

## Research Article

# A Comparison of Social Connectedness and Physical Activity Between Good and Poor Sleepers: A Pilot Study in Thai Older Adults

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### Abstract

*The role of social connectedness and physical activity in sleep in Thai older adults and self-care strategies to promote sleep are not well understood. This study compared social connectedness and physical activity between older adults with good and poor sleep quality, as well as explored self-care techniques older adults use to promote sleep. A multimethod design was used. Fifty cognitively intact older adults from one elders club in Hat Yai, Songkhla Province participated in a questionnaire-based face-to-face interview about sleep quality, measured by the Pittsburgh Sleep Quality Index (PSQI). A focus group with six participants with the highest and lowest PSQI scores was conducted to identify sleep-promoting strategies. Differences in social connectedness and physical activity between good sleepers (32 persons, PSQI  $\leq$  5) and poor sleepers (18 persons, PSQI  $>$ 5) were compared with the Mann-Whitney U Test. Content analysis was used for focus group data. The study showed no statistically significant differences in social connectedness and physical activity between good and poor sleepers, although the means for physical activity trended in the expected direction. The focus group data suggested self-care strategies participants used to promote sleep, including non-mind-body/mind-body activities and relaxation/spiritual techniques. Due to the small sample size, the results regarding the associations of sleep quality with social connectedness and physical activity are inconclusive. Thus, future research with larger samples is needed to evaluate the influence of physical activity and social connectedness on sleep quality. Self-care techniques in older adults with sleep problems should be considered with regard to their individual specific needs.*

**Keywords:** older adults; physical activity; sleep quality; sleep promotion; social connectedness

## Introduction

The experience of sleep disturbance is a common problem that increases with older age.<sup>1</sup> In Asian countries such as China, Taiwan, and Korea, its prevalence ranges from 50 to 60 percent.<sup>2-4</sup> This number is consistent with the estimated prevalence of poor sleep in Thai older adults.<sup>5</sup> Many factors cause poor sleep quality in older adults, including comorbidities, depressive symptoms, pain, and a sedentary lifestyle.<sup>6</sup> Among those factors, social connectedness, which referred to individuals' connections with families and friends, may be an additional determinant of sleep quality.<sup>7</sup> While social connectedness tends to decline as people age, research studies have found its physical and psychological benefits in helping the elderly stay active and maintain physical and emotional well-being.<sup>8,9</sup> Thus, those older adults who have a strong social connection with friends and families, may have good sleep quality.

Enhancing sleep quality in older adults includes several techniques, although existing literature merely emphasizes alternative sleep-promotion techniques, such as music<sup>10</sup> and exercise.<sup>11</sup> Of alternative techniques, sleep experts posit that physical activity may promote better sleep through the body mechanisms of homeostatic regulation, neurological systems, and mood control, that all affect sleep-wake cycles.<sup>12</sup> However, a several studies explored self-care strategies for sleep problems, suggesting different strategies that participants used to promote their sleep. In Taiwan, for example, older participants commonly took medications to help them gain better sleep.<sup>13</sup> However, Korean American elders spent time praying to promote their sleep quality.<sup>14</sup> Besides, Sandberg et al. found that African Americans were more likely than white older adults to stay in bed or rest when they had sleep difficulties.<sup>15</sup> Altogether, cultural differences and ethnicity may influence sleep-promotion techniques used in older adults.

In Thailand, previous research studies on sleep in older adults were focused on factors contributing to poor sleep quality<sup>5</sup> and interventions that enhanced good sleep.<sup>16</sup> Little is known about how Thai elders use self-care techniques to deal with their sleep difficulties. Since elders clubs have been established to provide exercise programs and social activities for older adults in all sub-districts of Thailand, there may have some factors affecting an older person's sleep quality regarding their participation in club activities, such as social connection and physical activity. Moreover, up-to-date evidence of sleep characteristics, especially in Thai older adults participating in club activities, is needed. Thus, the researchers initiated a pilot study among Thai older adults who participated in the club's activities to compare social connectedness and physical activity between older adults with good and poor sleep quality. The sleep characteristics and self-care strategies used to gain better sleep among Thai older adults were also explored. Understanding the role of social connectedness and physical activity related to sleep quality in older adults, sleep characteristics, and sleep-promoting techniques could guide future potential nursing practice and interventions to promote sleep quality and standard of care for this population.

## Objectives

This study aimed to (a) examine the differences in social connectedness and physical activity between good sleepers and poor sleepers, (b) describe sleep characteristics in Thai older adults, and (c) identify self-care strategies Thai older adults used to promote sleep.

## Research Questions

1. Is there a difference between older adults with good and poor sleep quality in regard to social connectedness and physical activity scores?

2. What are the sleep characteristics of Thai older adults?

3. What are the self-care strategies Thai older adults used to promote sleep?

### **Conceptual Framework**

This study was guided by the symptom management model (SMM).<sup>17</sup> This model explains interrelationships among three main components, including symptom experience, symptom management strategies, and symptom outcomes. These components can be influenced by personal factors, health/illness, and environment.<sup>17</sup> Regarding this model, older persons may or may not perceive their symptoms before they engage in self-care strategies. This study defined the symptom experiences of the elderly as sleep characteristics containing sleep latency (time spent falling asleep), sleep duration (total sleep time) and sleep efficiency (percentage of total sleep time divided by time in bed). In addition, symptom management strategies were equivalent to physical activities and self-care techniques which older adults used to promote their sleep. Levels of activities were measured by using the metabolic equivalent value (MET) per week. The symptom outcome variable was sleep quality, which was calculated from the total score of the Pittsburgh Sleep Quality Index (PSQI) scale. Contributing factors of sleep quality explored in this study included person (gender, education, marital status, and living status), health/illness (pain, depression, and comorbidities), and environment (social connectedness).

### **Methods**

#### **Study Design and Participants.**

This study used a multimethod design. All older adults (60 persons) who participated at one elders club in Songkhla Province and met the inclusion criteria were purposively selected to participate in the study, with a total of 50 eligible persons finally recruited. Inclusion criteria included

(a) age 60 years or older, (b) elders club membership at least 1 year, (c) intact cognitive function as indicated by the elders club director who was a gerontological nurse and had previously evaluated each member at the club by using the Mini-Mental state Examination 2002. Participants were excluded if they used medications to help them sleep more than once a week.

#### **Ethical Considerations.**

This study was approved by the University of Missouri Institutional Review Board (IRB Number 2002868 HS) and the Ethical Committee of the research site. Participation in this study was voluntary. All information obtained in connection with this study was kept confidential. All participants provided written informed consent before data collection.

#### **Data Collection.**

Data were collected using quantitative and qualitative approaches. For quantitative data, questionnaire-based face-to-face-interviews were used to measure social connectedness, physical activity, sleep quality, comorbid diseases, depressive symptoms, and pain intensity. For qualitative data, a focus group interview was used to explore self-care strategies to promote sleep. Five participants with the highest score (poor sleepers) and five participants with the lowest score (good sleepers) were invited to participate in a focus group interview. Of those, three good sleepers and three poor sleepers participated.

#### **Instruments.**

##### **Demographic characteristics**

Demographic characteristics collected included age, gender, years of education, marital status, and living situation.

##### **Social connectedness**

Social connectedness was measured by the social connectedness questionnaire developed by Krishnakumar et al.<sup>18</sup> This questionnaire consists of three-items on family's and friend's connections

with the score of each item ranging from 0 (not at all) to 4 (everyday) and five-items on an active community participation with scores of each item ranging from 1 (not at all) to 3 (always).<sup>18</sup> The total score ranged from 5 to 27. Cronbach's alpha for the social connectedness questionnaire, tested in Thai older adults, was 0.61.<sup>18</sup> The summed score was used for analysis.

### **Physical activity**

The self-reported physical activity questionnaire (SPAQ), developed by Visuthipanich et al.,<sup>19</sup> was used to measure physical activity. Participants were asked if they had engaged in each of the activities listed in the questionnaire over the past seven days.<sup>19</sup> The SPAQ consists of 55 items, grouped into five categories: household physical activity, occupational physical activity, leisure time, transportation, and other physical activities not previously mentioned. The estimated weekly duration for each task was multiplied by the metabolic equivalent value (MET), and the results summed across all activities in which participants engaged. The test-retest reliability for the SPAQ in 150 Thai older adults was 0.93, and the concurrent validity with activity count (measured by Actigraphy) and with six-minute walk test (6MWT) was 0.31 and 0.74, respectively.<sup>19</sup> The summed score was used for analysis.

### **Sleep quality**

The Pittsburgh Sleep Quality Index (PSQI)<sup>20</sup> translated in Thai by Sitasuwan et al.<sup>21</sup> was used to explore sleep quality and sleep characteristics. The 19-item PSQI consists of seven domains: subjective sleep quality, sleep onset latency (time spent falling asleep, minute), sleep duration (total sleep time, hour), sleep efficiency (percentage of total sleep time divided by time in bed), sleep disturbance, use of sleep medicine, and daytime dysfunction. The score for each domain ranges from 0-3 (no difficulty-severe difficulty). Then, seven domains

are summed to produce the global PSQI score ranging from 0-21. Cronbach's alpha for the PSQI, tested in 108 adult patients, was 0.84, and the test-retest reliability was 0.89.<sup>21</sup> Sleep latency, sleep duration, and sleep efficiency were used to report sleep characteristics. A global PSQI score greater than five was used to indicate poor sleep quality.<sup>21</sup>

### **Comorbid diseases**

Comorbid diseases were evaluated by self-reported co-morbidity questionnaires.<sup>22</sup> Participants were asked to indicate any of 19 common health conditions they had been diagnosed with. All 19 conditions were separated into eight separate domains that included cardiovascular, respiratory, musculoskeletal, neurological, cancer, diabetes, visual, and a general domain. Summed scores were calculated by the simple summation of domains containing any diagnosis. The test-retest reliability for each domain in 28 older people ranged from 0.85 to 1.0.<sup>22</sup>

### **Depressive symptoms**

Depressive symptoms were evaluated by the 9-item Thai version of the Patient Health Questionnaire (PHQ-9), which was translated from the original version by Lotrakul et al.<sup>23</sup> Participants were asked to rate depressive symptoms during two weeks prior to answering the questions. The score for each item ranges from 0-3 (not at all-nearly every day), while summed scores range from 0-27. Cronbach's alpha for the PHQ-9, tested in 1,000 Thai primary care patients with a mean age of 45 years, was 0.79, and the cut-off score of PHQ-9  $\geq 9$  had a sensitivity of 0.84 and specificity of 0.77 to predict major depression.<sup>23</sup>

### **Pain intensity**

Pain intensity was evaluated by the Geriatric Pain Measure Short-Form (GPM-12).<sup>24</sup> The GPM-12 was translated in Thai by the principal investigator and back translated by one bilingual expert. Then, the two versions were compared for concept equivalence until no errors were found.<sup>25</sup> Participants were asked

to respond if they had experienced any pain symptoms listed over the past month. The GPM-12 consisted of 12 items, ten of which were scored dichotomously (yes and no), and two of which were scored categorically on a scale of 0 to 10. The summed raw score ranges from 0 to 30. The raw score was then adjusted to a scale of 0 to 100. A higher score indicates greater pain intensity. Cronbach's alpha in the present study was 0.77.

### **Self-care strategies used to promote sleep**

The focus group interview questions were developed by the researchers to explore self-care strategies used by Thai older adults to promote sleep. The interview guide consisted of three major questions: (a) Can you tell me what you usually do to help you sleep well? (b) How did you learn about that technique? and (c) If you consulted with your doctors or nurses, what suggestions did you get from them?

### **Data Analysis**

Data analysis was performed using SPSS version 23.0 for Windows<sup>®</sup> (IBM Inc., Chicago, IL, USA). All data were double entered in an Excel file to verify accuracy before analysis. Descriptive statistics, including mean, standard deviation, frequency, and percentage, were computed to describe sample demographic characteristics and scores on measures of the PSQI, SPAQ, PHQ-9, GMP-12, social connectedness, and comorbid diseases.

Homogeneity testing was conducted to determine the differences in demographic and health-related characteristics between participants with good and poor sleep quality using the Mann-Whitney U Test for age, education, comorbid diseases, pain, and depressive symptoms, and Chi-square test for living status. Marital status was categorized into two groups: not currently married and married. Living status was grouped as living alone and living with someone (children and/or with spouse or partner). Differences in gender and marital status between

the two groups were analyzed using Fisher's exact test, since there were some observed occurrences for these variables with less than five per category. Since the distribution of scores on measures of social connectedness and physical activity were violated, the Mann-Whitney U Test was used to compare groups on social connectedness and physical activity. Statistical significance was set at  $p < .05$ .

Focus group data were analyzed using content analysis. The audiotape of the focus group interview was transcribed verbatim, and the transcript was translated in English by the principal investigator and rechecked for accuracy by an expert who was fluent in both English and Thai. Content analysis was used to identify self-care strategies that promote sleep.<sup>26</sup> The transcript was read carefully several times, and repeated words were highlighted in different colors. All repeated words were coded, and then, all data related to each code were grouped, with quotations in the transcript used as evidence to support the major codes. All codes were rechecked and confirmed by the research team.

## **Results**

**Demographic characteristics.** The majority of participants were female with mean age 74.58 (SD=8.17) years and educational attainment of 11.74 (SD=5.12) years. More than half of the participants were not currently married (single, divorced, and widowed) and lived with someone (a spouse and/or children). Forty-four percent of the sample (22 participants) reported no comorbidities. The most common comorbidity was arthritis (16%), followed by diabetes mellitus (10%) and cataract (10%). Demographic characteristics of the sample are illustrated in Table 1.

The homogeneity test showed no statistically significant differences in demographic and health-related characteristics (gender, marital status, living status, age, years' of education, comorbidity diseases,

pain, and depressive symptoms) between participants with good sleep quality and those with poor sleep quality. The comparison of demographic characteristics and health-related variables between good and poor sleepers is displayed in Tables 2 and 3.

#### **Differences in social connectedness and physical activity for good and poor sleepers.**

The results showed no significant difference between good and poor sleepers in social connectedness or physical activity scores, although the mean trended in the expected direction for physical activity (Table 3).

**Sleep characteristics.** Of the sample, 18 participants (36%) reported poor sleep quality (M=

7.72, SD=2.22), and the rest (64%) reported good sleep quality (M=3.41, SD=0.98). Participants reported overall mean sleep latency of 25 (SD=31.10, range 5-180) minutes, with sleep duration of 5.96 (SD =1.18, range 3-9) hours, and sleep efficiency of 85.97% (SD=13.41, range 42.86-100). Poor sleepers reported mean sleep latency of 40 (SD=45.11) minutes, with sleep duration of 5.17 (SD=1.34) hours and sleep efficiency of 77.68 % (SD = 16.99). Good sleepers reported mean sleep latency of 16.56 (SD =14.45) minutes, with sleep duration of 6.41 (SD =0.80) hours and sleep efficiency of 90.64% (SD =7.97).

**Table 1.** Sample Characteristics (N=50)

Variable	N(%)
Gender	
Female	44(88.00)
Marital Status	
Single	5(10.00)
Married	21(42.00)
Divorced	2(4.00)
Widowed	22(44.00)
Living Status	
Living alone	9(18.00)
Living with his/her children	23(46.00)
Living with spouse/partner	9(18.00)
Living with spouse and children	9(18.00)
Comorbidities	
No conditions	22(44.00)
At least one condition	28(56.00)

**Table 2** Differences Between Good and Poor Sleepers in Sample Characteristics

Variable	Overall (n=50)	Good Sleepers (n=32)	Poor Sleepers (n=18)	Test Statistic	p-value
	n(%)	n(%)	n(%)		
Gender					
Female	44(88.00)	27(84.37)	17(94.44)	Fisher's test=1.231	.399
Male	6(12.00)	5(15.63)	1(5.56)		
Marital Status					
Married	21(42.00)	13(40.62)	8(44.44)	$\chi^2 = .069$	1.00
Not currently married	29(58.00)	19(59.38)	10(55.56)		
Living Status					
Living alone	9(18.00)	4(12.50)	5(27.78)	Fisher's test=1.756	.253
Living with someone	41(82.00)	28(87.50)	13(72.22)		

Note.  $\chi^2$ =Chi-square

**Table 3.** Differences Between Good and Poor Sleepers in Age, Education, Health-Related Variables, Social Connectedness, and Physical Activity

Variable	Overall (n=50)	Good Sleepers (n=32)	Poor Sleepers (n=18)	U	p-value
	M (SD)	M (SD)	M (SD)		
Age (years)	74.58 (8.17)	75.03 (8.55)	73.78 (7.61)	269.00	.701
Education (years)	11.74 (5.12)	12.53 (4.77)	10.33 (5.56)	230.00	.234
Comorbidities	0.76 (0.82)	0.66 (0.70)	0.94 (0.99)	249.00	.392
Pain intensity (range 0-100)	8.20 (12.89)	8.67 (13.38)	7.36 (12.32)	278.50	.828
Depressive symptoms (range 0-27)	0.86 (1.51)	0.53 (0.88)	1.44 (2.15)	231.50	.189
Social Connectedness (range 5-27)	15.76 (2.15)	16.13 (2.14)	15.11(2.08)	216.00	.130
Physical Activity (MET/week)	151.51 (80.69)	160.83 (69.30)	134.93 (97.76)	191.00	.050

MET = Metabolic Equivalent for Task, U = the Mann-Whitney U Test

#### Self-care strategies used to promote sleep.

Analysis of the focus group interview transcripts revealed two main approaches that informants with good and poor sleep quality practiced to help them gain better sleep, namely non-mind-body/mind-body activities and relaxation/spiritual techniques. Non-mind-body/mind-body activities reported by informants were clarified by whether mindfulness components were combined for physical practice to enhance their sleep. These activities included exercise (Tai Chi, aerobic exercise, Yoga, and swimming), a warm shower, maintenance of a regular bedtime,

and lying down. For relaxation/spiritual techniques, informants addressed techniques they used before bedtime, including watching television, reading Dharma books, doing meditation or listening to Buddhist doctrine, and taking herbal remedies (e.g. ginger and job's tear juice) to relieve symptoms altering their sleep (e.g. abdominal discomfort, joint and muscle pain). Among informants, ones with poor sleep quality reported that they usually spent more time doing exercise before bedtime (e.g. Tai Chi and aerobic exercise), listening to Buddhist doctrine, doing meditation, watching television and leaving it

on while sleeping. Regarding these techniques, they perceived listening to Dharma doctrine and doing meditation as effective approaches that helped them sleep better. Participants with good sleep quality, however, mostly exercised during the day and maintained a regular bedtime, and they perceived that both techniques effectively promoted their sleep.

## Discussion

**Social connectedness and physical activity between good and poor sleepers.** The current results do not reflect findings from previous studies which indicated that older adults who had good sleep were more likely to have strong and good relationships with family and friends.<sup>27,28</sup> This unexpected finding could be caused by several factors, since all participants were recruited from the elders club where they were routinely involved in group activities arranged within the club.

Thus, being a member at the elders club can help older people stay connected and make relationships among individuals. For physical activity, even though a comparative finding was not statistically significant between participants with good and poor sleep quality, this study provided some interesting results. In particular, the mean score for the physical activity scale trended in the expected direction, and participants with good sleep reported a higher mean score on the physical activity scale, compared with those who had poor sleep. Likewise, focus group participants with good sleep also perceived exercise as an effective technique to enhance their sleep quality. Thus, these findings seem to support the positive role of physical activity in sleep in older adults as found in existing evidence.<sup>29,30</sup>

**Sleep characteristics.** This study revealed a lower percentage of older participants with poor sleep quality (36%), when compared with another study in Thai older adults (46.3 %).<sup>5</sup> Differences in the percentage of participants who reported poor

sleep quality may be the result of physical and psychological factors since most participants in this study had better health and psychological status than those of general older adults. In this study, however, mean sleep duration was 5.96 hours, which is less than the recommended range of 7-8 hours of sleep a day.<sup>31</sup> This finding is congruent with Ohayon et al.'s study that found sleep duration gradually declined from 6.5-8 hours in young adults to 5-7 hours in older adults.<sup>32</sup>

**Self-care strategies used to promote sleep.** The findings from the focus group data suggest that participants applied non-mind-body/mind-body approaches (e.g. doing Tai Chi and Yoga, and maintaining a regular bedtime) and relaxation/spiritual techniques (e.g. doing meditation and listening to Dharma doctrine) instead of taking medications to help them gain better sleep. These findings are similar to that of Sandberg et al.'s report that found American older adults were less likely to consume over-the-counter medicine than use other techniques, such as praying and staying in bed, in response to sleep difficulties.<sup>15</sup> Besides, participants with good and poor sleep quality had different perceptions of effective sleeping promotion techniques. In particular, effective sleep-promoting techniques perceived by participants with good sleep were non-mind-body/mind-body approaches, including exercise and maintenance of a regular bedtime. However, participants with poor sleep reported their effective sleep-promoting strategies, including relaxation/spiritual techniques, especially meditation and listening to Dharma. These findings are consistent with prior evidence, suggesting that intense meditation practices can help bring harmony to the body and mind.<sup>33</sup> Meditation is credited as limiting cognitive arousal and reducing muscular tension that facilitate sleep.<sup>34</sup> However, some self-care strategies that participants used to help them with sleep problems should be considered since they were not recommended for sleep promotion,

such as exercising before bedtime and watching television and leaving it on while sleeping. Current evidence on sleep suggests that exercise should be done at least four hours before bedtime.<sup>35</sup> Similarly, exposure to artificial light emitted from television has been found to decrease melatonin levels and increase cortisol production, both of which can worsen nighttime sleep.<sup>36</sup> This deficit in knowledge about self-care strategies to promote sleep suggests an opportunity for healthcare providers to educate older adults on evidence-based approaches to sleep management.

Some limitations need to be considered when interpreting the results of this study. Firstly, the generalizability could not be promoted because of the small sample size and homogenic ethnicity of participants in this study. Participants were unique in the way that all older adults were members of one senior club. They were mostly female and regular exercisers. Secondly, the social connectedness instrument adopted in this study did not address family/friend support. Thus, the results do not explain how family/friend support affects sleep quality. Thirdly, as a cross-sectional study, the direction of causal effect between sleep quality and physical activity cannot be determined.

### Conclusion

A low percentage of the sample of Thai older adults who were members of an elders club reported poor sleep quality. The results regarding physical activity and social connectedness are inconclusive. In addition, Thai older adults engaged in non-mind-body and mind-body techniques, as well as relaxation and spiritual approaches to help them with disturbed sleep.

### Recommendations and Implications

This study sheds new light on the independence and self-care abilities of older adults to overcome

their sleep difficulties. Self-care techniques in older adults with sleep problems should be considered with regard to their individual specific needs. Also, nursing specialists or healthcare providers should offer older adults self-care knowledge related to sleep management and advice on appropriate techniques recommended to promote sleep quality. Future research should be conducted with a larger sample of both men and women to evaluate the influence of physical activity and social connectedness on sleep quality.

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### References

1. Ancoli-Israel, S. Sleep and its disorders in aging populations. *Sleep Medicine*. 2009; 10(1), S7-S11.
2. Li J, Yao YS, Dong Q, et al. Characterization and factors associated with sleep quality among rural elderly in China. *Arch Gerontol Geriat*. 2013; 56(1): 237-43.
3. Park JH, Yoo MS, Bae SH. Prevalence and predictors of poor sleep quality in Korean older adults. *Int J Nurs Pract*. 2013; 19(2):116-23.

4. Wu CY, Su TP, Fang CL, et al. Sleep quality among community-dwelling elderly people and its demographic, mental, and physical correlates. *J Chin Med Assoc.* 2012; 75(2): 75-80.
5. Tubtimtes S, Sukying C, Prueksaritanond S. Sleep problems in out-patient of primary care unit. *J Med Assoc Thai.* 2009; 92(2): 273-8.
6. Mazzotti DR, Guindalini C, Sosa AL, et al. Prevalence and correlates for sleep complaints in older adults in low and middle-income countries: a 10/66 dementia research group study. *Sleep Med.* 2012; 13(6): 697-702.
7. Cornwell B, Laumann EO, Schumm LP. The social connectedness of older adults: A national profile. *Am Sociol Rev.* 2008; 73(2): 185-203.
8. Cornwell B, Laumann EO. The health benefits of network growth: New evidence from a national survey of older adults. *Soc Sci Med.* 2015; 125: 94-106.
9. Thanakwang K. Social networks and social support influencing health-promoting behaviors among Thai community-dwelling elderly. *Thai J Nurs.* 2008; 12(4): 243-58.
10. Wang CF, Sun YL, Zang HX. Music therapy improves sleep quality in acute and chronic sleep disorders: A meta-analysis of 10 randomized studies. *Int J Nurs Stud.* 2012. 2014; 51(1): 51-62.
11. Li F, Fisher KJ, Harmer P, et al. Tai Chi and self-rated quality of sleep and daytime sleepiness in older adults: A randomized controlled trial. *J Am Geriatr Soc.* 2004; 52(6): 892-900.
12. Uchida S, Shioda K, Morita Y, et al. Exercise effects on sleep physiology. *Front Neurol.* 2012; 3: 48.
13. Tsai Y, Wong T KS, Ku Y. Self-care management of sleep disturbances and risk factors for poor sleep among older residents of Taiwanese nursing homes. *J Clin Nurs.* 2008; 17(9): 1219-26.
14. Sok SR. Sleep patterns and insomnia management in Korean-American older adult immigrants. *J Clin Nurs.* 2008; 17(1): 135-43.
15. Sandberg JC, Suerken CK, Quandt SA, et al. Self-reported sleep difficulties and self-care strategies among rural older adults. *JEBCAM.* 2014; 19(1): 36-42.
16. Taboonpong S, Puthsri N, Kong-In W, et al. The effects of Tai Chi on sleep quality, well-being and physical performances among older adults. *Thai J Nurs Res.* 2008; 12(1): 1-13.
17. Dodd M, Janson S, Facione N, et al. Advancing the science of symptom management. *J adv nurs.* 2001; 33(5): 668-76.
18. Krishnakumar A, Narine L, Soonthorndhada A, et al. Family stressors, home demands and responsibilities, coping resources, social connectedness, and Thai older adult health problems: examining gender variations. *J Aging Health.* 2015; 27(2): 257-83.
19. Visuthipanich V, Sirapo-ngam Y, Malathum P, et al. Physical activity questionnaire development and testing among elderly community-dwelling Thais. *Thai J Nurs Res.* 2009; 13(4): 249-67.
20. Buysse DJ, Reynolds CF, Monk TH, et al. The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Res.* 1989; 28(2): 193-213.
21. Sitasuwan T, Bussaratid S, Ruttanaumpawan P, et al. Reliability and validity of the Thai version of the Pittsburgh Sleep Quality Index. *J Med Assoc Thai.* 2014; 97(Suppl 3): S57-67.
22. Rigler SK, Studenski S, Wallace D, et al. Comorbidity adjustment for functional outcomes in community-dwelling older adults. *Clin Rehabil.* 2002; 16(4): 420-8.
23. Lotrakul M, Sumrithe S, Saipanish R. Reliability and validity of the Thai version of the PHQ-9. *BMC Psychiatry.* 2008; 8: 1-7.

24. Blozik E, Stuck AE, Niemann S, et al. Geriatric pain measure short form: Development and initial evaluation. *J Am Geriatr Soc.* 2007; 55(12): 2045-50.
25. Cha E, Kim KH, Erlen JA. Translation of scales in cross-cultural research: Issues and techniques. *JAN.* 2007; 58(4): 386-95.
26. Hsieh H, Shannon SE. Three approaches to qualitative content analysis. *Qual Health Res.* 2005; 15(9): 1277-88.
27. Ailshire JA, Burgard SA. Family relationships and troubled sleep among US adults: Examining the influences of contact frequency and relationship quality. *J Health Soc Behav.* 2012; 53(2): 248-62.
28. Yao KW, Yu S, Cheng SP, et al. Relationships between personal, depression and social network factors and sleep quality in community-dwelling older adults. *J Nurs Res.* 2008; 16(2): 131-9.
29. Baron KG, Reid K J, Zee PC. Exercise to improve sleep in insomnia: Exploration of the bidirectional effects. *JCSM.* 2013; 9(8): 819-24.
30. Chien MY, Chen HC. Poor sleep quality is independently associated with physical disability in older adults. *JCSM.* 2014; 11(3): 225.
31. Hirshkowitz M, Whiton K, Albert SM, et al. National Sleep Foundation's sleep time duration recommendations: methodology and results summary. *Sleep Health.* 2015; 1(1): 40-43.
32. Ohayon MM, Carskadon MA, Guilleminault C, et al. Meta-analysis of quantitative sleep parameters from childhood to old Age in healthy individuals: developing normative sleep values across the human lifespan. *Sleep.* 2004; 27(7): 1255 -73.
33. Nagendra RR, Maruthai N, Kutty BM. Meditation and its regulatory role on sleep. *Front Neurol.* 2012; 3: 54.
34. Trauer JM, Qian MY, Doyle JS, et al. Cognitive behavioral therapy for chronic insomnia: A systematic review and meta-analysis. *Ann Intern Med.* 2015; 163(3): 191-204.
35. Chennaoui M, Arnal PJ, Sauvet F, et al. Sleep and exercise: A reciprocal issue? *Sleep Med Rev.* 2015; 20: 59-72.
36. Stevens R G, Blask DE, Brainard GC, et al. Meeting report: The role of environmental lighting and circadian disruption in cancer and other diseases. *Environ Health Perspect.* 2007; 115(9): 1357-62.