980), the US is classified as having strong individualistic values whereas Thailand tends to be more collectivistic. It has been shown that members of collectivistic culture rated the expression of fear as more appropriate in both in-group (close friends and family) and out-group (public, acquaintances, and higher or lower status) situations than members of individualistic cultures (Mutsamoto, 1994). Therefore, Thai older people are more likely to openly talk about their fear of falling. Furthermore, it has been demonstrated that family and friends are important influencing factors for socially desirable biases in Asian culture. Because falls are problems that have

impact on both older adults and their family, the opinion of family members might have influencing effects on their expression. Thai older adults may therefore feel that expressing fear of falling is both appropriate and acceptable. Therefore, compared to American older persons, one should expect higher scores on fear of falling in Thai older persons. Future study it is needed to investigate the actual correlation between the fear of falling and social desirability.

As mentioned in chapter 2, one item (take a shower/wash yourself with a basin of water) was added to the SAFE Thai version. During the development of the original version development, both 'take a tub bath' and 'take a shower' were included in the scale. However the 'take a shower' item was excluded because it overlapped (Lanchman et al., 1998). It was shown in this study that none of the 50 participants took a tub bath. Therefore there was no overlap between these two items in Thai older adults population. This suggests that the 'take a tub bath' item could be dropped without compromising the psychometric quality of the scale. However, because the participants in this section were not randomly selected, the exclusion of 'take a tub bath' will be considered again in the main study.

One of the advantages of using the SAFE for fear of falling evaluation is its ability to also assess fear related activity restriction. The results in this study indicated that the majority of Thai older persons engaged in all of the activities, except taking a tub bath. Therefore, the fear related activity restriction could also be measured with the SAFE Thai version.

4.7 Summary

In conclusion, the reliability of the SAFE Thai version was investigated. The results demonstrated high correlation in both inter- and intrarater reliabilities. For raters with limited clinical experience, a one-day training session appears adequate to ensure reliability. Additionally, the test-retest reliability indicated high reproducibility of the tool. This suggests appropriateness of the measurement tool for both research and clinical purposes. Furthermore, there was no administration problem in the face-to-face interviews conducted with Thai older adults using the ladder chart. In terms of activity restriction measurement, the majority of Thai

older persons did all the activities listed in the SAFE Thai version except the 'take a tub bath'. Thus the tool can be used to evaluate the fear of falling related activity restriction and the item 'take a tub bath' is likely to be excluded without compromising the psychometric quality of the tool.

CHAPTER 5: FEAR OF FALLING AND FALL CIRCUMSTANCES IN THAILAND: A SURVEY OF 546 ELDERLY ADULTS

5 Introduction

The Thai elderly population is increasing, as in many countries around the world. According to the national census, the Thai elderly population has increased from 1.2 million in 1960 to 5.7 million in 2000 (National Statistic Office, 1960, 2000). Because of the prevalence of many chronic diseases, the number of Thai older adults who are dependent and require care is expected to increase more than 4 times by 2050 (WHO, 2003). The rate of disabilities and dependency affects not only individual older persons but also Thai society as a whole. Therefore, effective disability prevention and health promotion programs will improve the quality of life of older persons and ensure the cost-effectiveness of medical services and have important economic implications for the country. Controlling the potential increase in disabilities in old age is an achievable goal. For example, in the United States of America, the National Long-Term Care Survey shows that there was a decline in chronic disabilities between 1982 and 1994 and the savings in nursing home costs alone is estimated to be greater than $17 billion (Singer & Manton, 1998). In Thailand, a long term plan for care of the elderly was announced by the National Committee on the Elderly Population of Thailand in 1980 (Jitapunkul, Bunnag, & Ebrahim, 1993). However, information concerning type, size and distribution of health problems, particularly falls in the population is limited.

As reviewed earlier in Chapter 2, previous studies show that falls lead to many serious problems but they are preventable. Approximately 20% of Thai older people have had fall experiences and most falls have taken place outside (Jitapunkul et al., 1998) which is different from data from Western countries (Sattin, 1992). In addition, a multinational study of southern Europe suggested a diverse approach to prevention due of a diversity of fall circumstances (Allander et al., 1998). Thus the effectiveness of fall prevention strategies adopted from Western countries is questionable. Nonetheless, there is no information on the full types, time, location and related activity in Thai older people. This information is essential for developing specific fall interventions for Thai older people. Moreover,

there is no information regarding FOF, a post fall syndrome, in Thailand. Cultural or ethnic differences in FOF have been suggested (Kressing et al., 2001); which might lead to differences in activity restriction and implication for the well being of Thai older people. In order to ensure effective falls and FOF prevention strategies in Thailand, the fall circumstances, the prevalence of FOF, and activity restriction associated with FOF need to be investigated.

5.1 Fall and Fall Related Data in Thailand

As mentioned in Chapter 2, there are a number of factors that influence fall related data gathering. The factors are definition of falls, participant characteristics and data collection methods. As in international studies, falls studies in Thailand have also used varied definitions of falls, participant characteristics and data collection methods. Therefore, these differences should be considered before drawing a conclusion.

5.1.1 Definition of falls and falling

As in international studies reviewed in Chapter 2, studies of falls in Thailand also have inconsistencies in falls definition. Most of the studies have not provided a specific definition. In a national survey, only falls resulting from overwhelming outside events, such as motor vehicle accidents or violence were excluded (Jitapunkul et al., 1998). Another 1-year longitudinal study of 1043 older adults defined falls as loosing one's balance and any part of the body, except the feet, hitting the ground regardless of the cause (Assantachai, Praditsuwan, Chatthanawaree, Pisalsarakij, & Thamlikkitkul, 2002). It is clear that falls as defined in these 2 studies are different. For example, falls due to pushing by a crowd or human stampede will be excluded from the first study but included in the second. On the other hand, if an older person looses balance and falls on a chair, this event will not be counted as a fall in the second study but it is a fall in the first study. Therefore it has to be noted that the estimated fall prevalence in Thai older people has come from studies that use different definitions. Comparison between these studies might not be appropriate.

5.1.2 Participant demographics

Though globalisation has had a great influence on Thai culture, Thailand is an agricultural country. The majority of Thai people, especially older people, still

maintain an agricultural lifestyle. Ageing transformations in an agricultural society and an industrial society are different in many ways e.g. age of retirement, roles of older people in their family etc. Unlike an industrial society, there is no specific age for retirement in an agriculture society. Older people can continue working at their own pace and stop working if and when they choose. Nevertheless, the transformation from adults to elders in Thailand normally occurs at age 60, because it is imposed by law; for instance, to retire from government service and be eligible for public assistance takes effect at age 60. Thus most Thai studies of older populations use the age of 60 and over as a criteria for recruitment. Generally, studies of older populations in Western countries use the age 65 and over for recruitment. This means, when comparing results to studies of Western countries, the populations in Thai studies are usually younger.

The next problem concerning participant characteristics in fall studies is generalisation. Many fall studies in Thailand were conducted with specific groups; such as those living around hospitals (Assantachai et al., 2002), or those who have had fall experiences (Boonchom, 1995). In addition, some studies have not randomly selected participants. Each group of elderly has many differences in terms of intrinsic and extrinsic risk factors for falls. Thus the findings from these specific groups might be not suitable for extrapolation to Thai older people in general.

5.1.3 Data collecting methods

In chapter 2, a number of data collection methodologies for falls were introduced. In Thailand, the most popular technique is asking older persons whether/how many times they fell in a set period. As mentioned earlier, this technique is inexpensive and easy to apply but there are inevitable accuracy and reliability problems (Cumming et al., 1988). Both 6 month and 12 month recall periods have been used in Thai studies; for instance, Jitapunkul et al. (1998) used a 6-month recall period whereas Bunrayong (2002) et al. used a 12-months recall period. The time frames lead to estimates of different fall prevalence.

The first longitudinal fall study in Thailand used the postcard follow-up method (Assantachai et al., 2002). The postcards were sent to the older persons every 2 months for 1 year. If the older person failed to return the postcard, a telephone

follow-up call was made. The author asserted that the 2-month recall period improves the accuracy of fall recalls. However, there was a 20% (203 from 1043 cases) dropout rate in the first episode (month 0-2) (Assantachai et al., 2002). This suggests difficulties in filling in the postcards; a condition which is supported by low literacy rates in Thai older people. Therefore it should be noted that researchers should anticipate a high dropout rate by using this method. Furthermore, the participants that remain in the study might be different from those who drop out. This point has to be taken into account when comparing the results with other studies or generalizing the findings to the general population.

5.2 Falls in Thailand

5.2.1 Falls prevalence in Thai elderly people

Data on falls prevalence in Thai older people is required to provide appropriate health services. The data have to be drawn from studies that meet three requirements. Firstly, the study has to be carried out using older community dwellers. To identify the frequency of falls affecting Thai older people, the subjects should be drawn from the general population rather than a population associated already with falls. In other words, the observations should be made on community dwellers rather than people who have already had a fall. Secondly, although making observations of an entire population is very difficult and usually not necessary (Barker, 1976), it is necessary that the observations are made on a random sample, large enough to generalise to the population. Thirdly, it has to have a clear definition of falls. The definition is a basic description of falls used as a standard to identify a fall. Without the definition, it means there is no standard for the observation.

Although most fall studies in Thailand were conducted on specific groups, there is one study that meets all three requirements, the National Survey of the Welfare of the Elderly in Thailand (SWET) (Choprapawon, 1995; Jitapunkul et al., 1998). The SWET was conducted in 1995. Multistage random sampling was performed for recruitment. The 12 zones of the Ministry of Public Health were used as a sampling frame. Seven thousand, seven hundred and thirteen older persons aged 50 and over were recruited from 24 provinces and the metropolis of Bangkok. Falls were defined as '*fall incidences excluding those resulted from overwhelming*

outside events, such as motor-vehicle accidents or violence'. Trained interviewers conducted data collection. The frequency of falls in six months prior to the study was recorded.

The prevalence of falls in Thai older people was reported in two groups. The first group was the 7,713 older persons aged 50 and over. The fall prevalence of this group was 16.1% (Choprapawon, 1995). The second group was 4,480 Thai older persons aged 60 and over drawn from the larger sample. The prevalence of falls for this group was 18.7% (Jitapunkul et al., 1998). Comparing rural and urban areas, the fall rate in rural areas was higher. Additionally, females were more likely to fall than males. For older persons aged 60 and over, fall rates of female and male were 21.5% and 14.4% respectively.

Comparing these results to Western studies, it seems that Thai older people have lower fall prevalence. However, it should be noted that the survey used different criteria for recruitment. Generally, studies of older populations in Western countries use age 65 and over for recruitment e.g. Friedman (2002), Tromp (2001) etc. The Thai participants in the survey were younger. In addition, most fall studies recorded fall frequency in the previous 12 months but the Thai survey used a 6-month recall period for data collection.

All in all, in the specific context, the estimated fall prevalence of Thai older persons is approximately 20%.

5.2.2 Fall Circumstances of Thai elderly people

In epidemiological studies, information about when and where a disease occurs provides relevance to the planning of medical services (Barker, 1976). Internationally, it has been shown that environmental or extrinsic factors are risk factors for falls in older adults (Downton, 1993; Tideiksaar, 1998). Knowledge of fall circumstances will lead to developing effective screening techniques and prevention programs. The results from a multinational hip fracture risk factors study revealed variability in the fall circumstances and strongly suggested the pattern for intervention should be country or site specific (Allander et al., 1998).

Falls also cause fear of falling and activity restriction (Nevitt et al., 1989) that will decrease quality of life of the older persons (Suzuki et al., 2002). Therefore the knowledge is important for both falls and post-fall syndrome.

In Thailand, the national survey showed that 65% of falls occurred outside (Jitapunkul et al., 1998) which differs from the Western studies (Northridge et al., 1995; Parker & Martin, 1994; Tinetti, 1988). However, 85% of falls occurred during day time (Jitapunkul et al., 1998), a finding similar to studies in Western countries (Allander et al., 1998; Parker & Martin, 1994).

A second study has demonstrated that most older adults who live in urban areas fall inside their homes, especially in the toilet and bathroom (Loasawadchaiyakul, Sirapongan, & Puttawattana, 1999). This is different from the national survey. This might suggest that older persons living in urban areas have different patterns of falls. However, the definition of falls was not provided in this study. The difference might have occurred because of differences in how falls were counted as well.

5.2.3 Fall prevention in Thailand

As the majority of Thai older people live in the community, fall prevention programs could be expected to be mostly based on educational programs. However, there were no studies testing the effectiveness of the educational programs until 2002.

In 2002, the first and only study about strategies to prevent falls in Thai elderly was reported (Assantachai et al., 2002). It was a longitudinal study of falls in older people living in the urban area around the Siriraj Hospital Medical School. One thousand and forty three older persons were recruited, 585 in the study group and 458 in the control group. In this study, falls were defined as:

'the elderly lost their balance and any part of the body, except the feet, hit the ground regardless of any cause was reported initially' (Assantachai et al., 2002).

The fall intervention was carried out by sending a leaflet identifying risk factors for falls and fall prevention strategies to older persons in the study group.

Moreover, the study group could access free health services at the geriatric clinic operated by the researcher's team. Data collection was performed by sending a follow-up postcard every two months for one year. In the event that the older person failed to return the postcards, a follow-up telephone was made.

This study showed that the overall incidence of falls were 6.6% and 10.1% in the study group and control group respectively. The fall rate of the control group was higher than the study group at every data collection point, but it only achieved statistical significance at 8 and 12 months of intervention ($p = .002$ and .004, respectively).

Fall rates in this study were much lower than the national survey (Jitapunkul et al., 1998). However, these two studies used different fall definitions. In addition, the longitudinal study had a 20% dropout rate at the first follow-up ($n = 840$; control group = 406 and study group = 434) and 26% for the overall study ($n = 775$; control group = 371, study group 404). As discussed earlier, the postcard follow-up method required the participants to fill in and return the card; which might be a burden for older persons and account for the high dropout rate. Although the dropout rate decreased in the following episodes and the overall dropout rate was 26%, this suggests a positive bias of the participants who remained in the study. The study did not provide a comparison of demographic data between the older persons who stopped and those who continued their participation. Nevertheless, it demonstrated that 60% of the participants had primary school education whereas the national statistic showed that only 36% of Thai older people have 4 years of education and over (National Statistic Office, 2000). This indicates that the participants in Assantachai's study had higher education than Thai older people in general.

Moreover, the study was designed to study, specifically, the elderly living in the urban area near the Siriraj Hospital Medical School, Bangkok. The older persons living in this area are different from general Thai older people in many ways. First, they live in one of the most urbanized areas in Thailand. This means their environmental factors for falls are different from those who live in rural areas. Second, because they lived around the hospital, the health services should be easily accessible. In addition, the Siriraj Hospital Medical School is one of the best-

equipped government hospitals in Thailand and offers a wide range of health services from primary care to tertiary care. Since the Thai government provides free health services for older persons (Jitapunkul et al., 1999), this is a barrier-free and affordable health service for older persons. Compared to general Thai older people, this group of older persons had greater opportunity for health promotion, disease prevention and curative services. This means they were likely to have fewer intrinsic risk factors for falls. Consequently, it is not surprising that fall rates in this study were lower than the national survey.

The fall intervention in the above reported study mainly relied on the leaflet. Therefore the effectiveness of the program depended on the educational background of the participants. Although the authors simplified the message by using cartoons, it is questionable whether the leaflet would be effective in other groups of Thai older people. Moreover, as discussed earlier, the participants in this study had a better chance to manage both intrinsic and extrinsic risk factors for falls. This raises a question of whether an educational program alone would be sufficient for all.

5.3 Purpose of Study

As reviewed in the introduction, the details of fall circumstances, FOF and activity restriction in Thai older persons are lacking. The specific approach cannot be developed without the details. Although it has been shown that the educational program could prevent falls in Thai older persons living in urban areas, fall interventions for other groups needs further investigation. Moreover, it has been shown that Thai older persons prevented falls by avoiding risky areas and activities where possible (Bunrayong et al., 2002). This suggests that a trade-off between falls and activity restriction might exist for Thai older persons. If the educational program for falls prevention is not based on specific fall circumstances of Thai older people, they might exchange their activity engagement for dependency with no real gain.

Therefore the overall aim of this study was to explore and describe FOF in Thailand. The specific objectives were to:

1. Describe fall circumstances of elderly people in Thailand (location, associated activity, hazards, time and fall type);

2. Calculate the prevalence of FOF and activity restriction;

3. Compare FOF and activity restriction in fallers and non-fallers, identifying associated risk factors for each; and

4. Examine the associations between falls, FOF and activity restriction.

5.4 Methodology

5.4.1 Design

A cross sectional design was used in this study. The design is best for obtaining a snapshot of current conditions (Dawson & Trapp, 2001); fear of falling and activity restriction in this case. Moreover, other advantages of using this design are that it is relatively quick to complete and inexpensive. Although the design provides information on the condition at only one point in time, it yields fundamental information for planning of health services and further studies.

5.4.2 Ethical considerations

Prior to conducting the study, ethical approval was given by the Human Ethic Research Committee at Curtin University of Technology (HR 129/2002). Permission to conduct the research was also granted by the Lamphun, Samut Prakran, Surat Thani and Udon Thani Provincial Health Offices. The procedure for providing information and obtaining consent from potential participants were described in Chapter 3.

5.4.3 Sample and sampling methodology

The multistage random sampling method was used in this study. There are four designated regions of Thailand: Middle, Northern, Northeastern and Southern. One province from each region of Thailand was randomly selected by using a list of provinces as a sampling frame (Appendix D). Each province name was put in an envelope corresponding to its regional designation. Then one province was picked for each region. Each province has designated districts and each district is composed of named sub-districts. Districts and sub-districts were chosen by the

same method of random selection (Figure 5.1). In each sub-district, local leaders and public health officials provided the names and the addresses of all elderly people in the selected sub-districts.

In order to ensure the statistical power for estimation of FOF, which is a single binomial parameter, the sample size calculation was calculated based on estimated proportion of older adults with FOF based on the literature review. Although it was reported that 24-43% of older persons living in the community have FOF (Arfken et al., 1994; Cumming et al., 2000; Murphy et al., 2002; Tinetti et al., 1994b), some studies were conducted with populations aged 72 and over; for example Murphy et al. (2002) and Tinetti et al. (1994b). As the current study explored FOF in Thai older adults aged 60 and over, estimated proportions were obtained from studies with samples age 65 and over. Therefore, estimated proportion of the older persons who had FOF was 30% (Cumming et al., 2000).

The sample size depends on the standard error of the FOF to be estimated. In this study, the standard error was set as .04. Using the equation, the standard error (SE) of p equals $[P(1-P)/n]^{1/2}$ (Kahn & Sempos, 1989); a total number of participants of not less than 500 was required to ensure statistical power. Based on the national census data, the proportion of elderly people in the designated regions; Middle, North-eastern, Northern and Southern regions of Thailand, is 10:9:7:4 respectively (Thai Population Information Center, 2002). The sampling procedure was designed to obtain the same proportion of participants as the national statistic. Therefore, the sub-districts in each region were randomly selected until the same proportion of elderly people was recruited.

All elderly people aged 60 and above were contacted by door-to-door method or else local leaders or public health officials made an appointment for interviews. In Thailand, older people generally have limited education (National Statistic Office, 2002). Sometimes they have difficulty understanding the details of projects and are reluctant to provide written consent. It is more appropriate to contact local leaders, to explain the study and give them all the written documents. They review the proposal and consent form. After approval is granted, they contact the older person, explain the study as per the written documents and inform potential participants that the study has the approval of the authorities. In this way, the older

persons feel more confident that the project has been screened by someone they trust. In this study, the interviewers provided a clear explanation to the leaders about the rights of the older people to refuse or stop participation in the study; that the older person was in no way forced to participate if they were not willing to. Prior to interviewing, the usual procedure for providing information and obtaining consents from older persons was again undertaken to ensure that the older persons received the same information once again before making their decision. Only older persons who consented to participate were interviewed.

The following inclusion criteria for participants were applied:

1. Thai citizen, confirmed by identification card or by inclusion in the census register

2. Aged 60 or over

3. Living in the community

4. Able to communicate using Thai language

5. Good orientation and memory: time, place and person orientation and memory were screened before data collection. The screening was performed as follows:

    - Time orientation was tested by asking the time, date, month, year and season
    - Place orientation was evaluated by asking where the older person lived, type of building and province
    - Person orientation was assessed by asking the older person their name, age, and occupation
    - Memory was be determined by giving the older person three numbers and the name of three cities and asking them to repeat them after three minutes

6. Consent to participate in this study provided

In Thailand, retirement and rights for public assistance take effect at age 60. Therefore this study used age 60 and over for inclusion criteria instead of age 65 as in international studies.

As the data collection of fall history and circumstances was based on the participants ability to recall fall experiences, it was necessary to ensure that the potential participants did not have cognitive problems such as disorientation and memory loss. The procedure used for screening orientation and memory are one part of the Mini Mental State Examination (MMSE). Although it cannot be used for diagnosis, it has been proven to be a good brief screening test (Tombaugh & McIntyre, 1992).

Using multistage random sampling, 4 provinces were chosen: Samut Prakan in the Middle region, Lamphun in the northern region, Udon Thani in the North Eastern region and Surat Thani in the Southern region (Figure 5.1). The Samut Prakan province was the only province where more than 1 sub-district had to be selected in order to recruit enough older persons to meet the regional proportion required for the study. This was primarily because the response rate was very low in this area. The main reason for refusing to participate was the written consent. Because they had no or limited educational background, they were not willing to provide written consent. Most of the older persons said they would participate if written consent was not required. Therefore there were 3 sub-districts chosen in the Middle region: Nakorn Samut Prakan, Bang Mueng and Bang Mueng Mai.

Figure 5.1 The Multistage Random Sampling Results

Thailand	Provinces	Districts	Sub-districts
	North: Lamphun	- King Amphoe Wiang Nong Long	- Nong Long
	Northeast: Udon Thani	- Amphoe Mueang Udon Thani	- Mak Khang
	Middle: Samut Prakan	- Amphoe Mueang Samut Prakan	- Nakorn Samut Prakan
			- Bang Mueng
			- Bang Mueng Mai
	South: Surat Thani	- Amphoe Phunphin	- Tha Rong Chang

The written consent was also the main reason given by people for refusing to participate in the other areas. However, unlike Sumut Prakan, it was more likely that there were other family members with higher education levels than the older persons. Therefore they could assure the person that there was no further commitment, in particular financial obligation.

Five hundred and forty six older persons participated in the main study. There were 178 older persons from Samut Prakan, 129 older persons from Lamphun, 160 older persons from Udon Thani and 79 older persons from Surat Thani.

As mentioned in the methodology, the study was designed to match the national statistics in terms of the proportion of older people in each region. A chi-square test for goodness of fit was used to test for differences between the actual and expected frequencies. To allow comparison with international studies, some

analysis was limited to participants aged 65 and over (as opposed to the total sample). Therefore, the proportion of the sample 65 and over was also tested for goodness of fit with national statistics. The results showed that the proportion of both the total group and the 65 and over group were not different from the national statistics at an alpha level of 0.01 [χ^2 (3, N = 546) = .724, p = 0.868 and χ^2 (3, N = 378) = 8.115, p = 0.044 respectively]. The descriptive data of 546 Thai elderly participants are shown in Table 5.1.

Almost 60% of the participants were aged between 60 and 69 years old. Sixty percent of the participants were female. There were a large proportion of married persons (68%). A quarter of the participants were widowed. Most participants had limited educational background; less than 15% had more than 4 years of education. Due to the reluctance to give written consent of those with limited education, there could be some degree of bias towards more educated older people. Ninety percent of the participants did not live alone. The majority of participants perceived their health as fair or poor.

Table 5.1 Descriptive Data of the 546 Participants

Demographic data		Number	Percent
Regions	Middle	178	32.6
	North	129	23.6
	Northeast	160	29.3
	South	79	14.5
Age (years)	60-64	168	30.8
	65-69	153	28.0
	70-74	116	21.2
	75-79	63	11.5
	80-84	29	5.3
	85-89	13	2.4
	90-94	4	0.7
Gender	Male	213	39.0
	Female	333	61.0
Marital status	Never married	17	3.1
	Married	371	67.9
	Widowed	147	26.9
	Divorced	3	0.5
	Separated	8	1.5
Education	No education	136	24.9
	1-4 yr	330	60.4
	More than 4 yr	80	14.7
Living	Not living alone	492	90.1
	Living alone	54	9.9
Perceived health	Excellent	8	1.5
	Very good	41	7.5
	Good	183	33.5
	Fair	220	40.3
	Poor	94	17.2

5.4.4 Measurement tools and procedures

Data collection was conducted using a structured interview that included the SAFE Thai version. The outline of the structured interview is shown in Appendix C. Demographic data and fall circumstances were collected by structured interview. The demographic data included age (in years), gender, current marital status, education (in years) and living situation. Self-perceived health was also collected by the structured interview.

Because it has been shown that elderly subjects recall recent falls during the preceding 12 months more accurately than the preceding three and six months (Cumming et al., 1988), each participant was questioned about whether and how many falls they had sustained in the previous 12 months. In order to exclude fall incidents which were caused by diseases or external events, falls were defined as:

"an event which results in a person coming to rest inadvertently on the ground or other lower level and other than as a consequence of the following: sustaining a violent blow; loss of consciousness; sudden onset of paralysis, as in a stroke; or an epileptic seizure' (Sattin, 1992).

The interviewers provided the definition before asking about fall experiences. If the participants had fall experiences, the interviewer would confirm that the fall met the requirements of the definition by questioning participants about the fall event.

Fall history, a dichotomous question measuring FOF, a dichotomous question measuring activity restriction, and fall circumstances for the most recent fall were also provided. The fall circumstances data included time of the day, activity engaged in, fall location, type of fall and environmental hazards. The type of falls (W00-W19) was based on ICD-10-AM classification (National Centre for Classification in Health, 1998).

The SAFE Thai version was used to measure FOF and activity restriction. The details of each variable are summarized in Table 5.2.

Table 5.2 Measurements and Classifications of Variables

Variables	Measurements	Measurement/Classification
Demographic data and variables		
Age	Structured interview	Years
Gender	Structured interview	Male/Female
Marital status	Structured interview	Never married Married Widowed Divorced Separated
Education	Structured interview	Years
Living situation	Structured interview	Not living alone Living alone
Self perceived health status	Structured interview	Excellent Very good Good Fair Poor
Fall circumstances		
Fall history	Structured interview	Yes/No
Number of falls	Structured interview	No fall 1 fall 2 falls More than 2 falls (number of falls if the participants could specified)
Time of fall	Structured interview	Time (in hour)
Place of fall	Structured interview	Home: indoor/outdoor Outside: indoor/outdoor
Fall associated activity	Structured interview	Work related Self-care Leisure Social/recreational
Fall type	Structured interview	ICD 10-AM (W00-W19)
Fall hazard	Structured interview	Yes/No If yes, following categories would be specified Extrinsic hazard - Fall of objects - Pushed over - Uneven surface - Slippery floor surface - Miscellaneous - Other (please specified) Intrinsic hazard - Side effects of medication - Other (please specified)
Dependent variables - prevalence		
Fear of falling - dichotomous question	Interview: Are you worried about falling?	Yes/No
Fear of falling	The SAFE Thai version	See section 4.5.3
Activity restriction - dichotomous question	Interview: Do you stop, avoid or restrict doing any activities because you worried about falling?	Yes/No
Activity restriction	The SAFE Thai version	See section 4.5.3

Data was collected by trained research assistants using face-to-face interviews. The training procedure was described in Chapter 4. There were 6 interviewers in this part of study. The interrater reliability of the interviewers are reported in section 5.5.1

5.4.5 Data analysis

The overall purpose of this study was to describe the fall circumstances, prevalence of FOF, activity restriction in fallers and non-fallers and identify the association between falls, fear of falling and activity restriction. As seen in Table 5.2, fall circumstances included fall history, number of falls, type, time and place of last fall along with associated activity and fall hazards. All were analysed descriptively using frequencies and percentages. Next, prevalence rates were calculated for FOF and activity restriction.

As will be discussed in the methodological issues section, FOF as measured by the SAFE Thai version presented better specificity, compared with the dichotomous question, thus FOF of Thai older people was measured using the SAFE Thai version. On the other hand, (see section 5.5.3) activity restriction as measured by the SAFE Thai version was not related to FOF. Therefore, the activity restriction of Thai older persons was determined by the dichotomous question.

To examine the relationship between activity restriction and FOF, FOF scores for each activity item were calculated by summing FOF scores regardless of whether the older adults had curtailed the activity or not. In order to identify differences in the FOF scores between the 11 activities a Friedman analysis was performed. The Friedman analysis was employed because the FOF and activity restriction scores of each activity were not normally distributed (Portney & Watkins, 2000). The Friedman analysis is an alternative to the parametric repeated measures ANOVA for ordinal data or when the parametric assumptions are not tenable. The analysis begins by converting scores in each variable (column) to ranks. The ranks are assigned across each subject (row). Then the ranks within each column will be summed. The Friedman statistic is tested using χ_r^2, which follows the standard χ^2 distribution with k-1 degree of freedom. The null hypothesis expects an even distribution across all columns, resulting in the summation of the ranks in all

columns will be the same. The null hypothesis will be rejected if any pairs of variable comparison show statistical differences.

Comparisons between fallers and non-fallers, those who had FOF and no FOF, and those who had activity restriction and no activity restriction were performed as they could be linked to identify the kind of persons more likely to have the problems (details in section 5.6). The Student t-test was chosen if the variables were measured in numeric scales and Chi-square was employed if the scales of measurements of the variables were nominal or ordinal scales (Dawson & Trapp, 2001).

The last objective of this study was to identify the association between falls and FOF, falls and activity restriction, and FOF and activity restriction. For the reason that FOF measured by the SAFE Thai version is more activity-specific, this FOF was used for calculation. The activity restriction measured by the dichotomous question was selected because of the same reason (details in section 5.6). Because all variables are categorical variables, Chi-square test was used to identify the associations.

5.5 Methodological Issues

Three methodological issues related to the SAFE Thai version will be discussed in this section: interrater reliability; retention/exclusion of the item 'take a tub bath'; and calculation of scores in the SAFE Thai version. The interrater reliability of 6 interviewers used in the main study is reported before the discussion of other methodological issues.

5.5.1 Interrater reliability

The main study was conducted by 6 interviewers. The interviewers were recruited from the group of raters who volunteered for the reliability study of the SAFE-Thai version reported in Chapter 4. Using the subset of data of the SAFE-Thai version interrater reliability study, interrater reliability of the 6 interviewers was performed. Twelve older adults were interviewed by the 6 interviewers. Each interviewer conducted 6 face-to-face interviews. Two participants withdrew from the study after the first interview because they were too busy to continue participation. Therefore, on average, each participant was interviewed by 3

interviewers. As the SAFE Thai version consists of 3 sets of scores: FOF if older people perform the activity, FOF if older people do not perform the activity and activity restriction (as compared to 5 years ago), the interrater reliability analysis was conducted in accordance with the scoring system. The results are shown in Table 5.3.

Table 5.3 Interrater Reliability

	ICC	p
Fear of falling score of those who did the activities	.9969	0.0027
Fear of falling score of those who did not do the activities	.9515	0.0062
Activity restriction score	.9562	0.0050

5.5.2 Retention/exclusion of the item 'take a tub bath'

The item 'take a tub bath' was retained for investigation in the larger scale study. In this Chapter, the item is reviewed again. The percentage of participants who engaged in the activity was calculated and the effect of preserving the item in the SAFE Thai version was investigated by comparing the SAFE score of older persons with and without the item. The Mann-Whitney U test was selected for the comparison because the SAFE score were not normally distribution (Dawson & Trapp, 2001).

The results from 546 Thai older adults showed that only 5 persons or 0.9% took a tub bath (Table 5.4). Furthermore, 98.7% of participants who did not do the activity were not afraid of falling during this activity (Table 5.4). Thus they did not stop doing this activity due to worry, rather than did not do the activity because they had never taken a tub bath. A comparison between SAFE scores across the 12 items (including 'take a tub bath'), and 11 items (excluding 'take a tub bath') showed that there were statistically significant differences in the mean scores of fear of falling and activity restriction (Table 5.4). For example, FOF scores during the activities that older people curtailed, showed that the mean FOF score across 12 activities was 0.75 whereas the score across 11 activities was 1.12. As a higher mean score indicates a higher degree of FOF, the inclusion of the item 'take a tub bath' reduced the affect of other activities.

A specific example further illustrates the distortion caused by the inclusion of the 'take a tub bath' item. If an older person is very worried about falling (FOF score =

3) on the 'take a walk for exercise' item and he stops doing the activity, his FOF score for the activity that he does not do should be 3. However, if the item 'take a tub bath' is included, and he has never take a tub bath and he is not worried about falling in this activity (FOF score =0). Consequently, the mean FOF score is 1.5. Consequently, the seriousness of FOF for the activities that the older person does not do decreased by 50%. Because of this effect, the item was deleted.

The 'take a tub bath' item also affected the activity restriction in the same way. The activity restriction score across 12 and 11 activities was statistically different (Table 5.5). However, the magnitude of the effect was less than the effect on the FOF score of activities not done. This is because the FOF score of activities done and not done are calculated separately whereas the activity restriction score is calculated only once. Therefore the 'take a tub bath' item was excluded from the SAFE Thai version and all further analysis was completed using an 11-item scale.

Table 5.4 Frequency of Participants Who Did the Activities and Did Not Do the Activities. (n = 546).

Activity	% Who did the activity	% Who did not do the activity for reasons unrelated to FOF	% Who did not do the activity because of FOF
Go to the store	77.1(421)	13.6(74)	9.3(51)
Prepare simple meal	70.9(386)	23.4(128)	5.6(31)
Take a tub bath	0.9(5)	98.7(539)	0.4(2)
Take a shower/wash yourself with a basin of water	99.6(544)	0.4(2)	0
Get out of bed	100.0(546)	0	0
Take a walk for exercise	85.0(464)	10.1(55)	4.9(27)
Go out when slippery	52.9(289)	5.7(31)	41.4(226)
Visit a friend or relative	85.5(467)	7.7(42)	6.8(37)
Reach over head	85.5(467)	4.4(24)	10.1(55)
Go to place with crowd	78.9(431)	9.7(53)	11.4(62)
Walk 200-300 meters outside	89.6(489)	5.1(28)	5.3(29)
Bend down	91.9(502)	2.6(14)	5.5(30)

Table 5.5 Comparison Between Fear of Falling Score and Activity Restriction Score Across 12 and 11 Activities.

SAFE score	Mean	SD	p value
FOF: activities completed			
- 12 activities	1.06	0.88	p = .971
- 11 activities	1.06	0.88	
FOF: curtailed activities			
- 12 activities	0.75	0.67	p < .001
- 11 activities	1.12	1.00	
Activity restriction			
- 12 activities	2.33	0.31	p < .001
- 11 activities	2.36	0.34	

5.5.3 Calculation of FOF using the SAFE Thai version

The SAFE original version showed that older persons who had higher FOF scores for activities done were more likely to have reduced their activities in the past 5 years (Lanchman et al., 1998). Furthermore, it was demonstrated that FOF scores of those who engaged in the given activities are significantly less than

FOF score of those who did not engaged in the activities (Lanchman et al., 1998). The SAFE original version was able to differentiate between people with FOF alone and those with FOF plus activity restriction. Therefore, It was considered important to explore whether the same relationships exist for Thai older people.

5.5.3.1 Comparison of FOF scores for Activities Done and Not Done

The SAFE Thai version yields two FOF scores: FOF of activities done and FOF of activities not done. The frequency, mean and standard deviation of the two FOF scores in this study are shown in Table 5.6. Comparisons of FOF scores of activities done and FOF of activities not done were performed by the Mann-Whitney U test. The results demonstrated statistical differences in some activities (Table 5.7). However, the direction of the differences was not the same; which is in contrast to expectation. Lanchman (1998) demonstrated that the FOF of activities done were significant lower than FOF of activities not done; therefore the SAFE (original) can differentiate FOF among those who do and don't restrict activity.

Table 5.6 Frequency of mean FOF scores across 11 activities of the SAFE Thai version

FOF score	FOF of activities done (n = 546)		FOF of activities not done [a] (n = 414)		FOF of all activities (n = 546)	
	Frequency	%	Frequency	%	Frequency	%
0.00 – 0.50	201	36.8	160	38.6	188	34.4
0.51 – 1.00	112	20.5	75	18.1	114	20.9
1.01 – 1.50	76	13.9	38	9.2	84	15.4
1.51 – 2.00	79	14.5	80	19.3	90	16.5
2.01 – 2.50	25	4.6	18	4.3	27	4.9
2.51 – 3.00	53	9.7	43	10.4	43	7.9
Mean ± SD	2.59±1.65		2.64±1.7		2.60±1.58	

[a] 132 of the participants did all activities.

The results of this study indicate that the relationship between FOF scores and activity restriction scores among Thai older person are not similar to the relationship in the original version. The comparison could not be performed for

two items, because only 2 participants did not 'take a shower/wash yourself with a basin of water' and all participants did 'get out of bed'. The comparison of results of the rest of items are described by groups in Table 5.6: FOF activities done > FOF activities not done, FOF activities done = FOF activities not done and FOF activities done < FOF activities not done.

Table 5.7 Comparison FOF Scores of Those Who Did Not Do and Those Who Did the Given Activities of 546 Thai Older Adults

Activity	FOF of those who did not do the activity		FOF of those who did the activity	
	Mean	SD	Mean	SD
Comparison cannot be performed				
Get out of bed[a]	-	-	0.87	1.05
Take a shower/wash yourself with a basin of water[b]	0.00	0.00	1.28	1.12
FOF activities done > FOF activities not done				
Go to the store*	0.78	1.05	1.02	1.13
Prepare simple meal***	0.39	0.87	0.79	1.03
Take a walk for exercise**	0.72	1.10	1.02	1.06
FOF activities done = FOF activities not done				
Go to place with crowd	1.14	1.20	1.03	1.09
Visit a friend or relative	0.94	1.09	0.91	1.06
Walk 200-300 meters outside	1.02	1.09	0.85	1.06
FOF activities done < FOF activities not done				
Bend down**	1.66	1.26	1.14	1.13
Go out when slippery***	1.98	0.98	1.44	1.05
Reach over head**	1.49	1.19	1.05	1.09

* $p \leq 0.05$
** $p \leq 0.01$
*** $p \leq 0.001$
[a] the comparison could not be perform, because all participants reported the they did the activity
[b] the comparison could not be perform, because the 2 participants who did not do the activity had no FOF

1. FOF scores greater in activities done versus not-done

As shown in Table 5.7, there were 3 activities: 'go to store', 'prepare simple meal' and 'take a walk for exercises' where the mean difference showed that older persons who did not engage in the activities had a lower FOF score. This raises two questions. 1) Did some participants curtail their activities for reasons other than FOF? and 2) Did those who complete the activities with FOF have no choice but to continue to do the activities? There was a considerable proportion of the 546 participants who curtailed their activities without FOF: 'go to store': 21.06%,

'prepare simple meal': 22.16% and 'take a walk for exercises': 9.34%. Additionally, 4.76% of the 546 participants did not curtail going to the store because they had not done it for 5 years. For the item 'prepare simple meal' and 'take a walk for exercise', there were 15.20% and 8.06% of the 546 who did not restrict the activity for this reason. This suggests that a large number of older persons did not do the activities for reasons other than FOF.

Interestingly, the 'go to store' and 'prepare simple meal' are the only 2 items that had a gender difference for participation among those who did not do the activities; [χ^2 (3, N = 125) = 11.261, p = .010] and [χ^2 (4, N = 160) = 23.047, p < .001] respectively. The persons who did not engage in the activities were more likely to be male. This indicates the gender-role difference in household chores. This supports a previous study in which the Thai older women had more roles in household chores than men (Chayovan, 1995). Furthermore, although most participants did not provide the reasons why they did not do the activities, some stated that they did not do or curtailed the activities because other family members did those activities or they had never done those activities. Thus gender and older status might determine the activity participation of older people in Thailand.

For the 'take a walk for exercise' item, 8% of the participants engaged in the activity more than they used to even though they had FOF. This percentage is much greater than the participation rate for all of the rest of the activities. Why older people do some activities more than they used to is not explored in the SAFE Thai version, thus the interviewers did not ask the participants about this topic directly. However, some information came up during the face-to-face interviews. A number of the participants reported that 'take a walk for exercise' is very important for maintaining their health. One said that it is a physician's prescription. The combination of older people who had never done the activity, who curtailed the activity because of other reasons and those who tried to maintain the activity even though they had FOF, might cause the FOF scores of those who did the activity to be greater than those who did not do the activity

2. FOF scores equal for activities done and not-done

There were 3 items where the FOF scores of activities done and not-done were equal: 'go to place with crowd', 'visit a friend or relative' and 'walk 200-300 meters outside'. However, there was a tendency for the older people to curtail these activities. The majority of older people who did 'go to place with crowd' (36.81% of 53.36%), 'visit a friend or relative' (33.33% of 54.39%) and 'walk 200-300 meters outside' (26.56% of 39.20%) less than they used to had fear of falling. Nevertheless, there were considerable proportions of the participants who curtailed the activities without FOF: 18.5% for 'go to place with crowd' 21.06% for 'visit a friend or relative' and 12.64% for 'walk 200-300 meters outside'.

Many of the older adults who curtailed 'going to place with crowd' for reasons other than FOF were monks, nuns and older people who practiced Buddhist traditional retreats. First, they curtailed the activity because of religious reasons. These three groups lay people, nuns and monks, each accepts different number of precepts: 8, 10 and 227 precepts for (lay people, nuns and monks respectively). Because of the precepts, they withdraw from going to crowded places. The degree of avoidance depends upon the number of precepts and period of practicing. Lay people may accept 8 precepts for a certain period of time e.g. 3 days, 5 days, every Buddhist holy day or a life time. The monks and nuns are practicing all the time. Second, the awareness resulting from practicing assures them that they are less likely to fall. The aim of practicing is to be aware of ones self and all surrounding circumstances. Therefore, the person can face vicissitude calmly and wisely. Although they cannot maintain the awareness all the time, practicing enables them to be aware of risk factors for falls. Thus they have confidence in managing falls. Third, as a result of the awareness, they concentrate on the present. Being worried for the future that has not come is an unnecessary suffering. Therefore, for them, being worried about falling is not only an ineffectual fall prevention strategy but also needless suffering. Furthermore, monks and nuns take more precepts. Therefore the degree of the withdrawal is greater than normal older people. In general they cannot touch anyone of the opposite gender. Because of the yellow robe for monks and white robe for nuns, Thai people notice their special conditions and it is a sin to break their intention. If they need to go to a crowded place, Thai

people will give way automatically to avoid breaking the precepts. Thus collision with or pushing by another person rarely happens.

Some older people who curtailed 'visit a friend or relative' and 'walking 200-300 meters outside' without FOF did not provide a reason why they did the activity less than they used to. Mostly, they reported their physical condition as the main reason for activity restriction. Hypertension, heart disease and joint pain were the main complaints.

3. FOF scores greater for activities not-done versus done

Mean differences showed that older adults who completed activities had lower FOF scores than those who curtailed the activity in 3 items: 'go out when slippery', 'reach over head' and 'bend down'. This is similar to results of the original SAFE tool used in Western country (Lanchman et al., 1998).

Only 5% of participants 'went out when slippery' less than they used to for reasons other than FOF. More than 80% of the 546 participants were concerned about falling in this activity. Therefore, it was clear that the participants stopped doing the activities because of FOF.

Only 10% of the participants 'reached over head' and 'bent down' less than they used to for reasons other than FOF, for example, joint problems and postural hypotension. Therefore they had rearranged their belongings to avoid those actions. Although around 30% of the participants performed the activities without FOF, almost 60% of the participants worried about falling while reaching or bending.

These results show that the FOF score for activities not done were not always higher than the FOF score of activities done. This indicates an inability to differentiate between persons who have FOF alone and those who have both FOF and activity restriction using the SAFE Thai version. Although a direct comparison could not be performed, the results suggest a different pattern of engaging in activities for Thai older people as compared to participants in the original SAFE study which showed a higher FOF score on those activities not

done. Because the FOF scores of activities done versus not done differed, neither one of the scores alone reflects the total picture of the FOF for each activity. Association between FOF-SAFE Thai version scores (FOF for activity done, activity not done and combination) and FOF from the dichotomous question were calculated using the Spearman's rho. The results indicate that the correlation between FOF-SAFE Thai version scores and FOF from the dichotomous question were improved after combination of the scores; from no correlation ($r = 0.084$, $p < .01$) to moderate correlation ($r = 0.502$, $p < .01$). Thus the combination FOF scores of both activities done and not done were combined to calculate an overall FOF score.

5.5.3.2 The cut-off score of the SAFE Thai version

This study measured FOF by a dichotomous question 'are you afraid of falling?' and the SAFE Thai version. The dichotomous question assesses FOF in general whereas the SAFE Thai version measures FOF while performing or curtailing specific set of activities and has the capacity to measure variability. As mentioned earlier Thai older people had different patterns of engaging in and curtailing the activities, so that the combination of FOF scores of those who did and did not do the activities are more appropriate for FOF measurement in Thai older people. This FOF score obtained from both the original SAFE and the Thai version provides a measure of severity, however the original version did not stipulate a set score to designate those with and without FOF. For the purpose of further analysis a cut-off score was required.

A score of 1 was selected as the cut-off point to identify those who have a FOF. The cut-off score was set based on the meaning of the rating scale in the SAFE Thai version. If a person has a FOF score equal to 1 (a little worried) or greater, it means that, across the 11 items a minimum FOF score of 11 was recorded. This equals to, on average, a score of 1 per item (FOF = 11/11 items = 1). Because the activities are activities of daily living, basic social activities and exercise, problems in these activities are clinically relevant.

Using the cut-off point, the FOF prevalence was 48.4%, compared with 72% when calculated by the dichotomous question. There were 153 older persons who had

FOF using the dichotomous question but had no FOF using the SAFE Thai version. On the other hand, there were 22 older persons who had no FOF by dichotomous question, but had FOF by the SAFE Thai version. Therefore, the FOF score obtained from the SAFE Thai version is more relevant to clinical aspects. Because of its specificity, only FOF from the SAFE Thai version was used for further analysis.

Because Thai older persons curtailed their activities for reasons other than FOF, the specificity of the activity restriction score of the SAFE Thai version needs to be examined. The correlation between FOF and activity restriction scores of the SAFE Thai version was calculated to decide whether the activity restriction scores should be used for further analysis. In order to determine the correlation between the SAFE Thai version FOF and activity restriction scores, the Spearman's rho was performed. The result revealed that there is no correlation between the FOF and activity restriction scores ($r = 0.055$, $p = .198$). This indicates that the activity restriction score was not related to FOF. Moreover, the majority of the older persons in this study were quite young (aged 60-69 years). At this stage of life, curtailment of activities appears to have changed because of changing roles not FOF. The activity restriction score from the SAFE Thai version might reflect overall activity restriction rather than activity restriction because of FOF among Thai older persons. Therefore, only activity restriction data from the dichotomous question was used for further analysis.

5.6 Results

5.6.1 Fall circumstances in Thai elderly people

5.6.1.1 Frequency of falls in Thai elderly people

Falls in the previous 12 months were recorded as no falls, 1 fall, 2 falls and 2 or more falls. All falls met the criteria set out in the fall definition. The majority of participants in the total sample (79%; $n = 432$) had experienced no falls whereas 21% of the older persons ($n = 114$) had fallen within the previous 12 months. Of the 378 participants aged 65 and over, the fall rate increased to 22% ($n = 84$ out of 378). The frequency and percentage of fall experiences are shown in Table 5.8.

Table 5.8 Frequency and Percentage of Falling, Fear of Falling and Activity Restriction

	Total sample (N = 546)		Sample aged 65 and over (N = 378)	
	Frequency	**%**	**Frequency**	**%**
Number of fall				
- NO FALL	432	79.1	294	77.8
- 1 fall	58	10.6	44	11.6
- 2 falls	23	4.2	13	3.4
- 2 or more falls	33	6.0	27	7.1
Total with 1or more falls	114	20.6	84	22.1
Fear of falling: the SAFE Thai version				
- NO	282	51.6	188	49.7
- Yes	264	48.4	190	50.3
Activity restriction				
- No	448	82.1	308	81.5
- Yes	98	17.9	70	18.5

5.6.1.2 Fall circumstances

Among the 546 participants, 114 older persons fell within the 12 months prior to the study. Using the face-to-face interview, the details of the most recent fall were recorded in terms of location of the fall, fall-associated activities, fall hazards, time of fall and fall type according to the ICD-10-AM (National Coding Center, 1996).

- Location

Table 5.9 indicates the location of falls, with more than 60% of falls taking place outdoors. Twenty three percent of falls took place in the area surrounding the house and 39% occurred outside their house and surrounding environment. Life style and housing design play an important role in falls in the surrounding area. For instance, townhouses in urban areas do not have a surrounding area. All activities and household chores are performed in the house. In contrast, houses in rural areas usually have compounds. Many activities including household chores like washing are performed in the compound. Thirty nine percent of falls occurred indoors (home and other buildings). With one third of the 114 falls happening inside the older person's home. Only 5% of participants fell inside other buildings. This suggests falls depend upon where the older people spend their time.

- Fall associated activities

The most common activity associated with falls was work (39%), most of these (32%) occurring outside (Table 5.9). Thai older people reported both paid and unpaid work e.g. household chores and subsistence farming, hawking etc. More than 80% of the work related falls took place outside the home, however one third of them occurred in the area surrounding the house. The second most common activity associated with falls was self-care (26%), followed by leisure activities (25%) and social and recreation activities (11%).

As expected, two thirds of falls related with self-care occurred inside participants' homes. The self-care activities that the older persons did outside were cooking, laundering and using an outside toilet. Some Thai older adults preferred cooking by charcoal cooking stoves. Because of the smoke, the stoves are usually placed outside. In rural areas, most houses have a washing area in a porch by the side of or at the back of the house. Clotheslines are also available. In very old houses, the toilet is on land at the back of the house. The distance between the house and toilet could range from 5 to 20 meters. This kind of toilet can also be found in public places e.g. temples. Although only a few participants had fall experiences associated with using the toilet, most participants reported their concerns about falls when engaging in the activity.

During leisure activities, falls almost equally occurred between inside and outside. However, the lowest fall rate was found inside other buildings. Gender differences in activities were also noted. The most common leisure activity among men was gardening. None of the male older persons had indoor leisure activities. Women were more likely to participate in indoor activities. Furthermore, as most activities were performed in the sitting positions (except gardening), the falls occurred when the participants was walking or transferring.

Falls related with social/recreation activities occurred in all places, but more than 50% of falls occurred outside. Most social/recreation activities were social functions or gatherings. They were held at participants houses, relative's or friends' houses or in public places. The gatherings varied from family members

or close friends as a small group to a big social function such as a wedding ceremony. Specific activities related to the falls varied depending upon the roles of the older person at the functions.

- Hazards

The majority of participants (76%) reported external hazards as the cause of falling. Tripping and slippery floor surfaces were the greatest external hazards (30% and 32%, respectively) (Table 5.9). Twelve percent of participants reported that no hazards were involved with their falls. For 11% who reported internal factors, most of them could not specify the hazards. 'Old age' was the most frequent answer; even though some of them mentioned diseases that had that made them weaker.

Table 5.9 Circumstances of falls for Thai older adults who fell in the previous 12 months

Fall circumstances	Inside Percent (n)	Surrounding Area Percent (n)	Overall Percent (n)
Place of falls			
- Home	33.33(38)	22.81(26)	56.14(64)
- Away from home	5.26(6)	38.60(44)	43.86(50)
Associated activity			
- Work-related	7.02(8)	31.58(36)	38.60(44)
- Self-care	17.54(20)	7.90(9)	25.44(29)
- Leisure	9.65(11)	14.91(17)	24.56(28)
- Social and recreation	4.38(5)	7.02(8)	11.40(13)
Hazard			
- No hazard	6.14(7)	6.14(7)	12.28(14)
- Extrinsic hazards			
• Fall of objects	1.76(2)	5.26(6)	7.02(8)
• Pushed over	0	0	0
• Uneven floor	7.90(9)	21.93(25)	29.83(34)
• Slippery floor surface	16.67(19)	14.91(17)	31.58(36)
• Miscellaneous	1.75 (2)	0.88(1)	2.63(3)
• Others	0	5.26(6)	5.26(6)
- Intrinsic hazard			
• Side effects of medications	0	0	0
• Others	4.38(5)	7.02(8)	11.40(13)

- Time

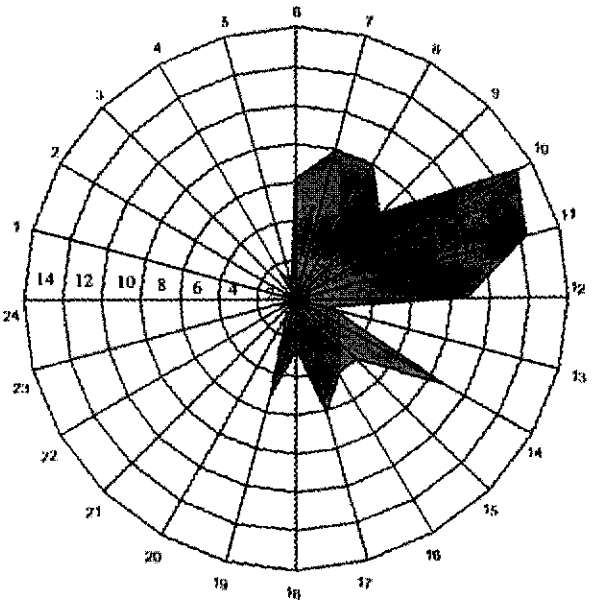
Data on the time of falling are shown in Figure 5.2. Ninety percent of falls occurred during the daytime. Morning was the most common period (62%). The percentage of falls dropped sharply during mid-day. Twenty eight percent of falls occurred in the afternoon. The fall rate dropped again at 6 pm., with a slight increase of up to 5% at 7 pm. There were only 2 falls after 7 pm interestingly, no falls occurred after 10 pm.

The time of falls sorted by place of falls and fall-related activities are shown in Figures 5.3 and 5.4. Indoor falls occurred between 4 am and 10 pm. whereas the outdoor falls occurred between 6 am and 7 pm. No outdoor falls occurred during the nighttime. Figure 5.4 demonstrates that the falls associated with self-care and leisure activities occurred from 4 am to 10 pm, but most falls occurred during

daytime. The falls associated with work and social/recreation activities occurred in a shorter range of time.

Figure 5.2 Percentage of falls sorted by time of falling

Night



Day

Figure 5.3 Time of Falls Sorted by Location of Falls (n = 114)

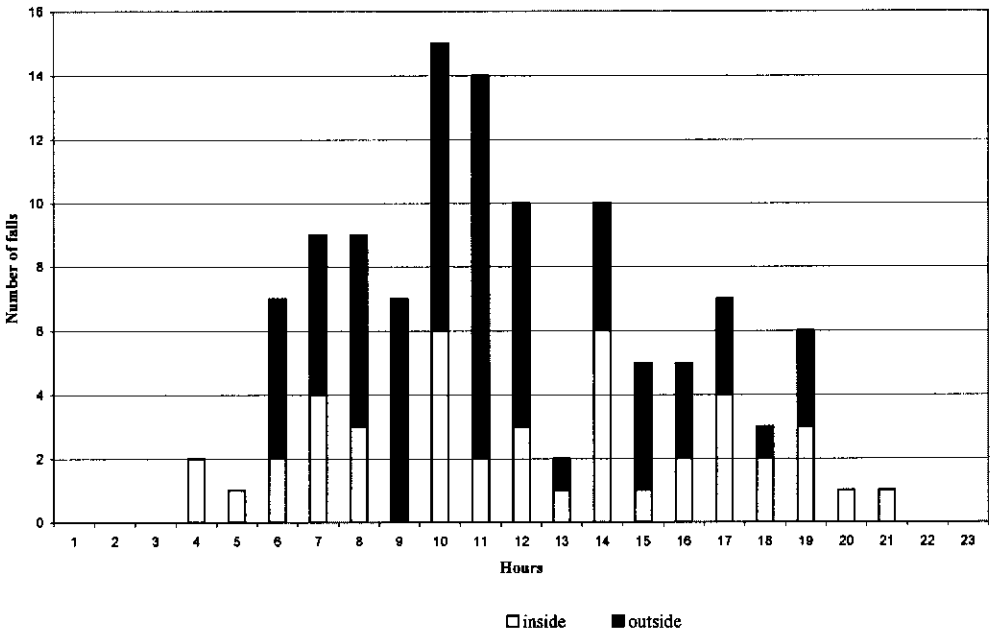
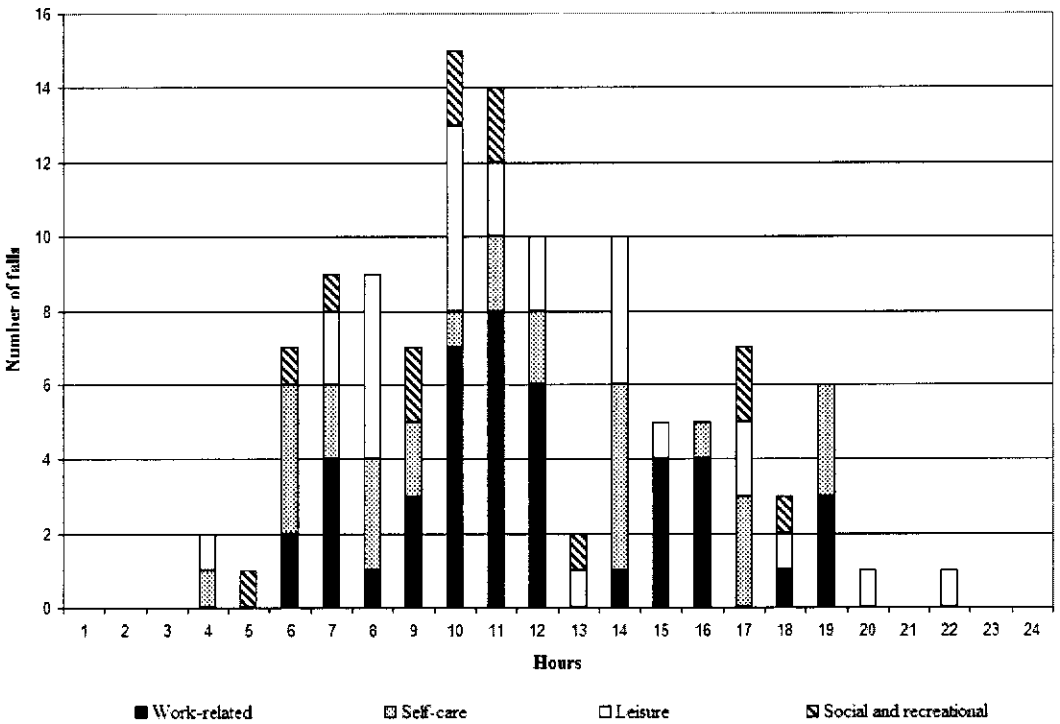


Figure 5.4 Time of Falls Sorted by Associated activities (n = 114)



- Type of falls

Fall types were classified using the International Classification of Diseases and Related Health Problem, 10th revision, Australian Modification (ICD 10AM) (National Centre for Classification in Health, 1998). The results are shown in Table 5.10. Most Thai older people fell on the same level from slipping, tripping or stumbling (61%). This was followed by falls on or from stairs or steps (24%). Eleven percent of falls were unspecified; the participants could not recall the details of the fall events.

Table 5.10 Frequency of Falls Classified by ICD-10-AM.

Fall circumstances		**Total Percent (n)**
W00	Fall on the same level involving ice and snow	0
W01	Fall on same level from slipping, tripping, or stumbling	61.40(70)
W02	Fall involving ice-skates, skis, roller-skates or skateboards	0
W03	Fall on same level from collision, pushing, or shoving, by or with other person	0
W04	Fall while being carried or supported by other person	0
W05	Fall involving wheelchair	0
W06	Fall involving bed	0
W07	Fall involving chair	0
W08	Fall involving other furniture	0
W09	Fall from playground equipment	0
W10	Fall on or from stairs or steps	23.68(27)
W11	Fall on or from ladder	0
W12	Fall on or from scaffolding	0
W13	Fall from, out of or through building or structure	0.88(1)
W14	Fall from tree	0
W15	Fall from cliff	0.88(1)
W16	Diving or jumping into water causing injury other than drowning or submersion	0
W17	Other fall from one level to another	2.63(3)
W18	Other fall on same level	0
W19	Unspecified falls	10.53(12)

5.6.2 Prevalence of FOF and Activity Restriction of Thai elderly people

5.6.2.1 FOF

Using the SAFE Thai version, the prevalence of FOF for total participants was 48.4%. The prevalence of participants aged 65 and over was 50.3%. (Details of cut-off point used to determine whether a person had FOF or not are described in section 5.5.3.2). The degree of fearfulness of each activity was analysed using the Friedman Test statistic. The results showed that 11 activities were statistically different in terms of FOF [χ_r^2 (10, N = 546) = 693.313, p < .001] (Table 5.11). The higher rank indicates higher degree of FOF.

Table 5.11 Mean Rank of FOF and Activity Restriction of Activities in the SAFE Thai Version

Activities	FOF		Activity restriction	
	Mean rank	Order	Mean rank	Order
Go out when slippery	8.09	1	7.32	1
Take a shower/wash yourself with a basin of water	6.77	2	4.32	11
Bend down	6.38	3	6.46	6
Reach over head	6.20	4	6.53	5
Go to place with crowd	6.05	5	6.64	2
Take a walk for exercise	5.79	6	5.20	9
Go to the store	5.73	7	6.54	4
Visit a friend or relative	5.54	8	6.58	3
Walk 200-300 meters outside	5.36	9	5.78	8
Get out of bed	5.34	10	4.52	10
Prepare simple meal	4.75	11	6.11	7
Friedman Test Statistics				
N	546		546	
Chi-Square	693.313		834.318	
Degree of freedom	10		10	
Asymp. Sig.	.000		.000	

The rank and quartiles of FOF scores confirmed that the 'go out when slippery' was the most fearful activity. The older people appeared to have more FOF in more challenging activities. The second highest was 'take a shower/wash yourself with a basin of water'. This style of washing causes the bathroom floor to become wet and slippery which explain why older people were afraid of falling while they performed the activity. The next 2 ranked items were activities that required maintenance of postural control: 'bend down' and 'reach overhead'. The 'go to place with crowd' item was ranked next. The hazardousness of the activity appears to depend upon external factors: crowd. The older persons might feel less

confident in preventing falls. The less challenging activities had lower FOF ranks. The 'prepare simple meal' had the lowest rank of FOF.

5.6.2.2 Activity Restriction

Using the dichotomous question, 17.9% of the Thai older persons restricted their activities. The differences in degree of activity restriction are shown in Table 5.11. The Friedman statistic showed that the 11 activities were statistically different in terms of degree of curtailments [χ_r^2 (10, N = 546) = 834.318, $p < .001$]. The results showed that the 'go out when slippery' was the item that the older people were most likely to curtail. The next 5 activities (go to place with crowd, reach over head, visit a friend or relative, go to store and bend down) had nearly the same mean scores. For basic activities of daily living, 'take a shower/wash yourself with a basin of water' and 'get out of bed', the mean score were nearly 2 which mean the participants did not curtail these activities.

5.6.3 Comparison between fallers and non fallers

The different characteristics of fallers and non-fallers are shown in Table 5.12. The results show that fallers were more likely to be older ($p < .001$). Women were also more likely to fall than men (71% vs. 29%), however, women were also more likely to be widowed [χ^2 (4, N= 546) = 61.102; $p < .001$], tended to live alone [χ^2 (1, N= 546) = 4.313; $p = .040$] and rated their health as poorer [χ^2 (1, N= 546) = 13.232; $p < .001$]. This suggests confounding effects between these 4 factors. Although there was no statistical difference in living situation, the older persons who were not currently married were less likely to fall than married older persons. Older persons who perceived that their health was not good were more likely to fall (68% vs. 32%). The fallers were more likely to have FOF than non-fallers (62% vs. 47%). Compared with non-fallers, the older persons with fall experiences were more likely to have activity restriction (25% vs. 16%). There was no statistical difference between fallers and non-fallers in terms of educational background.

Table 5.12 Comparison of Fallers and Non-Fallers (Total Group)

Continuous variable	**Non-fallers (n = 432)**	**Fallers (n = 114)**	**P value (if < .05)**
Age (years ± SD)	68.41±6.45	70.91±8.05	< .001
Education (years± SD)	3.98±3.66	3.11±2.97	ns.
Categorical variable	**Non-fallers (%) (n = 432)**	**Fallers (%) (n = 114)**	**Chi-square**
Gender			
- MALE	41.7(180)	28.9(33)	6.133*
- FEMALE	58.3(252)	71.1(81)	
Marital status			
- Married	70.6(305)	57.9(66)	6.687*
- Not married	29.4(127)	42.1(48)	
Living			
- Not living alone	90.3(390)	89.5(102)	0.065
- Living alone	9.7(42)	10.5(12)	
Perceived health			
- Excellent	1.6(7)	0.9(1)	11.150*
- Very good	8.8(38)	2.6(3)	
- Good	35.0(151)	28.1(32)	
- Fair	39.4(170)	43.9(50)	
- Poor	15.3(66)	24.6(28)	
Fear of falling			
- No	53.1(156)	38.1(32)	6.265*
- Yes	46.9(138)	61.9(52)	
Activity restriction			
- No	84.0(363)	74.6(85)	5.488*
- Yes	16.0(69)	25.4(29)	

ns = not significant
* $p < .05$

5.6.4 Comparison of Thai Older Persons With FOF and No-FOF

A comparison of those with and without FOF is shown in Table 5.13. The comparison demonstrated that older persons with FOF were significantly older (70 vs. 68 years). The educational backgrounds of those with FOF and no FOF were also statistically different. Women were more likely to have FOF than men (73% vs. 50%). Marital status and living situation among those who had FOF and no FOF were similar. Older persons who perceived their health as not good were more likely to have FOF. Around three quarters of older people with FOF rated their health status as fair or poor. They were also more likely to have had previous falls (25% vs. 17%) as well as activity restriction (26% vs. 10%).

Table 5.13 Comparison of Thai older persons with FOF and no FOF

Continuous variables	**No FOF (n = 282)**	**FOF (n = 264)**	**P value (if < .05)**
Age (years ± SD)	68.15±6.13	69.78±7.52	.005
Education (years± SD)	4.64±4.06	2.89±2.6	< .001
Categorical variables	**No FOF (%) (n = 282)**	**FOF (%) (n = 264)**	**Chi-square**
Gender			
- Male	50(141)	27.27(72)	29.602***
- Female	50(141)	72.73(192)	
Marital status			
- Married	70.57(199)	65.15(172)	1.836
- Not married	29.43(83)	34.85(92)	
Living			
- Not living alone	91.13(257)	89.02(235)	0.687
- Living alone	8.87(25)	10.98(29)	
Perceived health			
- Excellent	2.13(6)	0.76(2)	69.70***
- Very good	13.12(37)	1.52(4)	
- Good	42.91(121)	23.48(62)	
- Fair	31.91(90)	49.24(130)	
- Poor	9.93(28)	25(66)	
Fall history			
- No	83.33(235)	74.62(197)	6.265*
- Yes	16.67(47)	25.38(67)	
Activity restriction			
- No	89.72(253)	73.86(195)	23.267***
- Yes	10.28(29)	26.14(69)	

* $p < .05$
** $p < .01$
*** $p < .001$

5.6.5 Comparison of Thai Older Persons With Activity Restriction and No-Activity Restriction

A comparison of those with and without activity restriction is shown in Table 5.14. The comparison results show that the older adults who had activity restriction were more likely to be married (79% vs. 66%), perceived their health as fair or poor (72% vs. 54%), had previous fall experiences (30% vs. 19%) and a fear of falling (82% vs. 18%).

Table 5.14 Comparison of Thai Older Persons With and Without Activity Restriction Measured With a Dichotomous Question

	Dichotomous question		
Continuous variables	**No activity restriction (n = 448)**	**Activity restriction (n = 98)**	**P value (if < .05)**
Age (years ± SD)	68.64±6.48	70.30±8.37	ns.
Education (years± SD)	4.00±3.61	2.85±3.03	ns.
Categorical variables	**No activity restriction (%) (n = 448)**	**Activity restriction (%) (n = 98)**	**Chi-square**
Gender			
- Male	39.73(178)	35.71(35)	0.546
- FEMALE	60.27(270)	64.29(63)	
Marital status			
- Married	65.63(294)	78.57(77)	6.188*
- Not married	34.37(154)	21.43(21)	
Living			
- Not living alone	90.40(405)	88.78(87)	0.239
- Living alone	9.60(43)	11.22(11)	
Perceived health			
- Excellent	1.56(7)	1.02(1)	14.302**
- Very good	8.93(40)	1.02(1)	
- Good	35.27(158)	25.51(25)	
- Fair	37.50(168)	53.06(52)	
- Poor	16.74(75)	19.39(19)	
Fall history			
- No	81.03(363)	70.41(69)	5.488*
- Yes	18.97(85)	29.59(29)	
Fear of falling			
- No	29.69(133)	18.37(18)	5.150*
- Yes	70.31(315)	81.63(80)	

ns. = not significant
* $p < .05$
** $p < .01$

5.6.6 Association between falls, FOF and activity restriction

The last objective of the main study was to identify the association between falls and FOF, falls and activity restriction and FOF and activity restriction.

The Chi-square test indicated that fall history was associated with FOF as measured by the SAFE Thai version [χ^2 (1, N = 546) = 6.265, p = .015] and with activity restriction measured by the dichotomous question [χ^2 (1, N = 546) = 5,488, p = .027].

The FOF using the SAFE Thai version was significantly associated with the activity restriction as measured by dichotomous question [χ^2 (1, N = 546) = 23.267, p < .000].

5.7 Discussion

5.7.1 Can the results be generalized to Thai elderly people?

The main purpose of this study was to determine the prevalence of falls and FOF and describe the fall circumstances of Thai older people. Therefore it was necessary to ensure that the results could be generalized to Thai older people. The precision of generalization from sample to population is related to the size of the sample (Barker, 1976). It has been shown in the method section that to guarantee the statistical power for single binomial parameter (FOF or no FOF), the sample size needed to be not less than 500; n = 504 (1.96SE(p) = 1.96 [P91-P0/n]1/2 = 0.04) (Kahn & Sempos, 1989). There were 546 Thai older persons in this study. This means the sample size was large enough to merit a firm conclusion of FOF prevalence on statistical grounds with sampling errors less than 4%.

Generalization also relates to representativeness. The participants in this study were recruited using multistage random sampling. Using multistage random sampling, small areas (sub-districts) were selected randomly. Both advantages and disadvantages of the sampling method can be seen. By selecting one small area (in this case each sub-district), participants were clustered in one place, making it practical to conduct a study of a large population e.g. Thai older adults. Although it is possible that by chance the older people living in the one selected area were different from the entire population on some characteristics, the characteristic of all samples from all selected areas should be close to the population norms. In this study, the proportion of participants in each region was the same as the national statistic. Therefore specific characteristics in each region influenced the total sample in a way similar to that expected in the total population. A disadvantage of this sampling method is that if the condition of interest or the disease itself is clustered in one area, the method is not appropriate. It is known that there us wide variation in living conditions across Thailand. For example the urban-rural distribution of the elderly population was not taken into account in the sampling methods. Older adults in urban and rural areas might have different living

situations as well as social supports. Therefore this factor should be considered in future studies. Finally, while every effort was made to sample the entire population in each sub-district, it is well known that the registration system may not reflect numbers accurately and that local leaders may not be able to provide completely accurate data.

Although direct statistical comparison with the national census could not be performed, the description of the participants demonstrated that the participants and the entire population of Thai older people were alike in many ways (National Statistic Office, 2000). First, around 60% of the participants and the population are aged between 60 and 69. Second, the number of females was greater than males, however the percentages were slightly different (60% for the samples and 54% for the population). The majority of both group were married, but the percentage in the sample was much greater than the national statistics; 70% and 55%. A quarter of both groups were widowed. Older people in both the entire population and sample had limited educational background. Less than 15% had more than 4 years of education, however 75% of the sample completed primary school (4 years) or higher education; which is more than 2 times that of the entire population. As reported earlier, the main reason for refusing to participate in the study was the need for written consent. Many potential participants with limited educational background refused to participate. Older persons with limited education were more likely to provide consent if their spouse gave the consent. This resulted in a bias selection of married older persons with higher educational background. Nevertheless, more than 85% of elderly still had education level ranging from 0 to 4 years as per the nation census.

By the sample size, sampling method and the similarity of characteristics between the sample and population, the results of this study can be cautiously generalized to the Thai older people.

5.7.2 Falls in Thai elderly people

A retrospective method was used to measure falls in this study. The participants were questioned as to whether they had fallen in the past 12 months. A preceding study has demonstrated that the recall of fall history in the past 12 months is more accurate than 3 and 6 months recall period (Cumming et al., 1988). The accuracy

of this method relies mainly on the participant's memory. All of the participants were screened for memory problems before inclusion. Although the memory screening method in this study cannot be used to diagnose a memory disease, the method has been proven to be a good brief screening test (Tombaugh & McIntyre, 1992).

This study found a 20% fall prevalence rate for the total group which is slightly higher than the national survey (Choprapawon, 1995; Jitapunkul et al., 1998). However, this study recorded fall experiences during 12 months prior to the interview instead of 6 months as the national survey. Although the time period is 2 times longer, the fall rate was not double. It is likely that this difference is the consequence of using a different fall definition. In this study, falls were defined as an event that results in a person coming to rest on the ground or lower level unintentionally; and it is not a consequence of sustaining a violent blow, loss of consciousness, sudden onset of paralysis or an epileptic seizure (Sattin, 1992), while the national survey excluded only falls resulting from overwhelming external causes e.g. car accidence (Jitapunkul et al., 1998). Using the more restricted definition, less falls were included in this study. Because falls from sudden onset illnesses were excluded, the information gives more specific relevance to falls prevention.

Compared with international studies, the fall prevalence was much lower; 20% vs. approximately 33% (Sattin, 1992; A. Tromp et al., 2001). Even when only older persons aged 65 and over were selected for the analysis, the fall prevalence in Thai older people was 22%. This rate is in harmony with lower fall rates in Asian countries for example, 18% in Hong Kong (Ho et al., 1996) and 16.5% to 21.5% in Japan (Niino et al., 2000; Yasumura et al., 1994). Although the findings indicated lower rates of falling in Thai older people, it still reflects a considerable risk of falling. This suggests the necessity of falls prevention programs. Moreover, it has been demonstrated that the benefits of falls prevention programs are greater in young-old people (age 65-74 years) rather than frail elderly people (Stuck et al., 2001).

However, Thai older fallers shared many characteristics with older fallers in other countries which suggest the similar strategies for both falls prevention and target

group identification. Firstly, falling increased with age in this study as in international studies (Myers et al., 1996; Nevitt et al., 1991; Nevitt et al., 1989; Tinetti, 1988). This corresponds with declining function in older people with advancing age. A previous study has shown that the prevalence of impairment in sensory-motor functions, vision (acuity and contrast), peripheral sensation, vestibular sense, muscle strength, reaction time and stability increase with age (Lord et al., 1994). All of these are risk factors for falls (Myers et al., 1996; A. Tromp et al., 2001).

Secondly, women were more likely to fall than men. Seventy one percent of Thai fallers were women. This finding supports many international studies e.g. Blake (1988), Campbell (1990), Myers (1996) etc. Gender differences in health are a complex issue. Men and women are different in terms of biology, life style and social supports. These differences have life long health consequences. Moreover, it is known that woman have poorer health and higher degrees of disabilities due to the fact that they have a longer life expectancy (Quadagno, 2002). Although there was no age difference between men and women in this study, the females were more likely to be widowed and rated their health as poor. Because the marital status and self- perceived health were also significantly different between Thai fallers and non-fallers, widowhood and poor health might have confounded the effect of gender differences.

Thirdly, 68% of fallers reported their health as fair or poor. This supports similar findings in both Asian countries (Ho et al., 1996) and Western countries (Nevitt et al., 1989; O'Loughlin et al., 1993). Previous studies show that many diseases, physical impairments, visual impairments and medication use are related to falls (Campbell et al., 1989; Herala et al., 2000; Myers et al., 1996; A. Tromp et al., 2001). This study did not investigate all fall-related health problems identified in preceding research (Moreland et al., 2003; Myers et al., 1996; Prudham & Evans, 1981). Because of the applicability in practice, only the self-perceived health status was used. As the majority of Thai older people had limited education, reliability and validity of details of illnesses by interviews are questionable. In Thailand, the drugs prescribed are usually identified to patients related to their symptoms e.g. pain killers. Moreover, it has been reported that only 53% of Thai older people use

health services and they prefer to buy drugs over the counter (Jitapunkul et al., 1999). Therefore medication use could not be examined.

Fourthly, Thai fallers were more likely to have FOF as measured by the SAFE Thai version. Interestingly, 46% of non-fallers also had FOF. It has been shown that FOF and falls are risk factors for each other (Friedman et al., 2002). Because FOF was common among both fallers and non-fallers, it is important to identify whether the FOF leads to falls or vice versa.

Finally, Thai fallers tended to have activity restriction. Approximately 25.4% of the fallers had activity restriction. This supports the finding of a study of older persons living in the community which showed that the injurious falls were related to activity restriction in the older persons (Murphy et al., 2002). On the other hand, Howland (1998) indicated that older persons with and without activity restriction did not differ in terms of fall history, but the older persons who had activity restriction were more likely to know someone who had experienced a serious fall. This suggests the effects of both direct and indirect fall experiences on activity restriction. Future studies are needed to identify the effects of indirect experiences.

Unlike international studies, Thai fallers and non-fallers were not different in living situation. Despite rapid socioeconomic changes, familial support for older members has not changed to a significant degree. Similar to the past, older people living alone is uncommon in Thailand (6%) (National Statistic Office, 2000). In this study 10% of participants lived alone, which is slightly higher than the national statistic. Although living alone is a risk factor for falls (Campbell et al., 1990; Nevitt et al., 1989; Tinetti, 1988; Vellas et al., 1998), the number of older fallers living alone was low. Therefore, the effect of living alone could not be identified, probably due to the small numbers.

Although living alone was not identified as an important risk factor for falls, there is an increasing tendency for older people to live alone. The national census data showed that the percentage of older people living alone has increased from 4% in 1990 to 6% in 2000 (National Statistic Office, 1990, 2000). It should be noted that living situation might play a more important role in Thailand in the future.

5.7.3 Fall circumstances

Although environmental hazards are risk factors for falls (Northridge et al., 1995; Tinetti, 1988), interaction with other risk factors has also been suggested (Northridge et al., 1995). Moreover, a multinational study showed that fall circumstances varied by site (Allander et al., 1998). Lack of information could lead to under- or overemphasizing the hazards. The underemphasizing in a high-risk environment leads to a failure of falls prevention. On the other hand, overemphasizing in unnecessary areas is not cost-effectiveness. Therefore, it is important to identify the fall circumstances in Thailand.

Identification of fall circumstances of Thai older persons was one of the main objectives of this study. The 114 fallers in this study could report the fall circumstances of their latest falls without difficulty. All fall circumstances were recorded, however 10% of fallers could not recall some details, so their falls were classified as unspecified falls following the ICD-10-AM.

The accuracy of reporting fall circumstances is subject to the recall ability of older persons. As discussed in the previous section, screening for memory deficits was included in the recruitment procedures. Moreover, only the most recent fall was described. These methods were used to improve the accuracy of the reported data. However, for a retrospective study, the more details that are required the more possibility there is for underreporting or provision of incomplete information (Downton, 1993).

5.7.3.1 Location of falls

In this study, the location of the falls was divided into 2 categories: home and other places. Two sub-categories: indoors and outdoors were applied for each category. Among the 114 falls, 60% occurred outdoors. The percentage of outdoor-falls was slightly less than the results of the national survey (60% vs. 65%) (Jitapunkul et al., 1998). However, it was not clear whether 'fall outside' in the national survey included falls outside home but inside other buildings or not. This might explain why the percentage of outdoor falls in this study was less than the national survey. Additionally, this result was in accordance with falls study in Hong Kong (Ho et al., 1996) and Japan (Niino et al., 2000) but in contrast to other countries. For example, in a rural sample of New Zealand, the most common places for falls were

bedroom, kitchen, and living room (Campbell et al., 1990). In California, two-thirds of older people fell at home (Ellis & Trent, 2001). There was only 1 non-Asian study that has reported more than 50% of falls occurring outdoors (Hill et al., 1999), but 'regularly going outdoor was one of inclusion criteria for sample selection of Hill's study.

Forty percent of falls took places indoors. Thirty five percent occurred in the elderly adults' home and another 5% occurred inside other buildings. This rate differs from studies in other countries. It has been reported that the fall rate within the home among older community dwellers is 26 to 77% (Hill et al., 1999; Prudham & Evans, 1981; Tinetti, 1988; Yasumura, Haga, & Niino, 1996). One possible explanation for the difference may be related to the ability to control the hazards. A qualitative study of older people living in the community in Chiang Mai, a northern province of Thailand, demonstrated that most older persons recognised the environmental hazards for falls, but they could manage only home hazards (Bunrayong et al., 2002). Hazards in public areas such as temples and markets, could not be modified by the older adults; the main strategies for falls prevention were being watchful and careful (Bunrayong et al., 2002). This may indicate that Thai older people are more likely to be exposed to the hazards when going outside and then, therefore, are more likely to fall. Another possibility is that the Thai elderly might spend more time outdoors. First, there is no seasonal barrier for going outdoors in Thailand. Thai older adults can perform outdoor activities year-round. Second, one third of Thai older adults continue working regardless of their age (National Statistic Office, 2002); and 57% of jobs are related to the agricultural sector. This suggests that Thai older adults engage in outdoor activities regularly.

5.7.3.2 Fall associated activities

Fall-associated activities were classified as work, self-care, leisure and social/recreation activities. The participants in this study were active community dwellers. It was expected that their activity engagement pattern would be diverse. Using names of activities to classify fall-associated activities would not give relevance to future fall prevention program. Therefore the above classification was selected.

In spite of the rapid growth in the industrial sector in past decades, most Thai people continue to work in the agricultural sector. In the agricultural culture, there is no compulsory retirement. Thai older persons, therefore, continue to work as long as they are physically and mentally able, though they may gradually reduce the number of working hours or change their responsibilities. The national census reported that 32% of Thai older people worked in the year 2002 (National Statistic Office, 2002). On average the older worker worked 44 hours per week (National Statistic Office, 2002). Not surprisingly, the most common fall associated activity in Thai fallers was work. Almost 40% of falls for Thai older people were related to work. Eighty percent of these falls occurred outdoors. This supports the statistic that around 57% of older workers worked in the agricultural sector (National Statistic Office, 2002). Although Thai older adults usually continue working after 60, fall prevention programs in work places have not been proposed. Future investigations are needed for program development.

Self-care and leisure activities were the second most common fall-associated activities. One quarter of falls were classified in each category. Two-thirds of self-care related falls occurred inside homes. Because of different classification systems, the fall rate could not be compared to other studies. Nevertheless, using places of falls and lists of activities associated with falls in other studies, the findings support the fact that cooking, housework, and using the toilet are fall-associated activities (Campbell et al., 1990; Mackenzie et al., 2002).

In addition, the elderly still performed some activities outdoors; for example cooking, laundering and going to the toilet. Most have more modern equipment such as gas or electrical stoves and washing machines; but it is their preferences to do the activities in the old way. In the near future, outdoor falls related with self-care may decrease. However, the outdoor toilet still can be found in public places, especially temples. So specific approaches to reduce fall risks involving these activities is not only worthwhile for falls prevention but also for elderly quality of life.

In this study, 25% of falls occurred while the older persons performed leisure activities. The activities were varied. Therefore the finding does not suggest specific approaches for any activities. However, it was revealed that the older

persons fell when they transferred rather than when they performed the activities. This finding agrees with previous research that showed the most common activities associated with falls were 'just walking' (Mackenzie et al., 2002; Niino et al., 2000). Moreover, experiencing trouble with walking, lower extremity weakness and poor gait are risk factors for falls in older people living in the community (Lord et al., 1991; Myers et al., 1996; Nevitt et al., 1989; O'Loughlin et al., 1993). This suggests prevention should target transferring rather than the leisure activities.

The falls associated with social/recreation activities accounted for only 10% of falls in Thai older people. The most common activities were social gatherings. However, the activities related to the fall depended on elderly roles in the social gathering. Most falls occurred outdoor, but the older persons fell both indoor and outdoor, at their homes or other places. There was no previous study concerning falls associated with social/recreation activities.

5.7.3.3 Hazards

Both extrinsic and intrinsic hazards for falls according to elderly opinions were investigated. Three quarters of falls were caused by external hazards. The result agrees with a study in Japan which found the majority of falls were due to extrinsic factors. (Niino et al., 2000). In addition, more than 60% of the 114 falls were associated with uneven and slippery floor surfaces. The results were similar to a study of hospitalised falls injuries (Ellis & Trent, 2001). Ellis & Trent (2001) showed that the majority of hospitalised falls were falls on the same level because of tripping, slipping or stumbling rather than falls from one level to another (Ellis & Trent, 2001). This suggests that reducing the hazards could prevent hospitalised falls e.g. changing floor covering, even though none of the falls in this study caused hospitalisation.

Twelve percent of falls did not involve hazards. This might suggest a limitation of recalling falls. The longer period of time since a past fall, the less details the participants could recall. Another possibility is that there were no hazards for these falls. As mentioned in the literature review, balance threshold is lowered with advancing age. Moreover, It has been indicated that falls associated actions e.g. forward falls and backward falls are different from normal activities in terms of

velocity of body movement (Wu, 2000). Although none of participants in Wu's study were older persons and sample size was small (n = 3), the results suggest the falls associated activities requiring greater balance ability to prevent falls. Therefore, without any specific hazards, older persons with declining physical function might fall because they are more likely to lose and unable to regain balance.

There were 11% of falls related to internal factors. However most of the factors were not specified. 'Old age' and current diseases were frequently mentioned as making them weaker in general as opposed to specific symptoms at the time of the falls. This is because all the falls associated with sudden onset illness were excluded by the definition.

5.7.3.4 Time of falls

Similar to the national survey, more than 80% of falls occurred during daytime (Jitapunkul et al., 1998). This result agrees with findings in other countries (Allander et al., 1998; Niino et al., 2000; Parker et al., 1996). A possible explanation may be related to the expose-disease theory. Older people living in the community are usually active. The more activities they perform the more exposed to risk factors for falls they are, therefore, the more they fall. The results demonstrated a clear pattern of exposure-fall relationship. No falls occurred from 11 pm to 3 am; which is bedtime for most older persons. The fall rate sharply dropped during mid-day which is time for lunch. The outdoor falls happened during daytime only; which corresponds with the time of falls associated with work and social/ recreation activities. All of these suggest that the fall rate increased when the older persons were active and dropped when they were inactive. A previous study even indicated that performing physical activities frequently was a fall risk factor (O'Loughlin et al., 1993). However, the same study suggested that engaging in a variety of activities was a protective factor (O'Loughlin et al., 1993). Moreover, it has been shown that activity restriction was associated with poor health and psychosocial function, and disability (Murphy et al., 2002). In addition, functional limitations lead to recurrent falls (A. M. Tromp et al., 2001). Therefore, falls prevention by reducing activity participation is not appropriate. Exploration and reduction of environmental hazards and improving

physical ability would enable older persons continue their activities and retain their quality of life.

5.7.3.5 Types of falls

Types of falls were classified using the ICD-10-AM. The results showed that more than 60% of falls occurred on the same level from slipping, tripping, or stumbling. The results agree with Ellis's study (2001) where the majority of falls occurred in an equivalent ICD-9 category. However, two thirds of falls in Ellis's study were not specified. The proportion of falls in the category might change if all falls could be identified. The second most common type of fall was falls on or from stairs or steps. Some studies provided information that could be linked to both kinds of falls. For instance, Northridge (1995) indicated that storage, clutter, hall rugs and small rugs were related with elevated fall rates in healthy older persons. Hill (1999) reported that the tripping and slipping were the most common fall circumstances and a quarter of falls occurred on kerbs and steps. This highlights the importance of falls resulting from tripping and slipping on the same level as well as from one level to another. However, other fall circumstances should be taken into account. The indoor and outdoor obstacles that older persons trip over are different. The possibility and strategies for reducing environmental hazards in elderly homes and public places are not the same. For example, education programs can be used to educate older adults about the risk of uneven and slippery floors. Then they can change floor covering or get rid of obstacles in their own place immediately. However, changing floor covering of footpaths needs both education and community empowerment. In addition, it also depends on government policy and allocated resources.

5.7.4 Prevalence of fear of falling

Using the dichotomous question, FOF was common among Thai older people. Seventy two percent of the participants had a FOF using the dichotomous question. However, using the SAFE Thai version, the prevalence of FOF dropped to 48%. In Western countries, FOF is known to have underreporting problems. For example, some subjects do not consider themselves as being "afraid" of falling but rather being "worried" about falling (Tennstedt et al., 1998). Only half of those with low

FES scores said they had FOF (Cumming et al., 2000). The results suggest an over-reporting phenomenon in Thailand.

Because of the variety of definitions and measurement tools used in studies, the prevalence of FOF cannot be easily compared between studies. However, it has been reported that between 29 and 92% of older adults who have fallen report some degree of fear of falling (Legters, 2002). Among community dwellers, the FOF prevalence ranges from 29% to 60% (Arfken et al., 1994; Cumming et al., 2000; Howland et al., 1998; Niino et al., 2000; Tinetti et al., 1994b). In addition using the question 'are you afraid of falling?', the prevalence of FOF among Australian fallers and non-fallers was 40% and 23%, respectively (Cumming et al., 2000). In Thailand, seventy two percent of older adults reported FOF using the dichotomous question and 48% reported FOF with the SAFE Thai version. This is a considerably higher prevalence than in other studies. However, it has been reported that 30% of middle age (40-59 yr.) and 60% of Japanese older people (60-79 yr.) had FOF (Niino et al., 2000). This might suggest differences between Western and Eastern cultures.

As discussed in section 4.6.4, the results of reliability testing suggested that Thai older persons are more likely to openly talk about their fear of falling. The results of the main study confirmed this suggestion. The average score of this study was 1.05±0.88. The Thai older persons in this study were aged 60-91, but the majority were aged between 60-69. The original SAFE reported that the average FOF score of a young-old group (62-75 yr.) and old-old (76-93 yr.) group were 0.51±0.57 and 0.80±0.76 respectively. Although there is no report of comparison between Asian and Caucasian FOF, a study has reported that African-American older persons were also more likely to have FOF than Caucasian subjects (Odd ratio = 2.7) (Kressing et al., 2001). A racial difference might exist for Thai older persons as well.

A comparison between older persons who had FOF and no FOF, the results revealed that they were different in many characteristics. First, persons with FOF were more likely to be older than those who had no FOF. The result supports previous studies where those who had FOF and those who did not could be distinguished by age (Howland et al., 1998; Wong & Cheung, 2002). However, it

has also been shown that there was no association between FOF and age (Cumming et al., 2000; Howland et al., 1998; Kressing et al., 2001; Murphy et al., 2002). In spite of that, a study of older women living in the community showed that being 80 or older was a predisposing factor for FOF (adjusted relative risk = 1.48) (Murphy et al., 2003). This suggests that FOF increases with advancing age. The effect is greater in the very old, therefore, the association is found after the age of 80 in Caucasian studies at least.

Second, older persons who had a FOF were more likely to have a lower educational background. Kressing (2001) demonstrated that older persons who did not complete high school were more than twice as likely to have FOF than those who attended at least some college. Differences in education level lead to variations in income and in social roles throughout a person's life; which are known contributing factors for health in later life. Moreover, access to health care and information are easier for a person with higher education. Therefore, they are more likely to adopt a healthier life style and be better able to maintain their health. As a result, FOF should be less likely to be found in those with higher education. However, some studies present conflicting evidence showing that older persons with and without FOF did not differ with respect to education (Howland et al., 1998; Murphy et al., 2002). Thai older persons had very low educational background in general. Only 9% had more than 4 years of education (National Statistic Office, 2002). This might emphasise the contribution of lower education to the FOF. Today, however, education levels of the Thai population as a whole are much higher than that of elderly adults; almost 60% have completed primary school (6 years). Because of this, the effect of education level is likely to change in the near future.

Third, women were more likely to have FOF than men. This concurs with previous studies (Arfken et al., 1994; Howland et al., 1993). Moreover, it has been shown that the female gender can be used as a predictor of FOF (Friedman et al., 2002). This factor might be used in combination with other risk factors to identify targets for prevention in Thailand.

Fourth, Thai older persons with FOF were more likely to report their health status as fair or poor. This supports findings that older people who said they had FOF or

who had low FES score were more likely to have poorer health (Cumming et al., 2000). The poor health status has also been reported as an indicator of FOF (Murphy et al., 2002). Although it has been shown that some diseases such as depression (Suzuki et al., 2002), and poor functional ability such as low gait speed (Kressing et al., 2001) were associated with FOF, identifying all of the diseases and conditions to predict FOF is sometimes difficult and costly. Using the general health status is a cost-effective way to predict FOF.

The fifth difference between older adults with and without FOF in Thailand was related to previous fall experiences, older persons who had fall experiences were more likely to have FOF. Previous research has revealed that falls and FOF were predictors for each other (Friedman et al., 2002). Moreover, the same study has indicated that older persons did not have FOF at the time of their first fall developed FOF in the next 20 months (Friedman et al., 2002). This means the falls not only cause FOF immediately but the effects can be delayed up to 20 months. This suggests a complex relationship between falls and FOF. Further investigations are needed to explain the relationship.

Finally, older persons who reported activity restriction were more likely to have FOF. This supports the report that FOF is common among healthy older women who reduced their level of participation in recreational physical activities (Bruce et al., 2002). Furthermore, association between FOF and decreased participation in social activities has also been reported (Arfken et al., 1994). However, Howland (1998) reported that there was no association between FOF and activity restriction, but FOF was associated with having less social supports. This might suggest a complex relationship between these two factors that also needs further investigation. Moreover, the findings of this study showed that older adults were not always more likely to curtail the more fearful activity (Table 5.12). There are some activities that older persons have to engage in regardless of FOF. The findings of this study showed that the activities that are likely to cause FOF but were curtailed were activities of daily living (ADL). For example, the item 'take a shower/wash yourself with a basin of water' was the second most fearful activity; however, it was the last choice for activity restriction. Therefore, activity restriction in ADL might indicate more severe FOF.

Furthermore, similar to previous studies the current study showed that older persons with and without FOF did not differ regarding marital status or living situation. Nonetheless, another study demonstrated an important contribution of emotional supports to FOF (Murphy et al., 2003).

5.7.5 Activity restriction

The prevalence of activity restriction due to FOF in this study was 18%. One quarter of fallers curtailed their activities whereas only 16% of non-fallers curtailed their activities. A few previous studies have also reported higher rates of activity restriction, they included older persons with rheumatoid arthritis (38%) (Fessel & Nevitt, 1997) and persons living in senior housing (35-43%) (Howland et al., 1998; Howland et al., 1993). A study of non-institutionalized older persons provided the same results (19%) (Murphy et al., 2002).

Using the dichotomous question, some characteristics were more common among older persons with FOF related activity restriction than among older persons who had not curtailed their activities because of FOF. First, the older adults who had activity restriction were more likely to be married. None of the previous studies found a significant contribution of marital status to activity restriction. Therefore this was a unique result showing that older persons with activity restriction were more likely to be married than older persons who had no activity restriction.

Although it has been shown that married persons were more likely to have better health than their unmarried counterparts (Goldman et al., 1995; Waldron, Weiss, & Hughes, 1997), the married and unmarried participants in this study did not differ in self-perceived health [$\chi^2(1, N = 546) = 1.864, p = .172$]. Moreover the unmarried participants were more likely to live alone [$\chi^2(1, N = 546) = 29.538, p < .001$]. Even though a previous study has indicated that lack of social supports could lead to activity restriction (Howland et al., 1998), the older persons living alone have to do most activities by themselves. So they were less likely to have activity restriction.

Furthermore, as discussed earlier there was some degree of bias for inclusion of married persons in this study due to issues related to signed consent. Seventy percent of the participants were married. This might be a reason why those who

had activity restriction were more likely to be married. In addition, sharing activities with partner was another possibility.

A second difference between those with and without activity restriction was self perceived health as fair or poor (72% vs. 54%; p = .006). The result agrees with previous studies that poor health status is related to activity restriction (Fessel & Nevitt, 1997; Murphy et al., 2002). Furthermore self-assessment of health is known to be bound to a broad range of health problems that are typical in elderly (Idler & Benyamini, 1997). This might explain why those with activity restriction tended to perceive their health as fair or poor. This tendency might be useful when developing an indicator for falls related activity restriction in older adults. As self-perceived health is usually derived from a single question and rating scale e.g. how would you say your health is? (excellent, very good, good, fair or poor), it is an attractive, practical measurement for public health surveys.

Third, fallers were significantly more likely to curtail their activity (30% vs. 19%; p = .019); which supports a previous study of community dwellers (Tinetti et al., 1994b), but is in contrast to a study of older persons living in public seniors housing (Howland et al., 1998). Howland et al. (1998) indicated that the experience of falls is not associated with activity restriction. On the other hand, activity restriction is associated with indirect fall experiences: knowing someone who had fallen (Howland et al., 1998). Furthermore, less social supports and not communicating about falls have been shown to be associated with activity restriction. However, the participants in Howland's study were residents of public seniors houses. Because of the living situation, the social support factors might become more important. In the current study, however, living situation is the one variable that may shed light on elderly social contact. Ninety percent of the participants were not living alone. Moreover, the results show that those with and without activity restriction did not differ in terms of living situation; which supports a previous study in community dwelling elders (Murphy et al., 2002). These suggest that older adults living in the community and senior housing may have different risk factors for activity restriction. Nevertheless, further investigations are needed to identify contributions of indirect fall experiences and other forms of social supports.

Finally, the participants who curtailed their activities were more likely to have fear of falling (82% vs. 70%; p = .025). It has been known that activity restriction is a consequence of fear of falling. For example, Tinetti et al. (1994b) reported 19% of community dwelling elders had activity restriction because of FOF. Howland and colleagues (1998) reported 56% of older adults who had FOF curtailed their activities.

5.7.6 Association between falls, FOF and activity restriction

As expected, fall experiences were significantly associated with FOF. Previous studies found that a substantial number of fallers reported FOF (Howland et al., 1998; Howland et al., 1993; Tinetti et al., 1994b). Furthermore, it has been shown that falls are important risk factors for FOF (Howland et al., 1998; Murphy et al., 2002). Friedman et al. (2002) demonstrated that falls and FOF share predictors, older persons who develop one outcome have a high risk of developing the other. The results confirm a similar association in Thai older people. One previous study also reported a significant contribution of indirect fall experiences (Howland et al., 1998). Compared with studies in Western countries, the fall rate in Thai older people is lower but FOF rate is considerably higher. It is important to investigate the effect of indirect fall experience in this population in the future.

Fall experiences were also associated with activity restriction. A study of community dwelling elders indicated that fallers were more likely to acknowledge activity restriction than non-fallers (Tinetti et al., 1994b). A second study of older persons living in the community indicated that only injurious falls had a significant contribution to activity restriction (Murphy et al., 2002). Whereas a study of residents in senior housing found that only indirect fall experiences had a significant effect (Howland et al., 1998). These suggest complexity of the relationship between falls and activity restriction.

A significant association between FOF and activity restriction was found in Thai older adults. This result confirms that Thai older persons who had a FOF were more likely to curtail their activities and vice versa. This agrees with results from both studies of community dwellers and senior housing residents (Howland et al., 1998; Tinetti et al., 1994b).

In previous sections, the characteristics that distinguish fallers from non-fallers, those with and without FOF, and those with and without activity restriction were reported. The results indicate that those who had fall experiences, FOF and activity restriction share a specific character: perceived health status as fair or poor. This offers clear evidence that the self-perceived health status is the most important contributor of these problems. Furthermore falls, FOF, and activity restriction are predictors of each other. These findings are of considerable importance since it suggests that FOF and activity restriction intervention should be included in falls prevention programs.

5.8 Summary

There are two main issues in this chapter: methodological issues of the SAFE Thai version and the main study.

Regarding methodological issues, three judgments have been made. First, the 'take a tub bath' item was dropped. The results of 546 Thai older adults showed that there were only five persons who performed the activity. Furthermore, retaining the item decreased the severity of FOF when older persons did not complete the activities and activity restriction. Second, FOF as measured by the SAFE Thai version was used to identify the prevalence of FOF in Thai older adults, because it demonstrated a higher specificity than the dichotomous question. Third, activity restriction as defined by the dichotomous question was used to identify the prevalence of activity restriction of Thai older adults. In contrast to FOF, activity restriction measured by the SAFE Thai version appeared to be less specific since Thai older persons curtailed the activities for reasons other than FOF and they had to perform the basic ADL regardless of FOF.

In the main study, falls and fall circumstances were explored. The fall prevalence of Thai older persons was 21%. For participants aged 65 and over, the fall rate was 22%. Compared with studies in Western countries, the results are considerably lower. However, this finding is in harmony with Asian fall rate. Fallers were more likely to be older, female, unmarried, have poorer health, FOF and activity restriction.

The results of 114 falls revealed that in Thailand 60% of falls occurred outdoors. Around 40% of falls were work related. Trips and slips served as a cause of more than 60% of falls; results from both elderly opinion and ICD 10 AM. Ninety percent of falls occurred during daytime. Morning is the most common period for falls.

The FOF prevalence of Thai older people was identified by the SAFE Thai version. The results show that almost half of Thai older persons had FOF. Older persons who had FOF tended to be older, perceived their health as fair or poor, had experienced falls and curtailed their activities.

The activity restriction prevalence of Thai older persons was 18%; 25% for fallers and 16% for non-fallers. Older persons who curtailed their activity were more likely to be married, perceive their health as fair or poor, have fall experiences and FOF.

Using Chi square test, the results indicate significant association between fall experiences and FOF, falls experiences and activity restriction and FOF and activity restriction.

CHAPTER 6: PREDICTING AND SCREENING FOR FEAR OF FALLING

6 Introduction

As reviewed in Chapter 2, fear of falling (FOF) is a major consequence of falls in elderly adults. It may decrease quality of life by leading to activity restriction and social isolation (Arfken et al., 1994; Howland et al., 1998; Lanchman et al., 1998; Lawrence et al., 1998; Suzuki et al., 2002). Moreover FOF and its consequence, activity restriction, often lead to frailty and recurrent falls (Friedman et al., 2002; Howland et al., 1998).

Generally, fall history is a risk factor for FOF (Friedman et al., 2002; Nevitt et al., 1989). Firstly, fallers are known to have poorer physical health (Bergland et al., 2000; Donald & Bulpitt, 1999). Secondly, falls have a strong psychological effect on older people. In this study, almost 60% of Thai older fallers reported FOF. However, older persons can have FOF without fall history (Tinetti et al., 1994b). This study showed that 45.6% of Thai older adults who did not fall in the previous 12 months also had FOF.

Normally, a multidimensional approach including, FOF intervention is recommended for falls prevention (Auriemma et al., 1999; Legters, 2002; Tideiksaar, 1994). As mentioned earlier, FOF can occur without a fall history and the prevalence of FOF is much greater than the prevalence of falls, thus FOF intervention is a very important aspect of falls prevention. Furthermore, activity restriction and decreasing quality of life are concomitants of FOF (Arfken et al., 1994; Bruce et al., 2002; Howland et al., 1998; Kressing et al., 2001; Lanchman et al., 1998; Suzuki et al., 2002). Reducing FOF will not only prevent falls but will also enable older people to maintain their activity engagement and quality of life.

Although the SAFE was adapted for measurement of FOF in Thai older people, a screening tool for FOF is needed to identify older people with FOF for large-scale public health purposes. Internationally, the dichotomous question 'are you afraid of falling?' is suggested for FOF screening even though it has known problems

with under-reporting (Legters, 2002). However, as reported in Chapter 5, there were 14.57% false negative and 38.73% false positive results when using the dichotomous question for FOF screening with Thai older people. Furthermore, the Chi-square test revealed that there was no association between FOF detected by the dichotomous question and FOF detected by the SAFE-Thai version. This indicates that the dichotomous question might not be sensitive or valid for use in Thailand.

The results in Chapter 5, using the SAFE-Thai version, demonstrated that older people who had FOF and those who did not were different in age, education background, gender, perceived health and fall history. The objective of this Chapter is to report on the development of a screening tool and to propose a predictive model for FOF in Thailand, based on these observations.

6.1 Statistical Procedure Selection

Because of the complexity of diseases, medical studies usually determine one outcome of interest involving multiple observations. Researchers are using statistical techniques involving multiple independent variables to describe the relationship between the dependent outcome variable and these explanatory variables. These methods are concerned with explanation or prediction of the outcome or dependent variable (Dawson & Trapp, 2001). The statistical methods for multiple variables are summarized in Table 6.1.

Table 6.1 Summary of Statistical Techniques Involving 2 or More Independent Variable

Dependent variable	Independent variable	Statistical method
Nominal	Nominal	Log-linear
Nominal (dichotomous)	Nominal and numerical	Logistic regression
Nominal (two or more values)	Nominal and numerical	Discriminant analysis
Numerical	Nominal	ANOVA[a]
Numerical	Numerical	Multiple regression
Numerical (censored)	Numerical and nominal	Cox regression
Numerical	Nominal with confounding factors	ANCOVA[b]
Nominal	Nominal with confounding factors	Mantel-Haenszel
-	Numerical only	Factor analysis and cluster analysis[c]

Note. Adapted from Dawson & Trapp (2001)
[a] ANOVA = analysis of variance
[b] ANCOVA = analysis of covariance
[c] Certain assumption (for example, multivariate normality, independence, etc) are required for using these method

As shown in Table 6.1, scales of measurement of both the outcome (dependent variable) and observations (independent variables) of interest are taken into account when selecting an appropriate statistic. In order to select an appropriate statistical technique when developing a screening tool for FOF, the scale of measurement of the FOF and all observations must be considered.

In this study, the FOF score of Thai older people were obtained using the SAFE-Thai version. The score was calculated by using the mean FOF score across the 11 activities. Therefore it was numerical. However, a cut-off point was employed to distinguish older people with FOF from those without (details in Chapter 5), creating a dichotomous nominal scale. The observations (independent variables) used to develop the tool were selected from the differing characteristics of older people with and without FOF: age, education, gender, perceived-health and fall history. The scales of measurement of these variables were all nominal except age and level of education. In summary, it can be seen that the dependent variable was nominal (dichotomous) and the independent variables were either nominal or

numerical. According to Table 6.1, there are 2 statistical techniques of choice: discriminant analysis and logistic regression.

6.1.1 Discriminant analysis

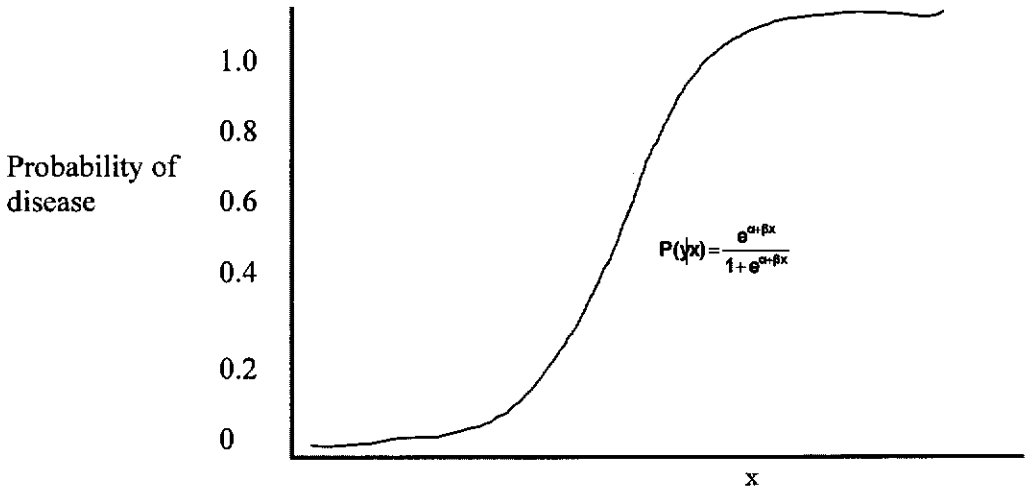
Discriminant analysis is a common technique in social sciences research. It is used to predict a nominal or categorical outcome (Dawson & Trapp, 2001). It determines which variables discriminate between two or more naturally occurring groups. The determining procedure is a simple linear combination of the independent variables that separate the groups defined by the outcome measure as much as possible. Wilks' lambda, a multivariate test statistic, is used to determine the discriminant functions. In order to identify which variables are important in discriminating among the groups, the discriminant function's coefficients can be interpreted in the same manner as in multiple regression. This method can be used to explain or describe factors that distinguish among groups of interest, and to classify future subjects. However, this procedure must be used with caution if some independent variables are nominal because it assumes that the independent variables follow a multivariate normal distribution. The majority of the independent variables in this study were nominal. Moreover, the numerical variables did not approximately normal distributions. For example the participants in this study were aged from 60 to 91 years. Skewness of the variable was 0.853 and the Kolmogorov Smirnov statistic was 0.109 ($p < .001$). This lack of normality is not surprising, as the variable age, for this group, was not expected to be normally distributed. It does make the use of discriminant analysis questionable. Additionally, there is a contemporary disadvantage when using discriminant analysis for binary targets. The disadvantage is that discriminant analysis does not directly produce partial regression coefficients to signify the impact of each independent variables (Feinsteain, 1996). Although the partial regression coefficients can be calculated indirectly; other statistical techniques for either polytomous or binary targets, e.g. logistic regression, provide the partial regression coefficients directly.

6.1.2 Logistic regression

Logistic regression is commonly used to identify a dichotomous outcome when the independent variables include both numerical and nominal measures

(Dawson & Trapp, 2001). Nevertheless, it can also be employed when the outcome has more than 2 categories (Hosmer & Lemeshow, 1989). There are 2 advantages of using logistic regression. Firstly, it does not require an assumption of normal distribution of the independent variables (Dawson & Trapp, 2001; Hosmer & Lemeshow, 1989). Secondly, the regression coefficient can be interpreted in terms of relative risks or odds ratios (Dawson & Trapp, 2001; Hosmer & Lemeshow, 1989). The logistic regression was selected in this study for two reasons. First, the logistic function ranges between 0 and 1 (Kleinbaum & Klein, 2002). This means the probability of an older adult having FOF is always some number between 0 and 1 which is not always true for other models (Kleinbaum & Klein, 2002). Therefore values that look like "negative diseases" do not exist in the logistic function. This is a clear advantage in interpretation. Second, the logistic regression lends itself to a biologically meaningful interpretation. The shape of the logistic function is an elongated S-shape (Figure 5.1). In epidemiology, diseases are usually a result of a combination of several risk factors. The elongated S-shape indicates that the risk of an individual having a disease is low unless the combined contribution of the factors reaches a threshold. At that point, the risk rises rapidly over a certain range of a combination of contributing factors (Kleinbaum & Klein, 2002). Once the combination of risk factors is high enough, the logistic function remains around 1. The threshold in the logistic model is considered to be applicable because FOF is multivariate in nature.

Figure 6.1 Logistic Function



Modified from Kleinbaum and Klein (2002)

6.2 Logistic Regression Model

This section describes the logistic regression model, strategies to select the variables that result in the best model, methods used to assess adequacy of the model and model interpretation.

6.2.1 Modelling strategies

The aim of logistic regression modelling is to select the best set of variables for inclusion in the model. The modelling starts with meaningful coding. It is very difficult to interpret logistic coefficients if the variables were not coded carefully. In binary variables, the category of greatest interest is usually coded as 1 and the other as 0. For multinomial variables, the category of greatest interest should be the last category. By doing so, the regression model will predict the log odds of outcome by impacts of the variables of interest.

The next step is variable selection. Traditionally, the most parsimonious model that explains the data with the fewest variables is chosen. However, some epidemiologists include all scientifically relevant variables in order to completely control for confounders. It is possible that an individual variable does not exhibit an important contribution alone, but presents a considerable confounding influence in the data when taken collectively (Miettinen, 1976). Nevertheless, this method may produce numerically unstable estimates and be overfitted (Hosmer & Lemeshow, 1989). Finally, logistic regression does not account for interaction

effects, unless interaction terms are deliberately added into the analysis. Hosmer and Lemshow (1989) suggested the following steps for variable selection:

- Contingency table of outcome and independent variables
- Univariate analysis of each variable
- Multivariate model: Stepwise regression versus best subsets selection
- Confounders and interaction variables

6.2.1.1 Contingency table of outcome and independent variables

The goodness of fit measures in logistic regression assume that no cell has a 0 frequency count and no more than 20% of cells have less than 5 counts. Inclusion of variables with a zero cell count in logistic regression will cause numerical problems. The contingency table is used to ensure that this requirement is met.

6.2.1.2 Univariate analysis of each variable

The likelihood ratio Chi-square with k-1 degrees of freedom is equal to the likelihood ratio in the univariate logistic regression model that contains a single independent variable. Therefore a univariate analysis can be used to screen the independent variables. However, it is possible that an individual variable that is weakly associated with the outcome becomes an important variable when taken collectively. For this reason, the significance level should be large enough to retain all suspected variables. It has been suggested that any variable whose univariate test has a p-value less than 0.25 should be a candidate for inclusion in the multivariate model (Hosmer & Lemeshow, 1989) and thus should be retained for further analysis. Although using the suggested p-value may result in a high probability of including unimportant variables, all candidate variables will be tested again with the traditional p-value in the collective model.

6.2.1.3 Multivariate model: Stepwise regression versus best subsets selection

Once all candidate variables are selected, the multivariate logistic regression is performed. Stepwise regression is an approach to select the candidate variables for either inclusion or exclusion from the model based solely on statistical criteria. The stepwise approach is useful for building a model in a sequential fashion. It can be done by either forward selection with a test for backward elimination or backward

elimination followed by forward selection test. The procedure is based on a statistical algorithm checking for the importance of the variables and either includes or excludes them on the basis of fixed decision rules (Hosmer & Lemeshow, 1989). To judge the importance of the variables, 2 choices of alpha level have to be set: p_E for selection and p_R for exclusion. It has been shown that the choice of $p_E = 0.05$ often excludes important variables from the model and the p_E range 0.15 to 0.20 is highly recommended (Hosmer & Lemeshow, 1989). There is no recommenced p_R, however it has to exceed p_E to prevent the program entering and removing the same variable at successive steps.

Another approach is the best subset selection method. This procedure examines a number of models containing various subsets of variables based on some specified criteria.

There is a caution when using these methods. Mechanical selection has been criticized for it may select irrelevant variables or produce a medically implausible model (Flack & Chang, 1987; Hosmer & Lemeshow, 1989). This is because the computer can select such models, if the analyst fails to examine the resulting model.

Analysts can alternatively fit a multivariable model by the following method. Once the candidate variables are selected, a multivariate model of all selected variables is obtained. After that each variable in the model should be verified by comparing each variable's coefficient with its coefficient from the univariate model and examining the Wald statistic of each variable. The coefficient comparison shows how each variable changes its contribution when the other variables have been included in the model. The Wald statistic demonstrates the significance level of the variable; the p-value should be less than .05. Any variables that are not important, based on these criteria should be removed. However, if the variable is known as an important variable, it should be kept for exploration of possible interactions. Then a new model is fitted. Comparison between new and old models using the likelihood ratio test is needed to estimate changes in the overall model. These processes (verification, deleting and refitting the model) are repeated until all of the important variables are included and unimportant variables are excluded.

6.2.1.4 Confounders and interaction variables

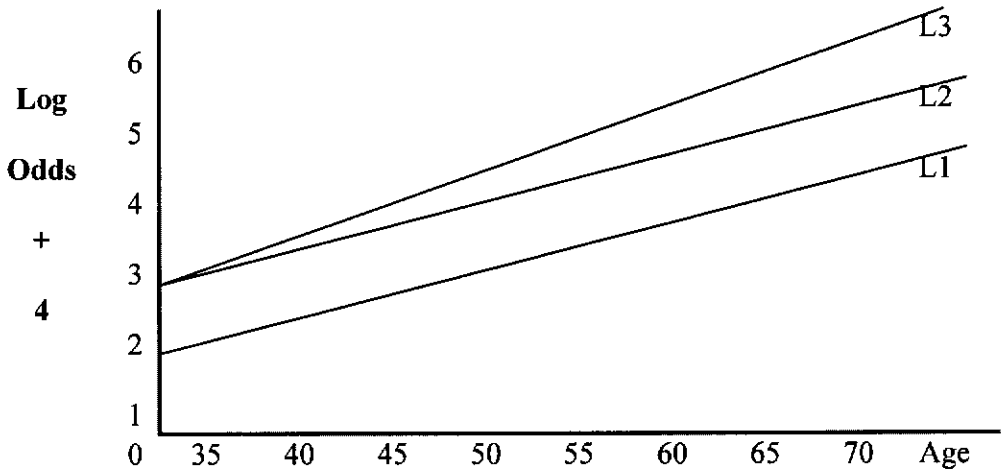
After a model with essential variables is obtained, the examination of confounding variable and interactions between variables within the model is needed. A confounder is a variable that is associated with both the outcome variable of interest and other independent variables. A variable is considered a confounding variable when it meets two specific criteria. First it must have a distinct effect on the outcome variable and second it must also have an effect on a second independent variable. The effect on the second independent variable must be variable across conditions. For example, if environmental hazards have a differing effect on young and old participants it may be considered a confounding variable (Feinsteain, 1996). The independent variables in this study were not considered confoundering variables unless they fulfilled both of the criteria.

An interaction or conjunctive effect is an event when 2 (or more) independent variables act synergistically or antagonistically to affect the outcomes; which is different from the anticipated effect of each variable alone (Feinsteain, 1996). If any 2 variables have an interaction, this means that one variable has a differential effect on the other, depending on the condition. An example from Hosmer and Lemeshow (1989) was employed for explanation. The example presents a logistic model where the outcome variable is the presence or absence of Coronary Heart Disease (CHD), the risk factor is gender and the covariate is age. Figure 6.2 shows plots of logit odds when interaction of the risk factor and covariate is present and absent. Each line represents the logit for gender as a function of age. L1 and L2 represent the logit when gender is female (0) and male (1) respectively. L1 and L2 are parallel; which demonstrates the absence of interaction between gender and age. In other word, effect of age is the same for female and male. If the logits function of male is L3, then L3 is steeper than L1. This indicates that the effect of age over gender is not constant. Therefore an interaction between the risk factor and covariate is present.

In SPSS, interaction terms can be created by using the categorical covariate option. The interactions examination is done using a likelihood test for significant level testing. If it is significant, it implies that the interaction contributes to the model and it should be included. However, the final decision regarding the inclusion of

interaction terms should be based on both statistical and practical considerations. It also needs to make sense from a real life point of view.

Figure 6.2 Plot of logits showing the presence and absence of interaction, modified from Hosmer & Lemeshow (1989).



6.2.2 Interpretation

6.2.2.1 Goodness-of-fit test

The goodness-of-fit is used to identify how effective the model is in describing the outcome. It is a summary statistic that may not provide specific information regarding each individual variable in the model. In logistic regression, there are a number of measures for goodness-of-fit; e.g. the Pearson residual, deviance residual and the Hosmer-Lemeshow test. For a well fitting model, the Chi-square value should be greater than 0.05 or not significant (Hosmer & Lemeshow, 1989).

6.2.2.2 Log-likelihood test:

Log-likelihood test of a model, also called model Chi-square, provides a significance test for a logistic model. The p-value of a well fitting model should be less than 0.05. However, a significant model is not an assurance that all independent variables are significant.

The likelihood ratio test comparing the full model containing all variables and the nested model containing a group of selected variables can be used for model improvement. If the differences are not significant, it means dropping the variable

in the nested model made no difference in predictive ability of the nested model. Therefore the variable can be dropped to minimize the number of variables in the model. This is a better alternative than the Wald statistic to consider which variable should be removed (Hosmer & Lemeshow, 1989; Kleinbaum & Klein, 2002).

6.2.2.3 Wald statistics

Wald statistic is a comparison the maximal likelihood estimate of the slope parameter to an estimate of its standard error. It is usually used for significance testing of each independent variable in the model. However, it usually has type II errors for models with large logit coefficients (Hosmer & Lemeshow, 1989; Kleinbaum & Klein, 2002).

6.2.2.4 R-square

The R-square measure is a proportion of the basic group variance that has been reduced or 'explained' by the regression model (Feinsteain, 1996). For a dichotomous dependent variable, the variance depends on the frequency distribution of that variable. This means the variance is at maximum for a 50-50 split and the more lopsided the split, the lower the variance. Therefore R-square in logistic regression is usually low and cannot compare directly with other multiple regression R-square values. However, a number of logistic R-square has been proposed e.g. Nagelkerke's R-square.

6.2.2.5 Logit coefficients

Logit coefficients (non-standardized logistic regression coefficients, b) correspond to the b coefficients in ordinary least squares regression. However, logistic regression calculates changes in the log odds of the dependent variable, not changes in the dependent variable itself. The logit coefficients can be substituted in the logistic equation to predict the probability of the outcomes as follows.

$$P_x = \frac{1}{1 + \exp[-(b_0 + b_1X_1 + b_2X_2 + b_3X_3 \ldots + b_nX_n)]}$$

P_x = probability of the outcome

b_0 = constant

b_{1-n} = logit coefficients of independent variable 1-n

X_{1-n} = independent variable 1-n

By using the exponential function, the logit coefficients can be converted to odds ratio. This term indicates the importance of the independent variables in terms of effect on the dependent variable's odds.

6.3 Methods for Logistic regression

The FOF results of the 546 participants of the survey were used for the logistic regression analysis performed using SPSS version 10.5. In order to get the best possible model with the available data, the following steps were performed.

- Variable selection
- Confounding and interaction test
- Model building

6.3.1 Variable selection

6.3.1.1 Dependent variable verification

Fear of falling was used as the dependent variable in this logistic regression model. The logistic regression requires a dichotomous variable. In this study, there were 2 sources of fear of falling data: a dichotomous question and the SAFE Thai version. As mentioned earlier, the fear of falling from the dichotomous question was general and had a high percentage of both false positive and false negative results when compared with the SAFE-Thai version. Therefore the fear of falling score obtained from the SAFE Thai version was used. The SAFE yields continuous data. However, the score was transformed using 1 as a cut-off point. If a person has a fear of falling score equal to 1, it means this person, on average, has fear of falling when performing 11 activities in the SAFE Thai version. Because the activities in the SAFE Thai version are activities of daily living and basic social activities, fear of falling when engaging in these activities is considered clinically relevant.

6.3.1.2 Independent variable specification

In order to obtain a meaningful model, independent variables were selected based on both the literature review and the survey results. (see Section 6.5.1). After the selection process, each variable was analysed using univariate analysis. As the

traditional level of p-value (0.05) often fails to identify variables known to be important (Hosmer & Lemeshow, 1989), the 0.25 level was used for variable selection. This means all variables whose univariate test had a p-value less than 0.25 were included in the initial multivariate model.

6.3.2 Confounding and interaction test

A confounder was determined based on the 2 criteria reviewed in section 6.3.1.4. No variables in the initial model met both criteria. All possible 2-way interactions of independent variables were examined in this study. The interactions were tested one by one in a full regression including all variables plus the tested interaction. Every interaction term with a significant contribution ($p > 0.05$) was included in the model.

6.3.3 Model building

Once all candidate independent variables were selected, a procedure for selection or deletion of the variables from the model was performed. This study used 2 criteria for variable selection. First, p-value = 0.05 was used to judge the import of the variables. Second, if any interaction term showed a significant effect, the main variables were included in the model whether they individually met the first criterion or not. Therefore the meaningful relationship between variables in the model can be explained (Kleinbaum & Klein, 2002).

6.4 Results

6.4.1 Independent variable specification

As noted above, the logistic regression analysis began with variable selection. In order to obtain the most meaningful model, independent variables were selected based on the literature review and the survey results. Previous studies show that FOF is associated with age (Howland et al., 1998; Lawrence et al., 1998), gender (Arfken et al., 1994; Friedman et al., 2002; Howland et al., 1998), poorer health status (Cumming et al., 2000; Friedman et al., 2002; Lawrence et al., 1998; Murphy et al., 2002), fall history (Friedman et al., 2002; Howland et al., 1998; Murphy et al., 2002; Nevitt et al., 1989), and less social support (Howland et al., 1998). Additionally, it has been demonstrated that Thai older people who had FOF and had no FOF differed in term of age, education, gender, perceived health, number of falls and fall history. Because the number of falls and fall history

variables represent the same information, only the number of falls was selected. Therefore, based on the literature and the results reported in Chapter 5, seven important independent variables, each with data available from the main survey, were selected for initial inclusion: age, gender, marital status, education, living situation, perceived health status and fall number. Next a contingency table of outcome (fear of falling) versus variables was used to ensure that no cell had a zero cell count and that not less than 20% of cells had a frequency count of less than 5. Only one variable did not meet these criteria: marital status (Table 5.2 a). Therefore, the variable was collapsed to two categories: not-married (0) and married (1).

Table 6.2 Contingency Table of Marital Status versus Fear of Falling

a. Original data

		Fear of falling		Total
		No	Yes	
Marital status	never married	13	4	17
	married	199	172	371
	widowed	61	86	147
	divorced	3	0	3
	separated	6	2	8
Total		282	264	546

b. Collapsed data

		Fear of falling		Total
		No	Yes	
Marital status	not married	83	92	175
	married	199	172	371
Total		282	264	546

The results of the univariate logistic models are shown in Table 6.3. All variables met the criteria for inclusion ($p<0.25$) except the variable "living situation". However, based on the literature it is known to be an important variable so it was retained for testing of interactions. The multivariate model containing all candidate variables is shown in Table 6.4.

Table 6.3 Univariate Logistic Models of Candidate Variables

	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
							Lower	Upper
Age	.035	.013	7.594	1	.006	1.036	1.010	1.062
Gender(1)	.981	.182	28.901	1	.000	2.666	1.865	3.813
Marital status(1)	.261	.184	2.007	1	.157	1.298	.905	1.862
Education	-.162	.030	29.303	1	.000	.851	.802	.902
Living situation(1)	-.238	.287	.685	1	.408	.788	.449	1.385
Perceived health								
- excellent(ref)			59.636	4	.000			
- very good(1)	-1.121	.971	1.333	1	.248	.326	.049	2.186
- good(1)	.430	.831	.268	1	.605	1.537	.301	7.840
- fair(1)	1.466	.828	3.137	1	.077	4.333	.855	21.956
- poor(1)	1.956	.847	5.332	1	.021	7.071	1.344	37.199
Number of falls								
- no fall(1)	1.003	.463	4.684	1	.030	2.726	1.099	6.758
- 1 fall(1)	.038	.280	.019	1	.892	1.039	.600	1.800
- 2 falls(1)	1.156	.403	8.249	1	.004	3.178	1.444	6.994
- more than 2 falls(ref)			12.399	3	.006			

Note. The categorical variables were coded as follows. For categorical variable with 2 items, the categories of interest were coded as 1; gender(1) for female, marital status(1) for not married, living situation(1) for living alone. Variables with more than 2 categorical variables, the category(ref) was set as reference group; and category(1) indicate the group of interest and 0 is otherwise.

B = Logit coefficients, S.E. = Standard Error, Wald = Wald statistic,
df = degree of freedom, Sig. = corresponding significant level of the Wald statistic,
Exp(B) = odd ratio, 95.0% C.I.for EXP(B) = 95% of confidential interval for odd ratio

Table 6.4 Multivariate Model Containing All Candidate Variables

	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
							Lower	Upper
Age	.028	.015	3.529	1	.060	1.029	.999	1.060
Gender(1)	.808	.222	13.291	1	.000	2.244	1.453	3.465
Marital status(1)	-.236	.223	1.124	1	.289	.789	.510	1.222
Education	-.083	.034	6.116	1	.013	.920	.861	.983
Living situation(1)	-.307	.333	.853	1	.356	.735	.383	1.412
Perceived health								
- excellent(ref)			39.931	4	.000			
- very good(1)	-1.198	1.004	1.425	1	.233	.302	.042	2.159
- good(1)	.338	.868	.152	1	.697	1.402	.256	7.687
- fair(1)	1.171	.866	1.830	1	.176	3.226	.591	17.604
- poor(1)	1.607	.887	3.283	1	.070	4.988	.877	28.377
Number of falls								
- no fall(1)	.766	.492	2.420	1	.120	2.150	.820	5.640
- 1 fall(1)	-.158	.310	.261	1	.610	.854	.465	1.567
- 2 falls(1)	.415	.429	.937	1	.333	1.515	.653	3.513
- more than 2 falls(ref)			3.721	3	.293			
Constant	-2.725	1.436	3.604	1	.058	.066		

Note. The categorical variables were coded as follows. For categorical variable with 2 items, the categories of interest were coded as 1; gender(1) for female, marital status(1) for not married, living situation(1) for living alone. Variables with more than 2 categorical variables, the category(ref) was set as reference group; and category(1) indicate the group of interest and 0 is otherwise.

B = Logit coefficients, S.E. = Standard Error, Wald = Wald statistic,
df = degree of freedom, Sig. = corresponding significant level of the Wald statistic,
Exp(B) = odd ratio, 95.0% C.I.for EXP(B) = 95% of confidential interval for odd ratio

6.4.2 Confounding and interaction Test

None of the selected variables met the criteria for confounding factors. Based on the interaction test, three groups of variables were identified: 18 pairs clearly had no interaction and could be excluded (see Table 6.5); one pair showed an obvious interaction (gender/marital status) so was retained; and two pairs had questionable or unclear results (number of falls/marital status and number of falls /education). The significance levels of all possible interaction variables are shown in Table 6.5. At this stage, the living situation variable, which had earlier been retained pending an examination of possible interactions, was completely excluded as no interactions were found.

Table 6.5 shows that the interactions between number of falls/marital status and number of falls / education were not always significant. However the significance level dramatically changed with each successively larger number of falls. This suggests that the number of falls was important but masked by the method used to count falls. To test further for a possible interaction, the number of falls variable was collapsed, making it dichotomous; 0 –equal or less than 2 falls and 1 – more than 2 falls. In order to distinguish between the original variable (fall number) and the new variable, the dichotomous variable was name "fall experience". Thus, all possible interactions between fall experience and other variables were then tested. In the full model, the number of falls variable was also changed to the dichotomous fall experience variable. Results, shown in Table 6.6 indicate that only one variable showed a significant interaction with fall experience (fall experience – gender) and thus needed to be retained.

Table 6.5 Significance Levels of Interaction Variables

	Interaction variables	Significance level	Note
1	Gender-marital status	0.044	Included
2	Gender- number of falls		
	- 1 fall	0.678	Excluded
	- 2 falls	0.701	
	- More than 2 falls	0.096	
3	Gender-age	0.866	Excluded
4	Gender-perceived health	0.394	Excluded
5	Gender-education	0.362	Excluded
6	Gender-living	0.547	Excluded
7	Marital status- number of falls	0.167	Questionable
	- 1 fall	0.071	
	- 2 falls	0.073	
	- More than 2 falls		
8	Marital status-age	0.489	Excluded
9	Marital status-perceived health	0.804	Excluded
10	Marital status-education	0.341	Excluded
11	Marital status-living	0.275	Excluded
12	Number of falls-age		
	- 1 fall	0.192	Excluded
	- 2 falls	0.525	
	- More than 2 falls	0.153	
13	Number of falls -perceived health	0.953	Excluded
	- 1 fall	0.319	
	- 2 falls	0.142	
	- More than 2 falls		
14	Number of falls -education		
	- 1 fall	0.876	Questionable
	- 2 falls	0.472	
	- More than 2 falls	0.053	
15	Number of falls -living		
	- 1 fall	0.259	Excluded
	- 2 falls	0.708	
	- More than 2 falls	0.997	
16	Age-perceived health	0.719	Excluded
17	Age-education	0.530	Excluded
18	Age-living	0.898	Excluded
19	Perceived health-education	0.555	Excluded
20	Perceived health-living	0.988	Excluded
21	Education-living	0.386	Excluded

Table 6.6 Significance Levels of Interaction Tests of All Variables and The Dichotomous Fall Experience Variable.

	Interaction variables	Significance level	Note
1	Fall experience -Gender	0.096	Excluded
2	Fall experience -perceived health	0.148	Excluded
3	Fall experience -education	0.049	Included
4	Fall experience -living	0.905	Excluded
5	Fall experience –age	0.200	Excluded
6	Fall experience -marital status	0.106	Excluded

Substitution of the fall experience variable for the number of falls variable in the full model had the potential to change the significance values for other interactions. Therefore all interactions were tested again in the new full model. The results remained consistent with the only other interaction variable; gender-marital status variable (p = .042) interaction demonstrating significance. In the final model therefore, 2 significant interactions: gender-marital status (p = .042) and fall experience-education (p = .049) were retained.

6.4.3 Model building

All variables and the two significant interactions were included for testing in logistic regression Model 1. The Wald statistic and corresponding significance levels for each variable are shown in Table 6.7.

Table 6.7 Significant Levels of Variables in Model 1

	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
							Lower	Upper
Age	.025	.015	2.819	1	.093	1.025	.996	1.056
Gender(1)	-.638	.239	7.127	1	.008	.528	.331	.844
Marital status(1)	.047	.246	.037	1	.847	1.049	.647	1.699
Education	-.573	.263	4.743	1	.029	.564	.337	.944
Self perceived health(1)	1.218	.198	37.960	1	.000	3.379	2.294	4.978
Living situation(1)	-.208	.335	.385	1	.535	.812	.421	1.566
Fall experience(1)	-1.958	.964	4.120	1	.042	.141	.021	.935
Fall experience/ education Interaction(1)	.501	.265	3.566	1	.059	1.651	.981	2.777
Gender/marital status Interaction(1)	-1.142	.590	3.744	1	.053	.319	.100	1.015
Constant	.157	1.475	.011	1	.915	1.170		

Note. 1. The categorical variables were coded as follows. For categorical variable with 2 items, the categories of interest were coded as 1; gender(1) for female, marital status(1) for not married, living situation(1) for living alone, self perceived health(1) for perceived as not good, fall experience(1) for more than 2 falls, Fall experience/education Interaction(1) for where both variables > 0 and Gender/marital status Interaction(1) for where both variables > 0.

2. Nagelkerke R square = .226

B = Logit coefficients, S.E. = Standard Error, Wald = Wald statistic, df = degree of freedom, Sig. = corresponding significant level of the Wald statistic, Exp(B) = odd ratio, 95.0% C.I.for EXP(B) = 95% of confidential interval for odd ratio

Testing of Model 1 indicated that the marital status and living situation variables did not significantly contribute to the model. Although fall experience-education and gender-marital status interactions were also not statistically significant, they did not exceed 0.06. Because removal of any other item may alter their contribution they were retained for testing in Model 2. Retention of the gender-marital status interaction also necessitated the retention of the marital status variable even though on its own it made no significant contribution to the model. Therefore only the living situation variable could be excluded from Model 1 to created Model 2 for further testing. The Wald statistic and corresponding significance levels of variables in Model 2 are shown is Table 6.8.

Table 6.8 Significant Levels of Variables in Model 2

	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
							Lower	Upper
Age	.025	.015	2.801	1	.094	1.025	.996	1.055
Gender(1)	.643	.239	7.270	1	.007	1.903	1.192	3.038
Marital status(1)	-1.066	.540	3.907	1	.048	.344	.120	.991
Education	-.069	.033	4.445	1	.035	.933	.875	.995
Self perceived health(1)	1.219	.198	38.041	1	.000	3.383	2.297	4.984
Fall experience(1)	1.974	.963	4.204	1	.040	7.202	1.091	47.545
Fall experience/ education Interaction(1)	1.145	.590	3.766	1	.052	3.142	.989	9.987
Gender/marital status Interaction(1)	-.505	.265	3.638	1	.056	.603	.359	1.014
Constant	-2.646	1.105	5.730	1	.017	.071		

Note. 1. The categorical variables were coded as follows. For categorical variable with 2 items, the categories of interest were coded as 1; gender(1) for female, marital status(1) for not married, self perceived health(1) for perceived as not good, fall experience(1) for more than 2 falls, Fall experience/education Interaction(1) for where both variables > 0 and Gender/marital status Interaction(1) for where both variables > 0.

2. Nagelkerke R square = .235

B = Logit coefficients, S.E. = Standard Error, Wald = Wald statistic,
df = degree of freedom, Sig. = corresponding significant level of the Wald statistic,
Exp(B) = odd ratio, 95.0% C.I.for EXP(B) = 95% of confidential interval for odd ratio

Testing of Model 2 indicated that the gender-marital status had a significant contribution (p = .017) but the fall experience-education interaction variable was not significant (.056). This suggested that the fall experience-education interaction could be excluded. However, the changes in the log likelihood of the model when the variable was removed resulted in significant change (p=0.032). Dropping the interaction term will produce a significant difference in prediction value of the model. Therefore no further variables were deleted from Model 2.

The goodness of fit test for Model 2 was tested using the Hosmer and Lemeshow test. The test provides a summary of the agreement of observed and fitted values. These Chi-square values should not be significant (greater than 0.05) (Hosmer & Lemeshow, 1989). The results show that Model 2 is a well-fitting model [$\chi 2$ (8, N = 546) = 4.360, p = 0.823]. The classification table (Table 6.9) shows that the overall predicted percentage of the FOF is 68.6% accurate.

Table 6.9 Classification Table

		Predicted FOF[a]		Percentage correct
		No FOF	FOF	
Observed FOF	No FOF	193	88	68.7
	FOF	83	181	68.6
Overall Percentage				68.6

a The probability of having FOF ranges from 0 to 1. The cut value = .500

The b coefficient in Table 6.8 represents the logit coefficients for each variable that can be used to predict the probability of an individual person having FOF. Substitution of these values into the logistic equation allows calculation of the probability of successfully predicting the outcome. According to Model 2, the logistic regression is as follow

$$P_x = \frac{1}{1 + \exp[-(-2.6461 + 0.024(A) + 0.643(G) - 1.066(M) - 0.069(E) + 1.219(H) + 1.974(F) + 1.145(G\text{-}M) - 0.505(F\text{-}E)]}$$

P_x	= probability of having FOF
A	= age (year)
G	= gender; male =0, female = 1
M	= marital status; unmarried = 0, married = 1
E	= education (year)
H	= self perceived health; good = 0, 1 = poor
F	= fall experience; 2 or less than 2 falls = 0, more than 2 falls = 1
G-M	= gender-marital status interaction; gender (0/1) x marital status (0/1)
F-E	= fall experience-education interaction; fall experience (0/1) x education (year)

To provide a clearer illustration, the probability of having FOF of a Thai older woman was calculated (details of actual calculation see Appendix E). The example case is a Thai older woman who aged 70 years old, married, has 4 years of education, fell 4 times in the last 12 months and perceived health her health as good. Therefore the probability of having FOF of the older woman is

$$P_x = \frac{1}{1 + \exp[-(-2.6461 + 0.024(70) + 0.643(1) - 1.066(1) - 0.069(4) + 1.219(0) + 1.974(1) + 1.145(1x1) - 0.505(1x4)]}$$

$$= 0.36$$

The Exp(B) in Table 6.8 represents the odds ratio of each variable in Model 2. However, for variables that present interaction, the interaction terms were taken into account for the odds ratio calculation. Therefore the odds ratio of each variable and its interaction is shown in Table 6.10. For example, the odds ration for age is 1.025. This indicates that for every 1 year of increasing age the risk of FOF increase 1.025 times. Because the gender variable interacted with the marital status variable, the Exp(B) of the interaction term was included for the odd ratio calculation. The results show that older women who were not currently married were 6 times more likely to have FOF than older men, while older women who were married at the time of data collection were only two times more likely to have FOF than older men. However, for men, the risk of having FOF as an unmarried older adult was one-third that of all married adults (male and female). The older persons who perceived their health as poor were 3.4 times more likely to have fear of falling. For a person who had more than 2 falls, the risk of having FOF increases to 7 times that of a person who fell 2 times or less. The 95% confidential interval of the fall experience ranges from 1 to 47. This indicates the interval is skewed to the left. Furthermore every one year of increasing education decreases the risk almost 10% for a person who had 2 or less fall experiences and 40% for those who had more than 2 falls.

Table 6.10 Odds Ratio of Variables in Logistic Model 2

	Odd ratio
Age	
- Every 1 year increasing of age	1.025
Gender-marital status interaction	
(Compare to men)	
- Female-not married	5.979
- Female-married	1.903
Marital status	
- Not married	0.344
Perceived health	
- Poor	3.383
Education-fall history interaction	
(Compare to no education background)	
- Every 1 year increasing of education- 2 falls or less	0.933
- Every 1 year increasing of education- more than 2 falls	0.5625
Fall history	
- More than 2 falls	7.202

6.5 Discussion

The logistic regression model was developed from survey data of FOF. Although the participants in each region had different characteristics, the model was neither developed separately by regions nor included the region variability. This is due to two reasons. First, there are zero frequency categories of the fall number variable if the data was divided by region which affects the logistic regression modelling. Second, it is likely that the different characteristics by region were caused by limitation of sampling procedure which was intended to capture the variability across the country rather than represent regions. The participants of the survey were recruited by multistage random sampling. Therefore the differences between regions resulted from the characteristics of people in each small area. In theory, the differences might be different if the random sampling was repeated and another area in each region was selected. Moreover, the differences may not exist if the random sampling were performed on a larger scale. If regional differences are to be explored a different sampling procedure would be required.

The final logistic regression model includes 5 variables (age, gender, marital status, perceived health and fall experience) and 2 interaction terms (gender-marital status and fall experience-education). The model describes and predicts

FOF in Thai older people effectively. It also provides odds ratio of each variable; which is helpful to identify who is likely to have FOF. Moreover, the result gives an equation for individual prediction.

The odd ratios of continuous variables are close to one: 1.025 for age and 0.933 for education. The logit coefficients (B) of the continuous variable were small as well: 0.025 for age and –0.069 for education. Compared with other variables in the model, it seems like the continuous variables have a small effect. However, unlike dichotomous variables, the substituted value in the logistic equation is usually much greater than 1. Thus the effects of the age and education variables are not less important than the other dichotomous variables.

The results of the logistic regression model confirmed the results in chapter 5 that Thai older persons who had FOF were more likely to be older, female, have lower education level, perceived their health as poor and have had fall experiences. The only difference was that marital status that did not distinguish between those who had FOF from those had no FOF. The marital status variable became an important factor when interacting with the gender parameter. The results in this chapter confirmed previous findings that FOF increases with advancing age (Howland et al., 1998; Lawrence et al., 1998), is common among older persons who perceived their health to be poor (Cumming et al., 2000; Friedman et al., 2002; Lawrence et al., 1998; Murphy et al., 2003), and is associated with fall experience (Friedman et al., 2002; Howland et al., 1998; Murphy et al., 2003; Nevitt et al., 1989).

The findings in this study revealed that only when a person had 2 or more falls was there a significant effect. However, in general, the participants in this study were younger than in previous studies. The age 60 and over was used as an inclusion criteria and the majority of the participants aged between 60 and 69 years old. Therefore they were less likely to worry about falling even though they had fall experiences. Furthermore, in a study of attitude towards falls, Miller (1995) showed that fallers who had minor injuries showed little concern about falling; only falls that had a dramatic impact on their lives demonstrated a severe consequences of falling. Although this study was conducted on a small group of American older people (n = 23), Thai older people might show a similar response.

Nevertheless, attitude and responses towards falls of Thai older people should be investigated in the future.

Moreover, the results showed that there is an interaction between 2 or more falls experiences and educational background. The risk of FOF decreases with both increasing educational level alone and the interaction. The odd ratio changes from 0.9 in those had fallen 2 or less times to 0.6 in those who had fallen more than 2 times. This indicates that educational level has a greater protective effect among recurrent fallers. As discussed in chapter 5, persons with a higher education are more likely to adopt a healthier life style and more able to maintain healthy. When they have 2 falls or less, they might not be concerned about falling. However, when the falls become more serious, their ability to seek care and prevent falls is evident. As a result, the effect of education is greater than when they are not concerned about falling.

Concerning gender, the findings of this study are in agreement with other studies that women tend to fear falling more than men (Arfken et al., 1994; Friedman et al., 2002; Howland et al., 1998). However, marital status interacted with gender and it did not have the same effect for men as for women. The findings in this study indicate that older women who were not currently married were 6 times more likely to have FOF than men. Compared with those who were not currently married, the married women had lesser risks but still it was 2 times greater than men. On the other hand, unmarried older men were two-thirds less likely to fear falling. This is a unique result. No previous study has found married status to have a significant contribution on FOF. The findings did not only reveal the significance of marital status but also its action on gender.

The finding that married women were less likely to fear falling suggests marriage as protection among Thai older women. Earlier findings indicated that being a widow was associated with poorer health (Goldman et al., 1995). It has been shown that compared with unmarried persons, married persons generally have a larger social network and more are more likely to have an intimate confidant providing both emotional and instrumental supports (Goldman et al., 1995). This may explain these findings but it must be noted that these are Western studies and

may not be relevant for Thai older adults. No comparable data is available in Thailand.

For Thai older men, the marital status had the opposite effect. There were 28 men not currently married in this study. Two thirds of them were widowers. It has been shown that even though widowhood is associated with poorer health, unmarried persons in other categories (e.g. never married, divorced) were most likely to be healthy (Goldman et al., 1995). Because of the small number of participants in this category, the results might be confounded by one third of the participants who were single, divorced or separated.

Social support has also been found to be associated with FOF (Howland et al., 1998). Living situation was the only variable that might represent social support in this study. However, there was no significant association between living situation and FOF. The very small proportion (10%) of participants living alone might account for the insignificance of the living situation. Nevertheless the nation census data show that the household size in Thailand has declined consistently in the last few decades (National Statistic Office, 1970, 1980, 1990, 2000). The nuclear family is becoming more common in Thailand. In the near future, the effect of living situation might be more important. Furthermore, even though the living situation had no significant contribution in the logistic model, removing the variable increased the odd ratio of fall experience from 0.1 to 7. This gives some evidence of the importance of living situation after fall experiences.

This model can be used as a tool for FOF screening. Although the overall correct prediction percent of the model is not different from the dichotomous question, the model describes the observed FOF better than the dichotomous question. The model is a well-fitting model using the Hosmer and Lemeshow test [$\chi 2$ (8, N = 546) = 4.360, p = 0.823] whereas the Chi-square test showed that the results of the dichotomous question were different from the observed FOF [$\chi 2$ (1, N=546) = 95.385, $p < 0.001$]. One might argue that the model is more difficult to employ for individual cases because the model is given in equation form; however, it is unusual to perform the calculation (Dawson & Trapp, 2001). In practical way, health professionals can identify all needed information and then fill in the results in calculation helping devices such as chart or table. The FOF prediction will be

more precise by adding 5 questions about age, gender, marital status, perceived health and fall history in past 12 months. Moreover, most information is usually already available. Additionally, in term of public health intervention, the odds ratio of each variable in the model can be used to identify target groups for intervention.

However, it should be noted that the model is developed based on data from the survey of FOF study. Some factors known important for FOF e.g. poor balance and diseases are not available from the survey results. In the future study, it will be important to determine which of these factors should be included in the model to improve the FOF prediction.

6.6 Summary

A logistic regression model has been developed based on the results of the FOF survey. The model includes 5 independent variables (age, gender, marital status, perceived health and fall history) and 2 interaction terms (gender-marital status and education-fall history). The overall correction of the model for FOF prediction in Thai older people is 68.6%. The model can be used for both individual prediction and target group identification. Nonetheless, future study is required for model improvement.

CHAPTER 7 OVERALL DISCUSSION AND SUMMARY

7 Overall Discussion

This study consists of three main parts: modification a FOF measurement tool for Thai older adults, a survey of the fall circumstances and the prevalence of FOF in Thailand and development of a FOF screening tool. The modification process was designed to obtain a measurement tool suitable for Thai elderly people. This tool was then used to survey 546 older adults in Thailand. Results demonstrated lower fall rates but greater FOF and activity restriction rates than in overseas studies. Fall conditions also demonstrate differences between Thailand and Western countries. A multistage random sampling and statistical power calculations were employed to ensure that the findings of this study could be generalize to the Thai elderly population and allow the development of a screening tool. The important findings of this study are discussed as follow.

7.1 Modification of the SAFE Thai Version

The Survey of Activities and Fear of Falling in the Elderly (SAFE) is a standardized tool that measures FOF and activity restriction in older adults (Lanchman et al., 1998). Because it is appropriate for community dwelling older persons, avoids a hypothetical FOF assessment and uses a 4-point rating scale, it was selected for use with Thai older adults. However, it was developed in the English language for use with English speaking populations. This study has translated the SAFE into the Thai language and modified it to achieve of conceptual equivalence of the translation and cultural appropriateness expression.

In the translation process, translation and back-translation were each performed by independent qualified translators. Both of the translators were certified by the Ministry of Foreign Affairs, Thailand; therefore, the quality of the translation can be assured. After the translation process, a group of 10 Thai bilingual older adults examined the cultural relevance of the translated tool. This group of bilingual adults was not only fluent in both Thai and English languages but were also culturally representative of the target population. Therefore, the cross-cultural context could be revealed and improved. Moreover, a mathematic approach which

is that best for aggregating information (Guillemin et al., 1993) was employed for the cross-cultural examination. The 80% agreement criterion was used to modify or generate new items.

The cultural relevance examination indicated that three items in the SAFE required adjustment to obtain cultural relevance: 'go to store', 'prepare simple meal' and 'walk several block outside'. All three items were modified; therefore, they express the original concepts in the Thai culture. Additionally, the examination determined that the Thai older people do not commonly take a tub bath and suggested 'take a shower/wash yourself with a basin of water' for substitution. However, the 'take a tub bath' was retained for further examination in a larger scale of study. Therefore, the SAFE Thai version consisted of the original 11 items plus 'take a shower/wash yourself with a basin of water'. The back-translation demonstrated that the SAFE Thai version maintains the content validity.

The results of the main study were used for examination of the item 'take a tub bath'. Because the results demonstrated that the item significantly confounds the scores of FOF of activity not done and activity restriction, it was excluded from the SAFE Thai version.

Next, the reliability of the tool was tested with Thai older adults living in the community in Chiang Mai, Thailand. The SAFE Thai version was tested for interrater, intrarater and test-retest reliabilities. The interrater reliability test was conducted using nine fourth year occupational therapy students after one day of training. The results indicate good reliability; ICC for FOF of activities done, activities not done and activity restriction were .9845, .9236 and .9718 respectively ($p < 0.001$). The intrarater reliability also presents good reliability. All ICC (3,1) of the 4 raters significantly exceed 0.8 for FOF of activities done, of activities not done and activity restriction. This indicates the appropriateness of a one-day training program for interviewers who have limited clinical experience. For persons who have more experience such as occupational therapists, the reliability is expected to be better. The test-retest reliability was greater than 0.9; which ensures the reliability of the SAFE Thai version over a one-week interval.

Methodological issues required two changes from the original version. First is the calculation of FOF scores of the SAFE Thai version. The SAFE original version demonstrated that FOF scores of those who did not perform the activity were statistical greater than those who performed the activity each activity in every item (except 'get out of bed' for when comparison could not be performed because all subjects did the activity) (Lanchman et al., 1998). However, Thai older persons who have activity restriction did not always have greater FOF in every curtailed activity. Thai older persons demonstrated a similar pattern in only 3 of the 11 activities in the SAFE Thai version. The three activities are the most challenging activities e.g. go out when slippery or require greater ability to maintain balance e.g. reach over-head and bend down. This indicates that neither average FOF scores of activities done nor activities not done reflect FOF of Thai older persons. In order to obtain a FOF score that represents overall FOF of Thai older persons; the FOF scores of activities done and not done were combined, and then the overall FOF score was calculated.

Second, the activity restriction score in the SAFE Thai version was not employed. The results demonstrated that a considerable percentage of Thai older persons curtailed activities for reasons other than FOF. There were four items in which approximately 20% of Thai older persons curtailed the activities without FOF: 'go to store', 'prepare simple meal', 'visit a friend or relative' and 'go to place with crowd'. Coupled with the results showing that those who stopped doing three activities ('go to store', 'prepare simple meal' and 'take a walk for exercise') had less FOF than those who did. These indicate that the SAFE Thai version lacks validity to identify fall/FOF-related activity restriction. It may be an accurate measure of activity restriction, but not of FOF related activity restriction.

It must also be noted that the response pattern of Thai older adults is different than that previously reported. The mean score of FOF using the SAFE of Thai older adults was greater than that of American respondents. The mean scores of FOF - activities completed in a study of community dwellers in Chiang Mai were 1.37±1.10 in trial 1 and 1.39±1.18 in trial 2. The mean score in the main study was 1.06±0.88. Whereas Lanchman et al. (1998) reported a mean score 0.51±0.75 in a young-old group and 0.80±0.76 in an old-old group. Even though direct

comparison cannot be performed, the American respondents were more likely to be at higher risk of falls and FOF. The American subjects were older (mean age 76.16±7.91 versus 68.96±6.88), more often female (78% versus 61%), less often currently married (10% versus 68%) (Lanchman et al., 1998). However, they were more likely to rate their health as good or better (57% versus 42.5%). It is not clear why Thai older persons reported higher scores of FOF. One feasible explanation is cultural differences. It has been shown that the expression of fear is more appropriate in a collectivistic culture (Mutsamoto, 1994). Compared with the United of America, Thailand is more collectivistic (Hofstede, 1980). Moreover, Thai older persons were less likely to live alone (10%), and all family members would support them if they have health problems or falls. It, therefore, might be more appropriate for Thai elderly to express their concerns about falling to show that they have taken appropriate action to prevent falls. Thai older persons might express FOF more openly because of social desirability. Further investigations are needed to identify the relationship between the also FOF and social desirability.

7.2 Falls, FOF and Activity Restriction in Thai Older People

This study found that 21% of the participants experienced falls within the 12 months prior to the study. In addition, around 10% had fallen two or more times. This rate is similar to the findings of the national survey (Choprapawon, 1995; Jitapunkul et al., 1998), even though the period of recall for falls used in this study was 6 months longer. This might be because the falls definition of this study and Choprapawon's and Jitapunkul's studies are different. The fall definition of this study has more stringent requirements. This study excluded falls because of sudden onset of an illness whereas the national survey did not (Jitapunkul et al., 1998).

The fall rate also agrees with fall rates in other Asian countries. For example, Hong Kong and Japan reported approximately 20% of older people have fall experiences (Aoyagi et al., 1998; Ho et al., 1996; Niino et al., 2000; Yasumura et al., 1994). However, compared with Western countries, the fall rate in Thai older adults is lower. It has been reported that around one third of older people in Western countries have fallen each year (Sattin, 1992; A. M. Tromp et al., 2001). Even when only participants aged 65 and over were selected for fall rate calculation, the

fall rate in Thai older people is still lower than those in Western countries (22% versus 33%).

Fear of falling is common among Thai older people. Using the dichotomous question, the FOF rate of Thai older people is 72%. However, when measuring FOF involving a set of specific activities with the SAFE Thai version, the FOF rate dropped to 48%. This indicates that FOF as measured by a dichotomous question measures general fall-related fear rather than FOF associated with activity engagement. This is in contrast to the findings of previous studies that underreporting is common when using a dichotomous question (Cumming et al., 2000; Tennstedt et al., 1998).

As different methods were used in previous studies, comparison between studies is difficult. However, in general, 29-43% of older people living in the community have FOF (Arfken et al., 1994; Murphy et al., 2002; Tinetti et al., 1994b). Compared with this rate, the FOF rate in Thai older adults is considerably higher. Nevertheless, a study of Japanese older people reported a 60% FOF prevalence. Therefore there might be culture influence on FOF.

One study in Hong Kong revealed that fallers feared that falling could result in dependency or care burden for family members (Kong et al., 2002). This finding has not been documented in studies in Western countries. As most Thai older people are living with their families and Thai and Chinese cultures are alike in many ways, this fear might also exist in Thailand. This might be one explanation why older people in Thailand express their fear of falling more than those in Western countries.

The results also showed that 18% of Thai older persons had activity restriction associated with FOF. This finding is similar to the activity restriction rate in a study of non-institutionalized older persons in New Haven, Connecticut (Murphy et al., 2002). Although FOF was common, the activity restriction rate was not as common. One possible explanation is that the majority of participants did not live alone. Therefore, family members could support the older persons continue their participation. Furthermore, the variety of activities might be another explanation. If the participants could substitute the activities where they are at

risk of falls with the less challenging activities, they may not feel that they have activity restriction.

There were characteristics that distinguished Thai fallers from non-fallers, those who had FOF from those who had no FOF and those who curtailed activity from those who did not. The characteristics are summarized in Table 7.1. The results were similar to findings of previous studies (Arfken et al., 1994; Fessel & Nevitt, 1997; Howland et al., 1998; Howland et al., 1993; Moreland et al., 2003; Myers et al., 1996; A. M. Tromp et al., 2001). However, there are some distinct findings in Thai older people that should be noted below:

Table 7.1 A Summary of Factors Associated with Falls, FOF and Activity Restriction

Distinguish factors	**Falls**[a]	**FOF**[a]	**Activity restriction**[a]
Age	Older	Older	ns
Education	ns	Lower education	ns
Gender	Female	Female	ns
Marital status	Not married	ns / yes[b]	Married
Living situation	ns	ns	ns
Perceived health	Poor/fair	Poor/fair	Poor/fair
Fall history	-	Fallen	Fallen
FOF	FOF	-	FOF
Activity restriction	Activity restriction	Activity restriction	-

ns = not significant
[a] indicate only characteristics that are found more often in those who have fallen on FOF
[b] not significant in direct comparison but significant effect when interacts with gender in logistic regression

As seen in Table 7.1, self perceived health is a consistent factor across falls, FOF and activity restriction. This suggests that prevention programs should focus on this factor. Although previous studies implicate the role of social supports in falls and FOF (Campbell et al., 1990; Howland et al., 1998; Nevitt et al., 1989), no significant effect of living situation on falls and FOF could be found in this study. This might be because only 10% of the participants lived alone. However, dropping the living situation variable from the logistic model increased the influence of previous fall experience on FOF dramatically. This suggests that the

living situation might affect FOF. If the number of older people living alone in Thailand increase, the factor will have more important role.

It is interesting that marital status had the opposite effect on fall and activity restriction. Fallers were more often not married persons whereas those with activity restriction were more often married. On one hand, married persons were more likely to have more social supports; as a result they have more opportunities to curtail their activities without giving up their quality of life. On the other hand, unmarried persons have to do everything by themselves regardless of FOF. Therefore, they appear to be less likely to curtail activities and more likely to fall. With regard to FOF, marital status showed a complicated influence. The logistic model indicated that marital status alone did not have a significant contribution, however when interacting with gender, it became more important. Further investigations are needed.

7.3 Fall Circumstances

Using face-to-face interviews, the details of 114 falls were recorded. The results agree with the national survey that most falls in Thai older people occur during the daytime and taking place outdoors (Jitapunkul et al., 1998). There is no comparable information on other aspects of fall circumstances in Thai older people.

Compared to international studies, fall circumstances for Thai older persons were similar in some ways but dissimilar in other ways. One comparable finding is that most falls related to tripping and slippery floor. This finding supports the results of previous study (Ellis & Trent, 2001). This suggests that falls prevention programs should be aimed at these risk factors. The results of this study also confirmed the results of previous studies that falls associated with cooking, housework and using the toilet are common (Campbell et al., 1990; Mackenzie et al., 2002). However, the circumstances of the falls might be different because Thai older people still perform some activities such as cooking and laundering outdoors. This requires different strategies for falls prevention. Furthermore, 60% of falls in Thai older adults occurred outdoors whereas studies in Western countries indicated that the most common place for falls is inside the home (Carpenter & Demopoulos, 1990; Ellis & Trent, 2001). However, the findings of this study correspond with studies

in Hong Kong and Japan (Ho et al., 1996; Niino et al., 2000). This might suggest differences between Western and Asian cultures. There are no extreme seasonal changes that limit outdoor activities in Thailand. Thai older persons can engage in outdoor activities year round. Furthermore, it has been shown that even though Thai older people recognize environmental hazards in their homes and public areas, they can control the hazards only in their homes. This might increase probability to fall outdoors. A unique result of fall circumstances in this study is that the most common fall related activity was work (40%). This might be because one third of Thai older people continue working regardless of their age, especially in the agricultural sector (National Statistic Office, 2002). The finding implicates the importance of falls prevention in work places for Thai older adults.

7.4 FOF Screening Tool for Thai Elderly People

The FOF screening tool was developed using logistic regression. The independent variables available in this study were selected for logistic regression analysis based on a literature review and the results of the main study. The logistic model indicated that FOF could be predicted by six variables: age, gender, marital status, self-perceived health, education and fall experience. The results provided odds ratios for each variable and its interaction (Table 6.9). This information could be used to identify target groups for further FOF evaluation and interventions. Moreover the model provides a logistic equation for individual prediction with 70% of accuracy. There are two advantages of predicting FOF by the logistic regression: 1) it requires only information that is usually already available in medical records or can be obtained by a few questions; and 2) no specific skills are required for administration.

FOF is one of the most common concerns among older people (Howland et al., 1993) and can lead to activity restriction (Tinetti et al., 1994b) and falls (Arfken et al., 1994; Friedman et al., 2002). Moreover, FOF is preventable and reducing FOF will prevent falls, activity restriction and maintain quality of life in older people. Coupled with a 48% prevalence in Thai older people, a routine screening of FOF is warranted.

However, it must be noted that the screening tool was developed based on the FOF survey data. Many known FOF risk factors were not available for logistic regression analysis. Further studies are required to improve the screening tool.

7.5 Summary

This study consists of three main parts: modification of FOF measurement tool for Thai older people; a survey of the prevalence of fall circumstances, FOF and activity restriction; and development of a FOF screening tool for Thai older people.

The tool modification process has been designed to obtain a FOF measurement tool that is identifiable, repeatable and culturally appropriate. Both correctness of translations and cultural appropriateness can be guaranteed. Moreover, the rater reliability has been confirmed for Thai community dwelling older people. Thus the SAFE Thai version can be used with confidence. Thai older people tend to report higher degrees of FOF than American older adults. Furthermore, for some activities, older persons who had activity restriction did not always have higher degree of FOF than those who did not curtail the activities. As a result, the FOF score for the Thai version must be calculated from both FOF of activities done and activities not done. Moreover, because of the cultural differences, Thai older people curtailed their activities for reasons other than FOF. Therefore the SAFE Thai version lacks validity to identify FOF related activity restriction.

The main study reported falls, FOF and activity restriction prevalence as 21%, 48% and 18%, respectively. Comparison between fallers and non-fallers showed that they could be distinguished by age, gender, marital status, living situation, self-perceived health, FOF and activity restriction. Comparison between those who had FOF and did not have FOF indicated that they were different in age, gender, educational level, self-perceived health, fall experience and activity restriction. Whereas those who curtailed activities and those who did not were different in marital status, self-perceived health, fall experience and FOF. This indicates that prevention programs should be aim at these factors. The results revealed that falls, FOF and activity restriction were predictors of each other. The relationships were confirmed by statistically significant associations between falls and FOF, fall and activity restriction, and FOF and activity restriction. This suggests that falls

intervention in Thai older people should include an approach for FOF and activity restriction.

The results of this study indicated that most Thai older people fell outdoors during the daytime. Sixty percent of falls are associated with tripping and slippery floors. Forty percent of falls are associated with work; the second most common associated activities were self-care and leisure activities. These have implications for fall prevention programs.

Furthermore, a screening tool for FOF has been developed using data from the survey. The tool requires information of six variables: age, gender, marital status, self-perceived health, education and fall experience. The classification table showed that the tool has 70% accuracy.

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APPENDIX A: INFORMED CONSENT FORM

Thesis Title: Fear of falling and fall circumstances in Thai elders

I'm Hataichanok Apikomonkon. I am currently enrolled at Curtin University of Technology for Masters degree by research. This project is a part of my study. The purposes of this study are to modify a measurement tool for Fear of Falling in Thai elderly people, to explore the prevalence of fear of falling, to explore activity restriction in fallers and non-fallers and to identify the circumstances of falls in Thailand. The results of this study will be beneficial to health promotion and prevention for elders in Thailand.

I invite you to participate in this study. Participation will include a completion of questionnaire. A code number will be used for identification on the survey form. So no name will appear on the records. Additionally, all information will be kept in a secured place by researcher for a period of five years then, shredded. Therefore the anonymity and confidentiality will be guaranteed.

If you require further information, please contact me at the Department of Occupational Therapy, Faculty of Associated Medical Sciences, Chiang Mai University, Phone no: (053) 945065 between 8.30 am to 4.30 pm. Otherwise, if you have any concerns about this project you may contact my supervisor, Prof. Tanya Packer in Australian on (618) 92663621.

Yours sincerely,

Hataichanok Apikomonkon

Participant's consent

I, ..., have read the above information on the study. I understand the purpose of this study which has been explained in the information above, understand that my participation is voluntary. I hereby give permission to be interviewed and am willing to complete the questionaire.

I agree to participate in this study by joining in face-to-face interview following the survey form and the modified SAFE.

Signature of Participant: .....
Date: .....

ใบยินยอมเข้าร่วมงานวิจัย

หัวข้อวิจัย ความกลัวหกล้มและสภาพแวดล้อมขณะหกล้มในผู้สูงอายุไทย

ดิฉัน นางสาวหทัยชนก อภิโกมลกร เป็นนักศึกษาระดับปริญญาโท ณ Curtin University of Technology ประเทศออสเตรเลีย งานวิจัยนี้เป็นส่วนหนึ่งของวิทยานิพนธ์ มีวัตถุประสงค์เพื่อดัดแปลงเครื่องมือประเมินความกลัวหกล้มสำหรับผู้สูงอายุไทย และสำรวจอัตราความกลัวการหกล้มและสภาพแวดล้อมขณะหกล้ม รวมถึงการจำกัดการทำกิจกรรมในผู้สูงอายุไทย ผลงานวิจัยนี้จะเป็นประโยชน์ต่อการพัฒนาองค์ความรู้ในการส่งเสริมสุขภาพและการป้องกันการหกล้มในผู้สูงอายุไทย

ดิฉันขอเรียนเชิญท่านเข้าร่วมงานวิจัยนี้ โดยผู้วิจัยจะสัมภาษณ์ท่านตามแบบสอบถาม การบันทึกผลทำโดยการลงรหัส ดังนั้น ชื่อของท่านจะไม่ปรากฏในแบบสอบถาม นอกจากนี้ ข้อมูลจะถูกรักษาอย่างดี โดยผู้วิจัยเป็นเวลา ๕ ปี จากนั้น ข้อมูลทุกอย่างจะถูกทำลาย ท่านจึงแน่ใจได้ว่า ข้อมูลส่วนตัวของท่านจะถูกรักษาเป็นความลับ

หากท่านต้องการข้อมูลเพิ่มเติม ท่านสามารถติดต่อดิฉัน ได้ที่ ภาควิชากิจกรรมบำบัด คณะเทคนิคการแพทย์ มหาวิทยาลัยเชียงใหม่ หมายเลขโทรศัพท์ (๐๕๓) ๙๔๕๐๖๕ ระหว่างเวลา ๘.๓๐ ถึง ๑๖.๓๐ น. หรือติดต่ออาจารย์ที่ปรึกษาของดิฉัน Prof. Tanya Packer ณ ประเทศออสเตรเลีย หมายเลขโทรศัพท์ (๖๑๘) ๙๒๖๖๓๖๒๑

ขอแสดงความนับถือ

นางสาวหทัยชนก อภิโกมลกร

ใบยินยอมเข้าร่วมงานวิจัย

ข้าพเจ้า ..... ได้อ่านข้อความข้างต้นแล้ว ข้าพเจ้าเข้าใจและยินยอมเข้าร่วมงานวิจัย โดยให้ผู้วิจัยสัมภาษณ์ตามแบบสอบถาม

ลงชื่อ .....

วันที่ .....

APPENDIX B: THE SAFE TRANSLATION QUESTIONNAIRE

แบบสอบถามการแปลแบบสำรวจ SAFE เป็นภาษาไทย

แบบสอบถามต่อไปนี้ เป็นแบบสอบถามเกี่ยวกับการแปลแบบสำรวจ SAFE จากภาษาอังกฤษเป็นภาษาไทย ขอให้ท่านกรุณาพิจารณาข้อความภาษาอังกฤษและ ภาษาไทยในแต่ละข้อต่อไปนี้ แล้วทำเครื่องหมาย **วงกลม** ล้อมรอบหมายเลขที่ท่านคิดว่า ให้ความหมายตรงกับระดับความคิดเห็นของท่าน และหากมีข้อเสนอแนะเพิ่มเติม ขอความกรุณาให้ความคิดเห็นของท่าน ในช่องว่างของคำถามแต่ละข้อ

1. คุณเห็นด้วยหรือไม่ว่า "Go to the store" มีความหมายเหมือนกับ "ไปตลาด"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

_____

_____

_____

_____

2. คุณเห็นด้วยหรือไม่ว่า "Prepare simple meal" มีความหมายเหมือนกับ "ทำกับข้าวเอง"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

_____

_____

_____

_____

3. คุณเห็นด้วยหรือไม่ว่า "Take a tub bath" มีความหมายเหมือนกับ "อาบน้ำโดยใช้อ่างอาบน้ำ"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

_____

_____

_____

_____

4. คุณเห็นด้วยหรือไม่ว่า "Get out of bed" มีความหมายเหมือนกับ "ลุกขึ้นจากเตียงนอนด้วยตนเอง"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

5. คุณเห็นด้วยหรือไม่ว่า "Take a walk for exercise" มีความหมายเหมือนกับ "ไปเดินออกกำลัง"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

6. คุณเห็นด้วยหรือไม่ว่า "Go out when slippery" มีความหมายเหมือนกับ "ออกจากบ้านเมื่อพื้นลื่น"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

7. คุณเห็นด้วยหรือไม่ว่า "Visit a friend or relative" มีความหมายเหมือนกับ "ไปเยี่ยมเพื่อนๆหรือญาติ"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

8. คุณเห็นด้วยหรือไม่ว่า "Reach over head" มีความหมายเหมือนกับ "เอื้อมหยิบของเหนือศีรษะ"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

9. คุณเห็นด้วยหรือไม่ว่า "Go to place with crowd" มีความหมายเหมือนกับ "ไปในที่ที่มีคนหนาแน่น"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

10. คุณเห็นด้วยหรือไม่ว่า "Walk several block outside" มีความหมายเหมือนกับ "เดินไกลๆ"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

11. คุณเห็นด้วยหรือไม่ว่า "Bend down" มีความหมายเหมือนกับ "ก้มตัว"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

12. คุณเห็นด้วยหรือไม่ว่า

"Do you currently do it? มีความหมายเหมือนกับ "ปัจจุบันนี้ คุณทำสิ่งนี้อยู่ไหม

- ☐ Yes
- ☐ No"

- ☐ ทำ
- ☐ ไม่ทำ "

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

13. คุณเห็นด้วยหรือไม่ว่า "If you do the activity, when you do it how worried are you that you might fall?" มีความหมายเหมือนกับ "ถ้าคุณยังทำอยู่ ขณะที่คุณทำ คุณเป็นห่วงว่าจะหกล้ม หรือไม่"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

14. คุณเห็นด้วยหรือไม่ว่า "Not at all" มีความหมายเหมือนกับ "ไม่เลย"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

15. คุณเห็นด้วยหรือไม่ว่า "A little worried" มีความหมายเหมือนกับ "ห่วงนิดหน่อย"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

16. คุณเห็นด้วยหรือไม่ว่า "Somewhat worried" มีความหมายเหมือนกับ "เป็นห่วง"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

17. คุณเห็นด้วยหรือไม่ว่า "Very worried" มีความหมายเหมือนกับ "เป็นห่วงมาก"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

18. คุณเห็นด้วยหรือไม่ว่า "If you do not do the activity, do you not do it because you are worried that you might fall?" มีความหมายเหมือนกับ "ถ้าคุณไม่ทำสิ่งนี้ คุณไม่ทำเพราะว่าคุณเป็นห่วงว่าจะหกล้ม หรือไม่"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

19. คุณเห็นด้วยหรือไม่ว่า "If you do not do the activity because of worry, are there also other reasons that you do not do it (if yes, specify)" มีความหมายเหมือนกับ "ถ้าคุณไม่ทำสิ่งนี้ เพราะว่าคุณเป็นห่วงว่าจะหกล้ม คุณมีเหตุผลอื่นๆอีกหรือไม่ (โปรดระบุ)"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

20. คุณเห็นด้วยหรือไม่ว่า "For those not worried, what are the reasons that you do not do it" มีความหมายเหมือนกับ "ถ้าการที่คุณไม่ทำสิ่งนี้ ไม่ใช่เพราะว่า คุณเป็นห่วงว่าจะหกล้ม คุณไม่ทำเพราะอะไร"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

21. คุณเห็นด้วยหรือไม่ว่า "Compare to 5 years ago would you say that you do it" มีความหมายเหมือนกับ "เปรียบเทียบกับ 5 ปีก่อน คุณทำสิ่งนี้"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

22. คุณเห็นด้วยหรือไม่ว่า "More than you used to" มีความหมายเหมือนกับ "มากกว่าที่เคยทำ"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

23. คุณเห็นด้วยหรือไม่ว่า "About the same" มีความหมายเหมือนกับ "เหมือนเดิม"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

24. คุณเห็นด้วยหรือไม่ว่า "Less than you used to" มีความหมายเหมือนกับ "น้อยกว่าที่เคยทำ"

1	2	3	4	5
ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างยิ่ง

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

English version

Please give rating to the questions by circle your choice and give relevant suggestions.

1. Do you agree "Go to the store" is equivalent to "ไปตลาด" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

2. Do you agree "Prepare simple meal" is equivalent to "ทำกับข้าวเอง" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

3. Do you agree "Take a tub bath" is equivalent to "อาบน้ำโดยใช้อ่างอาบน้ำ" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

4. Do you agree "Get out of bed" is equivalent to "ลุกขึ้นจากเตียงนอนด้วยตนเอง" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

5. Do you agree "Take a walk for exercise" is equivalent to "ไปเดินออกกำลัง" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

6. Do you agree "Go out when slippery" is equivalent to "ออกจากบ้านเมื่อพื้นลื่น" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

7. Do you agree "Visit a friend or relative" is equivalent to "ไปเยี่ยมเพื่อนๆหรือญาติ" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

8. Do you agree "Reach over head" is equivalent to "เอื้อมหยิบของเหนือศีรษะ" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

9. Do you agree "Go to place with crowd" is equivalent to "ไปในที่ที่มีคนหนาแน่น" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

10. Do you agree "Walk several block outside" is equivalent to "เดินไกลๆ" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

11. Do you agree "Bend down" is equivalent to "ก้มตัว" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

13. Do you agree

"Do you currently do it? is equivalent to "ปัจจุบันนี้ คุณทำสิ่งนี้อยู่ไหม

- ❑ Yes
- ❑ No
- ❑ ทำ
- ❑ ไม่ทำ "

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

13. Do you agree "If you do the activity, when you do it how worried are you that you might fall?" is equivalent to "ถ้าคุณยังทำอยู่ ขณะที่คุณทำ คุณเป็นห่วงว่าจะหกล้ม หรือไม่" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

14. Do you agree "Not at all" is equivalent to "ไม่เลย" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

15. Do you agree "A little worried" is equivalent to "ห่วงนิดหน่อย" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

16. Do you agree "Somewhat worried" is equivalent to "เป็นห่วง" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

17. Do you agree "Very worried" is equivalent to "เป็นห่วงมาก" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

18. Do you agree "If you do not do the activity, do you not do it because you are worried that you might fall?" is equivalent to "ถ้าคุณไม่ทำสิ่งนี้ คุณไม่ทำเพราะว่า คุณเป็นห่วงว่าจะหกล้ม หรือไม่" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

19. Do you agree "If you do not do the activity because of worry, are there also other reasons that you do not do it (if yes, specify)" is equivalent to "ถ้าคุณไม่ทำสิ่งนี้ เพราะว่า คุณเป็นห่วงว่าจะหกล้ม คุณมีเหตุผลอื่นๆอีกหรือไม่ (โปรดระบุ)" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

20. Do you agree "For those not worried, what are the reasons that you do not do it" is equivalent to "ถ้าการที่คุณไม่ทำสิ่งนี้ ไม่ใช่เพราะว่า คุณเป็นห่วงว่าจะหกล้ม คุณไม่ทำเพราะอะไร" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

21. Do you agree "Compare to 5 years ago would you say that you do it" is equivalent to "เปรียบเทียบกับ 5 ปีก่อน คุณทำสิ่งนี้" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

22. Do you agree "More than you used to" is equivalent to "มากกว่าที่เคยทำ" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

23. Do you agree "About the same" is equivalent to "เหมือนเดิม" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

24. Do you agree "Less than you used to" is equivalent to "น้อยกว่าที่เคยทำ" ?

1	2	3	4	5
Totally Disagree	Disagree	Fair	Agree	Totally agree

โปรดให้ความคิดเห็นเพิ่มเติมเกี่ยวกับการตัดสินของท่านและข้อเสนอแนะในการแก้ไข

APPENDIX C: OUTLINE OF STRUCTURED INTERVIEW

Survey Date: ..... Study ID: .....

Date of Birth/Age: .....

Gender:

- ☐ Male
- ☐ Female

Marital Status:

- ☐ Never married
- ☐ Married
- ☐ Widowed
- ☐ Divorced
- ☐ Separated

1. How many years of regular schooling have you completed? .....

2. Do you live alone?
   - ☐ Yes
   - ☐ No

3. In general, would you say your health is
   - ☐ Excellent
   - ☐ Very good
   - ☐ Good
   - ☐ Fair
   - ☐ Poor

In this study, falls are defined as "*an event which results in a person coming to rest inadvertently on the ground or other lower level and other than as a consequence of the following: sustaining a violent blow; loss of consciousness; sudden onset of paralysis, as in a stroke; or an epileptic seizure*"(Sattin, 1992)

4. According to the above definition, have you fallen within the past 12 months?
   - ☐ Yes
   - ☐ No ⟶ 9
5. How many times have you fallen?
   - ☐ One
   - ☐ Two
   - ☐ More than 2 (please specify how many .....)

The next questions refer to your most recent fall.

6. What time of the day/night did you fall? (time in hour)

.....

.....

7. Where did you fall?
   - ❑ At home
     - ○ Indoors
     - ○ Outdoors
   - ❑ Outside home (please specify .....)
     - ○ Indoors
     - ○ Outdoors

8. What were you doing? (Levine & Brayley, 1991)

.....

   - ❑ Work-related
   - ❑ Self-care
   - ❑ Leisure
   - ❑ Social and Recreational

9. Please specify what is the type of your last fall by following classification (check 1)

	W00: Fall on the same level involving ice and snow
	W01: Fall on same level from slipping, tripping, or stumbling
	W02: Fall involving ice-skates, skis, roller-skates or skateboards
	W03: Fall on same level from collision, pushing, or shoving, by or with other person
	W04: Fall while being carried or supported by other person
	W05: Fall involving wheelchair
	W06: Fall involving bed
	W07: Fall involving chair
	W08: Fall involving other furniture
	W09: Fall from playground equipment
	W10: Fall on or from stairs or steps
	W11: Fall on or from ladder
	W12: Fall on or from scaffolding
	W13: Fall from, out of or through building or structure
	W14: Fall from tree
	W15: Fall from cliff
	W16: Diving or jumping into water causing injury other than drowning or submersion
	W17: Other fall from one level to another
	W18: Other fall on same level
	W19: Unspecified falls

10. Are there any intrinsic or extrinsic hazard implicated in your last fall?
    - ❑ Yes (please specify)

      .....

      .....

      Extrinsic hazard
        - o Fall of object
        - o Pushed over
        - o Trip
        - o Slippery floor surface
        - o Miscellaneous
        - o Others (please specify)

          .....

          Intrinsic hazard
        - o Side effects of medications
        - o Others (please specify)

          .....
    - ❑ No
11. Are you worried about falling?
    - ❑ Yes
    - ❑ No
12. Do you stop, avoid or restrict doing any activities because you worried about falling?
    - ❑ Yes (please specify)

      .....
    - ❑ No

The Survey of Activities and Fear of Falling in Elderly (SAFE) (Lanchman et al., 1998)

1. Go to the store
    a. Do you currently do it?
        - ❑ Yes
        - ❑ No
    b. If you do the activity, when you do it how worried are you that you might fall?
        0 Not at all
        1 A little worried
        2 Somewhat worried
        3 Very worried
    c. If you do not do the activity, do you not do it because you are worried that you might fall?
        0 Not at all
        1 A little worried
        2 Somewhat worried
        3 Very worried
    d. If you do not do the activity because of worry, are there also other reasons that you do not do it (if yes, specify)

    .....

    .....

    e. For those not worried, what are the reasons that you do not do it

    .....

    .....

    f. Compare to 5 years ago would you say that you do it
        1 More than you used to
        2 About the same
        3 Less than you used to

2. Prepare simple meal
    a. Do you currently do it?
        - ❑ Yes
        - ❑ No
    b. If you do the activity, when you do it how worried are you that you might fall?
        0 Not at all
        1 A little worried
        2 Somewhat worried
        3 Very worried
    c. If you do not do the activity, do you not do it because you are worried that you might fall?
        0 Not at all
        1 A little worried
        2 Somewhat worried
        3 Very worried
    d. If you do not do the activity because of worry, are there also other reasons that you do not do it (if yes, specify)

---

e. For those not worried, what are the reasons that you do not do it

---

---

f. Compare to 5 years ago would you say that you do it
   1 More than you used to
   2 About the same
   3 Less than you used to

3. Take a tub bath
   a. Do you currently do it?
      - ☐ Yes
      - ☐ No
   b. If you do the activity, when you do it how worried are you that you might fall?
      0 Not at all
      1 A little worried
      2 Somewhat worried
      3 Very worried
   c. If you do not do the activity, do you not do it because you are worried that you might fall?
      0 Not at all
      1 A little worried
      2 Somewhat worried
      3 Very worried
   d. If you do not do the activity because of worry, are there also other reasons that you do not do it (if yes, specify)

---

e. For those not worried, what are the reasons that you do not do it

---

---

f. Compare to 5 years ago would you say that you do it
   1 More than you used to
   2 About the same
   3 Less than you used to

4. Take a shower/wash yourself with a basin of water
   a. Do you currently do it?
      - ☐ Yes
      - ☐ No
   b. If you do the activity, when you do it how worried are you that you might fall?
      0 Not at all
      1 A little worried
      2 Somewhat worried
      3 Very worried

c. If you do not do the activity, do you not do it because you are worried that you might fall?
   0 Not at all
   1 A little worried
   2 Somewhat worried
   3 Very worried

d. If you do not do the activity because of worry, are there also other reasons that you do not do it (if yes, specify)

---

e. For those not worried, what are the reasons that you do not do it

---

---

f. Compare to 5 years ago would you say that you do it
   1 More than you used to
   2 About the same
   3 Less than you used to

5. Get out of bed
   a. Do you currently do it?
      ☐ Yes
      ☐ No
   b. If you do the activity, when you do it how worried are you that you might fall?
      0 Not at all
      1 A little worried
      2 Somewhat worried
      3 Very worried
   c. If you do not do the activity, do you not do it because you are worried that you might fall?
      0 Not at all
      1 A little worried
      2 Somewhat worried
      3 Very worried
   d. If you do not do the activity because of worry, are there also other reasons that you do not do it (if yes, specify)

---

   e. For those not worried, what are the reasons that you do not do it

---

---

   f. Compare to 5 years ago would you say that you do it
      1 More than you used to
      2 About the same
      3 Less than you used to

6. Take a walk for exercise
   a. Do you currently do it?
      ☐ Yes

- ❑ No

b. If you do the activity, when you do it how worried are you that you might fall?
   - 0 Not at all
   - 1 A little worried
   - 2 Somewhat worried
   - 3 Very worried

c. If you do not do the activity, do you not do it because you are worried that you might fall?
   - 0 Not at all
   - 1 A little worried
   - 2 Somewhat worried
   - 3 Very worried

d. If you do not do the activity because of worry, are there also other reasons that you do not do it (if yes, specify)

---

e. For those not worried, what are the reasons that you do not do it

---

---

f. Compare to 5 years ago would you say that you do it
   - 1 More than you used to
   - 2 About the same
   - 3 Less than you used to

7. Go out when slippery
   a. Do you currently do it?
      - ❑ Yes
      - ❑ No

   b. If you do the activity, when you do it how worried are you that you might fall?
      - 0 Not at all
      - 1 A little worried
      - 2 Somewhat worried
      - 3 Very worried

   c. If you do not do the activity, do you not do it because you are worried that you might fall?
      - 0 Not at all
      - 1 A little worried
      - 2 Somewhat worried
      - 3 Very worried

   d. If you do not do the activity because of worry, are there also other reasons that you do not do it (if yes, specify)

---

   e. For those not worried, what are the reasons that you do not do it

---

---

   f. Compare to 5 years ago would you say that you do it

1 More than you used to
2 About the same
3 Less than you used to

8. Visit a friend or relative
   a. Do you currently do it?
      - ❑ Yes
      - ❑ No
   b. If you do the activity, when you do it how worried are you that you might fall?
      0 Not at all
      1 A little worried
      2 Somewhat worried
      3 Very worried
   c. If you do not do the activity, do you not do it because you are worried that you might fall?
      0 Not at all
      1 A little worried
      2 Somewhat worried
      3 Very worried
   d. If you do not do the activity because of worry, are there also other reasons that you do not do it (if yes, specify)

      .....

      .....
   e. For those not worried, what are the reasons that you do not do it

      .....

      .....
   f. Compare to 5 years ago would you say that you do it
      1 More than you used to
      2 About the same
      3 Less than you used to

9. Reach over head
   a. Do you currently do it?
      - ❑ Yes
      - ❑ No
   b. If you do the activity, when you do it how worried are you that you might fall?
      0 Not at all
      1 A little worried
      2 Somewhat worried
      3 Very worried
   c. If you do not do the activity, do you not do it because you are worried that you might fall?
      0 Not at all
      1 A little worried
      2 Somewhat worried
      3 Very worried

d. If you do not do the activity because of worry, are there also other reasons that you do not do it (if yes, specify)

---

e. For those not worried, what are the reasons that you do not do it

---

---

f. Compare to 5 years ago would you say that you do it
   1 More than you used to
   2 About the same
   3 Less than you used to

10. Go to place with crowd
    a. Do you currently do it?
       - ❑ Yes
       - ❑ No
    b. If you do the activity, when you do it how worried are you that you might fall?
       0 Not at all
       1 A little worried
       2 Somewhat worried
       3 Very worried
    c. If you do not do the activity, do you not do it because you are worried that you might fall?
       0 Not at all
       1 A little worried
       2 Somewhat worried
       3 Very worried
    d. If you do not do the activity because of worry, are there also other reasons that you do not do it (if yes, specify)

---

e. For those not worried, what are the reasons that you do not do it

---

---

f. Compare to 5 years ago would you say that you do it
   1 More than you used to
   2 About the same
   3 Less than you used to

11. Walk several block outside
    a. Do you currently do it?
       - ❑ Yes
       - ❑ No
    b. If you do the activity, when you do it how worried are you that you might fall?
       0 Not at all
       1 A little worried
       2 Somewhat worried
       3 Very worried

c. If you do not do the activity, do you not do it because you are worried that you might fall?
   0 Not at all
   1 A little worried
   2 Somewhat worried
   3 Very worried

d. If you do not do the activity because of worry, are there also other reasons that you do not do it (if yes, specify)

---

e. For those not worried, what are the reasons that you do not do it

---

---

f. Compare to 5 years ago would you say that you do it
   1 More than you used to
   2 About the same
   3 Less than you used to

12. Bend down

a. Do you currently do it?
   - ❑ Yes
   - ❑ No

b. If you do the activity, when you do it how worried are you that you might fall?
   0 Not at all
   1 A little worried
   2 Somewhat worried
   3 Very worried

c. If you do not do the activity, do you not do it because you are worried that you might fall?
   0 Not at all
   1 A little worried
   2 Somewhat worried
   3 Very worried

d. If you do not do the activity because of worry, are there also other reasons that you do not do it (if yes, specify)

---

e. For those not worried, what are the reasons that you do not do it

---

---

f. Compare to 5 years ago would you say that you do it
   1 More than you used to
   2 About the same
   3 Less than you used to

APPENDIX D: SAMPLING FRAME

Regions	List of provinces	List of districts	List of sub-district
Middle	• Ang Thong • Bangkok • Chachoengsao • Chai Nat • Chanthaburi • Chon Buri • Kanchanaburi • Lop Buri • Nakhon Nayok • Nakhon Pathom • Nonthaburi • Pathum Thani • Phetchaburi • Phra Nakhon Si Ayutthaya • Phrachin Buri • Prachuap Khiri Khan • Ratchaburi • Rayong • Sa Kaeo • Samut Prakan • Samut Sakhon • Samut Songkhram • Saraburi • Sing Buri • Suphan Buri • Trat	• Amphoe Mueang Samut Prakan • Amphoe Bang Bo • Amphoe Bang Phli • King Amphoe Bang Sao Thong • Amphoe Phra Pradaeng • Amphoe Phra Samut Chedi	• Bang Doan • Bang Maung • Bang Maung Mai • Bang Prong • Bang Pu • Bang Pu Mai • Prag Sa • Prag Sa Mai • Samut Prakan • Sum Rong Nuea • Tai Ban • Thae Pa Ruk
North	• Chiang Mai • Chiang Rai • Kamphaeng Phet • Lampang • Lamphun • Mae Hong Son • Nakhon Sawan • Nan • Phayao • Phetchabun • Phichit • Phitsanulok • Phrae • Sukhothai • Tak • Uthai Thani • Uttaradit	• Amphoe Ban Hong • Amphoe Banthi • Amphoe Li • Amphoe Mae Tha • Amphoe Mueang Lamphun • Amphoe Pa Sang • Amphoe Thung Hua Chang • King Amphoe Wiang Nong Long	• Nong Long • Nong Yuang • Wang Pang

Regions	List of provinces	List of districts	List of sub-district
Northeastern	• Amnat Charoen • Buri Ram • Chaiyaphum • Kalasin • Khon Kaen • Loei • Maha Sarakham • Mukdahan • Nakhon Phanom • Nakhon Ratchasima • Nong Bua Lam Phu • Nong Khai • Roi Et • Sakon Nakhon • Si Sa Ket • Surin • Ubon Ratchathani • Udon Thani • Yasothon	• Amphoe Ban Dung • Amphoe Ban Phue • Amphoe Chaiwan • Amphoe Kumphawapi • Amphoe Kut Chap • Amphoe Mueang Udon Thani • Amphoe Na Yung • Amphoe Nam Som • Amphoe Non Sa-at • Amphoe Nong Han • Amphoe Nong Saeng • Amphoe Nong Wua So • Amphoe Phen • Amphoe Sang Khom • Amphoe Si That • Amphoe Thung Fon • Amphoe Wang Sam Mo • King Amphoe Ku Kaeo • King Amphoe Phibun Rak • King Amphoe Prachak Sinlapakhom	• Ban Chan • Ban Khaw • Ban Lueam • Ban Tad • Chiang Pin • Chiang Yuen • Ko Sa Aad • Kud Sa • Mak Khang • Mu Mon • Na Di • Na Kha • Na Kwang • Ni Com Song Ko • Non Sung • Nong Bao • Nong Hi • Nong Khon Kang • Nong Na Kum • Nong Pai • Sam Prow
South	• Chumphon • Krabi • Nakhon Si Thammarat • Narathiwat • Pattani • Patthalung • Phangnga • Phuket • Ranong • Satun • Songkhla • Surat Thani • Trang • Yala	• Amphoe Ban Na Doem • Amphoe Ban Na San • Amphoe Ban Ta Khun • Amphoe Chai Buri • Amphoe Chaiya • Amphoe Don Sak • Amphoe Kanchanadit • Amphoe Khian Sa • Amphoe Khiri Ratthanikhom • Amphoe Ko Pha-ngan • Amphoe Ko Samui • Amphoe Mueang Surat Thani • Amphoe Phanom • Amphoe Phrasaeng • Amphoe Phunphin • Amphoe Tha Chana • Amphoe Tha Chang • Amphoe Wiang Sa • King Amphoe Vibhavadi	• Bang Duean • Bang Ma Duea • Bang Ngon • Hua Toei • Kho Hua Kwai • Krud • Li Led • Ma Luain • Nong Sai • Num Rob • Phun Phin • Sri Wi Chai • Ta Pan • Tha Kam • Tha Rong Chang • Tha Sa Ton

APPENDIX E: THE CALCULATION OF PROBABILITY OF HAVING FOF

Example of formula entry in Excel worksheet for the probability of having FOF calculation

Screening tool for FOF in Thai older people			
Variables	Coding		
Age		Year	
Gender		Male = 0	Female = 1
Marital status		Married = 0	Not married = 1
Education		Year	
Self perceived health		Good = 0	Not good = 1
Fall experience		2 or less falls = 0	More than 2 falls = 1
Variables in Logistic Model			
		Multiplication of coding and beta value	
	beta values		
Age	0.024876	B18*B5	
Gender(1)	0.643449	B19*B6	
Marital status(1)	-1.066394	B20*B7	
Education	-0.069196	B21*B8	
Self perceived health(1)	1.218861	B22*B9	
Fall experience(1)	1.974329	B23*B10	
Gender(1) by Marital status(1)	1.144965	B24*B6*B7	
Education by Fall experience(1)	-0.505299	B25*B8*B10	
Constant	-2.645859	-2.645859	
summation		SUM(D18:D26)	
probability to have FOF	=	1/(1+EXP(-summation))	

Example of entering data in Excel worksheet for the probability of having FOF calculation

Screening tool for FOF in Thai older people				
Variables	Coding			
Age	70		Year	
Gender	1		Male = 0	Female = 1
Marital status	0		Married = 0	Not married = 1
Education	4		Year	
Self perceived health	0		Good = 0	Not good = 1
Fall experience	1		2 or less falls = 0	More than 2 falls = 1
Variables in Logistic Model				
	beta values		Multiplication of coding and beta value	
Age	0.024876		1.741291567	
Gender(1)	0.643449		0.643448992	
Marital status(1)	-1.066394		0	
Education	-0.069196		-0.27678411	
Self perceived health(1)	1.218861		0	
Fall experience(1)	1.974329		1.974329369	
Gender(1) by Marital status(1)	1.144965		0	
Education by Fall experience(1)	-0.505299		-2.021194455	
Constant	-2.645859		-2.645859	
summation			-0.584767872	
probability to have FOF			0.36	