A PATH ANALYSIS MODEL OF MOBILITY AMONG PERSONS WITH HIP FRACTURE AFTER SURGERY

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การวิเคราะห์โมเดลเชิงเส้นทางของการเคลื่อนไหวของบุคคลที่กระดูกสะโพกหักภายหลังได้รับการผ่าตัด

น.ส.ชนิภา ยอยืนยง

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาพยาบาลศาสตรดุษฎีบัณฑิต
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ชนิภา ยอยืนยง : การวิเคราะห์โมเดลเชิงเส้นทางของการเคลื่อนไหวของบุคคลที่กระดูกสะโพกหักภายหลังได้รับการผ่าตัด. (A PATH ANALYSIS MODEL OF MOBILITY AMONG PERSONS WITH HIP FRACTURE AFTER SURGERY) อ.ที่ปรึกษาหลัก : รศ. ดร.ชนกพร จิตปัญญา, อ.ที่ปรึกษาร่วม : รศ.ร.อ.หญิง ดร.ศิริพันธุ์ สาสัตย์

การศึกษาในครั้งนี้ มีวัตถุประสงค์หลัก 1) เพื่อศึกษาการเคลื่อนไหว และ 2) เพื่อศึกษาเส้นทางความสัมพันธ์ทั้งทางตรงและทางอ้อมของโรคร่วม การทำหน้าที่ด้านการรู้คิด การสนับสนุนทางสังคม อาการปวด อาการเหนื่อยล้า คุณภาพการนอนหลับ ต่อการเคลื่อนไหวของบุคคลที่กระดูกสะโพกหักภายหลังได้รับการผ่าตัด กรอบแนวคิดของการศึกษาพัฒนามาจากทฤษฎีอาการไม่พึงประสงค์ร่วมกับการทบทวนวรรณกรรมที่เกี่ยวข้อง ใช้วิธีสุ่มตัวอย่างแบบการสุ่มตัวอย่างสามขั้นตอน กลุ่มตัวอย่างคือบุคลที่กระดูกสะโพกหักหลังได้รับการผ่าตัด อายุ 50 ปีขึ้นไป ที่มารับการตรวจที่แผนกผู้ป่วยนอกของโรงพยาบาล 4 แห่ง จาก 3 เขตสุขภาพของประเทศไทย เครื่องมือวิจัยประกอบด้วย แบบบันทึกข้อมูลทั่วไป แบบสอบถามโรคร่วม แบบประเมินการทำหน้าที่ด้านการรู้คิด แบบสอบถามการสนับสนุนทางสังคม แบบสอบถามอาการเหนื่อยล้า แบบสอบถามคุณภาพการนอนหลับ แบบสอบถามความเจ็บปวด และแบบประเมินการเคลื่อนไหว เก็บข้อมูลในช่วงเดือน กรกฎาคม 2565 ถึง กุมภาพันธ์ 2566 วิเคราะห์ข้อมูลโดยใช้โปรแกรม SPSS และ Mplus

ผลการศึกษาวิจัยพบว่า 1) ค่าเฉลี่ยการเคลื่อนไหวอยู่ในระดับ 47.51 (SD 15.63) และ 2) โมเดลที่สร้างขึ้นมีความสอดคล้องกับข้อมูลเชิงประจักษ์ และสามารถอธิบายความผันแปรของการเคลื่อนไหวได้ 90.4 เปอร์เซ็นต์ (Chi-square= 415.198, df= 372, p= 0.0605, Chi-square/df= 1.116, RMSEA= 0.021, CFI= .993, TLI= .991, SRMR= .036) และพบว่า คุณภาพการนอนหลับเป็นปัจจัยที่มีอิทธิพลต่อการเคลื่อนไหวมากที่สุด โดยมีอิทธิพลทางลบทั้งทางตรงและทางอ้อมผ่านอาการอ่อนล้า (β = -1.385, $p < .001$) ส่วนการทำหน้าที่ด้านการรู้คิดมีอิทธิพลทางบวกต่อการเคลื่อนไหวทั้งทางตรงและทางอ้อมผ่านคุณภาพการนอนหลับ (β = .792, $p < .001$) อาการเหนื่อยล้ามีอิทธิพลทางลบต่อการเคลื่อนไหว (β = -.674, $p < .001$) อาการปวดมีอิทธิพลทางลบต่อการเคลื่อนไหว (β = -.182, $p < .05$) โรคร่วมมีอิทธิพลทางอ้อมต่อการเคลื่อนไหวผ่านอาการปวด (β = .164, $p < .05$) ส่วนการสนับสนุนทางสังคมไม่มีอิทธิพลต่อการเคลื่อนไหว (β = .109, $p > .05$)

การศึกษาในครั้งนี้แสดงให้เห็นว่า โรคร่วม การทำหน้าที่ด้านการรู้คิด อาการเหนื่อยล้า คุณภาพการนอนหลับ และอาการปวด เป็นปัจจัยที่มีอิทธิพลต่อการเคลื่อนไหวของบุคคลที่กระดูกสะโพกหักภายหลังได้รับการผ่าตัด ดังนั้น การพัฒนาการปฏิบัติทางการพยาบาลเพื่อส่งเสริมหรือคงไว้ซึ่งการเคลื่อนไหวของบุคคลที่กระดูกสะโพกหักภายหลังได้รับการผ่าตัดนั้น ต้องคำนึงถึง การส่งเสริมการทำหน้าที่ด้านการรู้คิด และคุณภาพการนอนหลับ การควบคุมโรคร่วม การจัดการกับอาการเหนื่อยล้าและอาการปวด

สาขาวิชา	พยาบาลศาสตร์	ลายมือชื่อนิสิต .....
ปีการศึกษา	2565	ลายมือชื่อ อ.ที่ปรึกษาหลัก .....
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Chanipa Yoryuenyong : A PATH ANALYSIS MODEL OF MOBILITY AMONG PERSONS WITH HIP FRACTURE AFTER SURGERY. Advisor: Assoc. Prof. CHANOKPORN JITPANYA, Ph.D., RN. Co-advisor: Assoc. Prof. Capt. SIRIPHAN SASAT, Ph.D., RN.

This correlational study aimed to 1) investigate mobility and 2) examine direct and indirect paths of relationships among comorbidity, cognitive function, social support, pain, fatigue, and sleep quality on mobility among persons with hip fracture after surgery. The hypothesized model was constructed based on the theory of unpleasant symptoms and the literature reviewed. A three-stage random sampling approach was utilized to recruit 260 persons with hip fracture after surgery aged 50 years old and older who visited four hospitals in three health regions of Thailand. Research measurements consisted of the demographic data form, Charlson Comorbidity Index, General Practitioner Assessment of Cognition, Groningen Orthopedic Social Support Scale, Fatigue Severity Scale, Pittsburgh Sleep Quality Index, Numerical rating scale, and de Morton Mobility Index. Data were collected from July 2022 to February 2023. The data analysis using SPSS and Mplus program

The study findings revealed that 1) the average mean of mobility was 47.51 (SD 15.63) and 2) the hypothesized model fit the empirical and could explain 90.4 % of the variance of the mobility (Chi-square= 415.198, df= 372, p=0.0605, Chi-square/df= 1.116, RMSEA= 0.021, CFI= .993, TLI= .991, SRMR= .036). Sleep quality was the most the influential factor affecting mobility by having both negative direct and indirect effect on mobility through fatigue (β = -1.385, $p < .001$). Cognitive function had a positive direct and indirect effect on mobility through sleep (β = .792, $p < .001$). Fatigue only had a negative direct effect on mobility (β = -.674, $p < .001$). Pain only had a negative direct effect on mobility (β = -.182, $p < .05$). Comorbidity had a positive indirect effect on mobility through pain (β = .164, $p < .05$). However, social support had a non-significant direct effect on mobility (β = .109, $p > .05$).

The findings indicated that comorbidity, cognitive function, fatigue, sleep quality, and pain were important factors influencing mobility among persons with hip fracture after surgery. Therefore, future nursing interventions should enhance cognitive function, and sleep quality. Managing comorbidity, fatigue, and pain to maintain or enhance mobility among persons with hip fracture after surgery.

Field of Study:	Nursing Science	Student's Signature .....
Academic Year:	2022	Advisor's Signature .....
		Co-advisor's Signature .....

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CHAPTER I
INTRODUCTION

Background and significance of the study

Hip fractures are associated with adverse outcomes including mortality (Morri et al., 2019; Hagen et al., 2020). Older adults with hip fracture have a 30% chance of dying within the first year after injury (Hagen et al., 2020; Lapcevic et al., 2010). Some studies showed an increase in long-term mortality in this population from two to ten years after the hip fracture (Haentjens et al., 2007). According to Braithwaite et al. (2003), the incidence of hip fracture reduced life expectancy of older adults by 1.8 years, or 25%, compared with an age-matched general population.

Hip fractures are found in persons aged 50 years and over. Approximately 10% of hip fractures occurred in middle adult while 90 % in the elderly (Wongtriratanachai et al, 2013; Sucharitpongpan et al., 2019; Rogmark et al., 2018). In Thailand, an incidence rate of hip fractures increased by an average of 2% per year. The numbers of the persons with hip fracture could increase from 181.0 per 100,000 in 2006 to 264.6 per 100,000 in 2025; and to 436.1 per 100,000 in 2050 (Wongtriratanachai et al., 2013). Finally, the prevalence of Thai persons with hip fracture during the year 2015 to 2019 were 37,693, 40,711, 41,948, 42,932, and 45,704 respectively (Ministry of Public Health, 2020).

About 82-90% of persons with hip fracture require hospitalization for surgery to repair their broken bones (Cram et al., 2017; Sucharitpongpan et al., 2019). The average length of hospital stay was 7-20 days (Castelli et al., 2015; Sucharitpongpan et al., 2019). After surgery, patients may experience complications including pneumonia,

venous thrombosis, infection, urinary tract infection, hip dislocation, and decreased mobility (Carpintero et al., 2014; Vochteloo et al., 2013).

One of the significant problems of persons with hip fracture after surgery is mobility. For persons with hip fracture after surgery, World Health Organization's International Classification of Functioning, Disability and Health (ICF) defines mobility as moving and changing body position or location or by transferring from one place to another, by carrying, moving & manipulating objects, by walking, running, or climbing, and by using various forms of transportation (WHO, 2001).

Many studies supported that mobility among persons with hip fracture after surgery has been decreased. Jansen et al. (2013) conducted a longitudinal study among patients with hip fracture after surgery. Data were collected at 3rd month, 6th month, and 12th months after the surgery. Findings revealed that the mobility scores were very low, especially at 3rd month after the surgery.

Ariza-Vega et al. (2016) conducted a prospective cohort study among persons with hip fracture. Data were collected at 1st and 3th months post-surgery. The results showed that the mobility scores were very low at 1st and 3th months post-surgery. Steihaug et al. (2018) conducted a prospective observational study among persons with hip fracture after surgery. The findings indicated that the mobility score at 3rd month was lower than 12th month. Rosendahl-Riise et al. (2020) employed a prospective study among persons with hip fracture. Data was collected at the 2nd month post-surgery. The findings showed that the mobility score was low. Lastly, regarding pre-facture mobility level, the persons with hip fracture after surgery are not able to achieve pre-fracture mobility. Vochteloo et al. (2013) conducted a prospective cohort study among

persons with hip fracture after surgery. The study found that at 3rd months post-surgery only 45.5% of them could regain pre-fracture mobility. However, 54.5% of them could not. At 12th months post-surgery only 47.8 % regained pre-facture mobility whereas 52.2% were not able to regain. Hansson et al. (2015) conducted a retrospective cohort study. They found that at 12th months post-surgery only 29% of them regained their pre-fracture mobility.

Dyer et al (2016) conducted a critical review. Thirty-eight studies were identified through PubMed and Scopus searches and contact with experts. The results indicated that 1) mobility following hip fracture is significantly worse for 1-2 years; 2) 26 % of the participants could be able to walk for 3 meters only; 3) 22 % could be able to walk for bed transfer only; 4) the mean increased in the number of limitations in those with hip fracture was 0.93 for the lower body ($p = 0.0001$) and 0.26 for the upper body ($p = 0.02$); and 5) only 40 to 60 % of patients regained their pre-fracture level of mobility within 1year.

Haslam-Larmer et al. (2021) conducted a mixed method study about mobility after hip fracture. Eighteen participants' mobility was monitored during 24 hours for 3 days. The results revealed that the data demonstrated a high mean daily sedentary time of 23.18 hours, ranging from 17.9 to 24 hours (SD 1.54). The median maximum upright time (standing, walking) was 24 min (Range 0.5–625), and the median number of maximum steps taken was 30 (Range 0–3762). Six participants got low level of mobility scores measured by the New mobility score (NMS). Some were able to walk only 5 to 10 meters. Finally, some walked only 4 steps from a chair.

About one month after the surgery studies reported that only 16% of persons with hip fracture after surgery can walk independently; 54% can walk with aids and need help; 23% of the them are unable to walk; and 75 of them unable to move or being bedridden (Hao et al., 2020; Lee et al., 2014). Most patients lose one level of mobility. For example, before an onset of hip fracture and surgery the patients can walk independently. However, after surgery they walk with one aid; some walk with two sticks; and some use a wheelchair (Jennison & Yarlagadda, 2019). Some patients (who can mobile outdoor before surgery) become mobile indoor only.

In Thailand, studies about mobility among persons with hip fracture after surgery has been scarce. Most studies focused on complications, self-care behaviors, and activity of daily living among this population. Few studies have been focused on mobility. One study conducted in 2019 reported that walking ability of persons with hip fracture after surgery was lower than those before hip fracture. About 12% of them were able to walk independently; 80% walked using a walker; 4% used wheelchair; and 4% were bed-ridden (Roobsoong et al., 2020).

Mobility is an important marker and predictor of physical abilities, independence, morbidity, and mortality. Mobility is a marker of adverse outcomes (Dyer et al., 2016). Loss of mobility can result in a decline in independence, physical disability, and injuries, rendering individuals reliant on caregivers to meet their basic needs, being unable to remain living independently (Macri et al., 2012; Studenski et al., 2003). As a result, it can also lead to institutionalization, increased hospital admissions (Macri et al., 2012) and high mortality (Lund et al., 2014; Tsuboi et al., 2007).

Nurses are vital to improve outcomes for persons with hip fracture after surgery. For example, nurses must accurately measure mobility to identifying persons at risk for mobility decline which is an important step to prevent this event. Independent mobility is a key factor in determining readiness for discharge for patients hospitalized (Macri et al., 2012). During acute period (or early postoperative period) after surgery decreased mobility and bed rest are common occurrences in persons with hip fracture (Morris et al., 2010). Mobilization program by nurses begins at the 1st day after surgery. Nurses teach and encourage them (including family and caregivers) to practice transfer lateral position, the fowler's position at 60-90 degrees, sitting in bed and sway his or her legs at the bedside, sitting in a bedside chair, standing. Nurses teach them to use walking aids (such as pick-up walkers). If there is no contra-indication, nurses will coach the patients to walk with partial weight-bearing or full weight-bearing (Morris et al., 2010; Thai Orthopaedic Nurses' society 2018). Finally, nurses recommend the patients to getting out of bed at least three times a day (Lewis et al., 2016). About 5-7 days after surgery, the patients should be able to discharge from the hospital.

However, most patients fail to improve their mobility by discharge (Brown et al., 2004; Zaslavsky et al., 2015). Some can walk without aids, some patients walk with aids, some patients can only sit around the bed, and some patients are bedridden (Münter et al., 2018). Some were transferred to a nursing home, greater care burden and, healthcare costs after discharge, as well as mortality (de Morton et al., 2008).

Although the primary aim of the operation is to restore the patient's mobilization status or to facilitate rapid postoperative mobilization as swiftly as possible and avoid poor outcomes associated with long-term immobilization

(Emmerson et al., 2022; Fernandez et al., 2015). However, the evidence showed that persons with hip fractures after surgery had mobility decline (Ariza-Vega et al., 2016; Dyer, 2016; Jansen et al., 2013; Kammerlander, 2018; Steihaug et al., 2018). Therefore, studying the causes and effects of factors about mobility decline is important.

Many factors influenced mobility such as comorbidity, cognitive function, social support, pain, fatigue, and sleep quality. Though existing knowledge about relationships among these factors and mobility had been explored, most studies only reported bidirectional associations between these factors and mobility. There has no study examining the set of variables acting on a specified outcome simultaneously. A path analysis provided the ways to analyze a set of relationships (Heir et al., 2019) leading to nursing interventions to improve mobility for persons with hip fracture in the future.

Research questions of the study

1. How was mobility among persons with hip fracture after surgery?
2. What were direct and indirect paths of relationships among comorbidity, cognitive function, social support, pain, sleep quality, fatigue, and mobility among persons with hip fracture after surgery?

Purposes of the study

1. To describe mobility among persons with hip fracture after surgery.
2. To examine direct and indirect paths of relationships among comorbidity, cognitive function, social support, pain, fatigue, and sleep quality on mobility among persons with hip fracture after surgery.

Conceptual framework of the study

A model should not be developed without some underlying theory. Theory is often a primary objective of academic research, but nurses may develop or propose a set of relationships that are as complex and interrelated as any academically based theory (Heir et al., 2019). This study used the theory of unpleasant symptom (TOUS) as the theoretical framework to select variables and in a combination with review of hip fracture and orthopedic patients' empirical evidence (Ensari, & Motl, 2020; Hai, 2015; Kless, 2010; Promchat et al., 2015).

The TOUS composes of three major concepts including symptoms, influencing factors, and performance. Symptoms have influencing factors that are physiological, psychological, and environmental. The individual's perception of symptom(s) is influencing by these three factors including the physiological, psychological, and situational factors. Consequently, symptom(s) and its influencing factors impact their performance (which is mobility in this study).

In this study, the TOUS postulates that mobility among persons with hip fracture after surgery will change because of influences from experiencing less unpleasant symptom and additional factors including physiological, psychological, and situational factors. Mobility could be maintained or enhanced when these influencing factors are manipulated. The manipulation of potential factors would facilitate the persons with hip fracture having a high level of mobility. Conversely, when symptom and its influencing factors affect persons with hip fracture, mobility will decline. Experiencing with unpleasant symptom directly affect mobility. It is possible that changes of mobility occur because of a combination of symptom reduction and other influencing factors.

This study uses the hierarchy of middle-range theoretical deduction proposed by Fawcett and Desanto-Madeya (2013) to explain the derivation of selected variables from the theoretical framework of the TOUS (Lenz et al., 2014) and other related empirical evidence. Fawcett and Desanto-Madeya (2013) suggested that specific concepts and propositions in particularly phenomena must be derived from theoretical model where middle-range theory must be formulated. The concrete concepts must be operationally defined and empirically testable. Hypotheses must be derived from the proposition of the theory. Concepts needed to test the direction and strength of the relationship between concepts. Each concept is linked to empirical indicators which provide a method to measure the variable. Thus, an explicit conceptual-theoretical-empirical structure, using the TOUS, is developed to test proposition of mobility among persons with hip fracture as presented as follows:

Table 1.1 The theoretical substruction of mobility among persons with hip fracture

Theoretical level	Physiological factors	Psycho-logical factors	Situational factors	Symptoms	Performance
Conceptual level	illness-related factors	cognitive factors	social-environment factors	perceptions of symptoms (intensity/ severity)	physical performance
Variable level	comorbidity	cognitive functions	social support	fatigue pain sleep quality	mobility
Empirical indicator	Charlson Comorbidity Index	GPCOG	Groningen Orthopedic Social Support Scale	Fatigue Severity Scale, Numeric Rating Scale, Pittsburgh Sleep Quality Index	de Morton Mobility Index
Measurement	21 items comorbidities weighted scale	15 items	12 items	9 items, 11 rating items, 19 items	15 items

Influencing factors is comorbidity as the physiological factor-related mobility in persons with hip fracture (Ariza-Vega, 2017; Maharlouei et al., 2019; Tam et al., 2020). Cognitive function is psychological factor (Ariza-Vega, 2017; Langford et al., 2018; Maharlouei et al., 2019). Social support as the situational factor (Nuotio et al., 2016). Symptoms are the perceptions of symptoms (intensity and severity) in persons with hip fracture after surgery, including pain (Foss et al., 2009; Salpakoski et al., 2011). Fatigue (Mueller-Schotte et al., 2016; Münter et al., 2018; Taylor et al., 2010) and sleep quality (Cho et al., 2020; Kuo et al., 2016; Promchat et al., 2015).

These influencing factors (which were called “exogeneous variables) were included in the study because they were modified leading to new nursing interventions.

Hypotheses with rationales

The researcher proposed hypothesis of the study as follows:

1. Comorbidity has a negative, direct effect on mobility among persons with hip fracture.

2. Comorbidity has an indirect effect on mobility through pain among persons with hip fracture.

3. Comorbidity has an indirect effect on mobility through fatigue among persons with hip fracture.

4. Cognitive function has a positive, direct effect on mobility among persons with hip fracture.

5. Cognitive function has an indirect effect on mobility through sleep among persons with hip fracture.

6. Social support has a positive, direct effect on mobility among persons with hip fracture.

7. Pain has a negative, direct effect on mobility among persons with hip fracture.

8. Pain has an indirect effect on mobility through fatigue among persons with hip fracture.

9. Sleep has a negative, direct effect on mobility among persons with hip fracture.

10. Sleep has an indirect effect on mobility through fatigue among persons with hip fracture.

11. Fatigue has a negative, direct effect on mobility among persons with hip fracture.

A hypothesized path analysis model of mobility among persons with hip fracture after surgery was shown in Figure 1.1

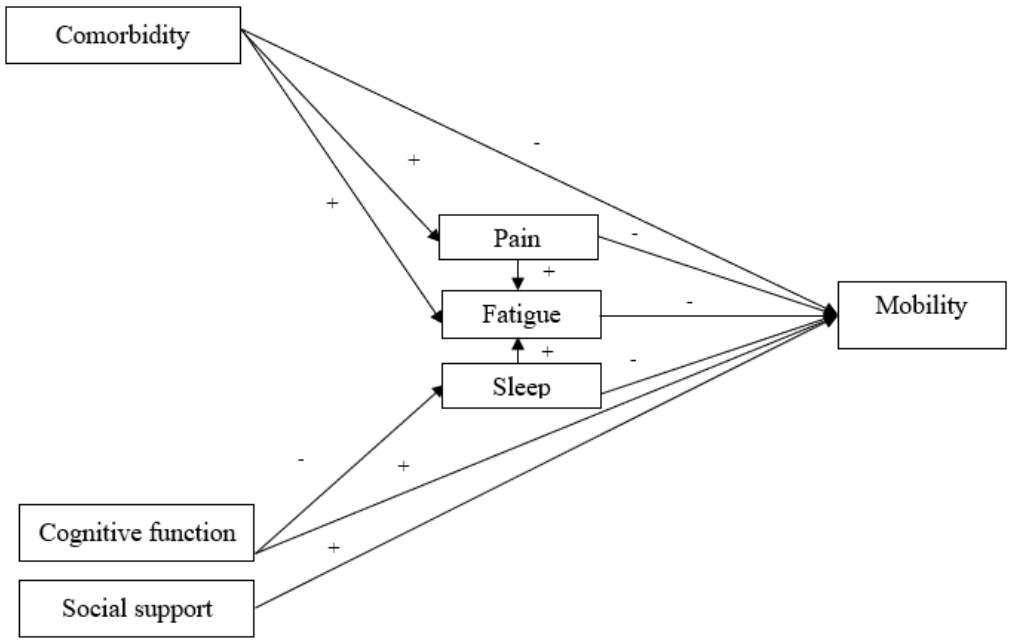


Figure 1.1 The hypothesized model

Directly effect of comorbidity on mobility

In this study, comorbidity is recognized as a physiological factor with an application of the TOUS. Multiple studies showed a significant correlation between one or more comorbidities of a hip fracture and decreased mobility. Tam et al. (2020) conducted a retrospective study. They indicated that comorbidities predicted mobility. Each increase in comorbidity corresponds to a 33% decrease in the likelihood of walking independently (OR = 0.67, $p < .05$). González-Zabaleta et al. (2016) conducted a prospective study. The result revealed that a predicting factor of mobility was comorbidity (OR = 1.407, $p = .031$).

Persons with more comorbidities will have decreased mobility than those with less comorbidities. For example, endocrine disorders can lead to fragile bones, such as an overactive thyroid, which can reduce the absorption of vitamin D and calcium and lead to weakened bones, low vitamin D levels are associated with impaired muscle strength lead to mobility decrease (Moo et al., 2020). Comorbidity that affects the brain and nervous system, including Parkinson's disease, also affect mobility (King et al., 2014). High blood pressure, hyperlipidemia, and diabetes are associated with a metabolic disorder. In addition, adipose tissue secretes hormones leptin and inflammatory agents into the systemic circulation. Such as tumor necrosis factor and C-reactive protein induce a pro-inflammatory state, mediate insulin resistance, and increase lipolysis, causing inflammation around the hip joint. As a result, The patient's mobility and activity levels have decreased. (Gandhi et al., 2010). Thus, it can be hypothesized that comorbidity has a negative direct effect on mobility.

Indirectly effect of comorbidity on mobility through pain

Another point, pain is recognized as a symptom. Pain is a common symptom that results from various comorbidities, such as rheumatoid, arthritis, and liver disease (Rogal et al., 2013; Sarzi-Puttini et al., 2014; Somers et al., 2012). So, patients with comorbidity face pain symptom. For instance, pain is common in patients with liver disease; approximately 34 % of patients had pain. The patients described abdominal pain from hepatic capsular distension, splenomegaly, and ascites with abdominal distension. Additionally, pain with advancing disease included pain at any site (not just the abdomen) (Rogal et al., 2013). In addition, rheumatoid arthritis (RA) is an inflammatory disease of synovial joints. Therefore, pain due to joint inflammation, prostaglandins, and bradykinin being increased in synovial fluids from patients with RA can directly activate sensory nerves within the synovium (Walsh & McWilliams, 2012).

Comorbidity affects physical functioning by increasing symptoms rather than by direct association. For example, the study indicated that medical conditions or comorbidity affect physical functioning (e.g., walking, climbing stairs) mediated by pain. Because the direct relationships between comorbidity and physical functioning changed from moderate to small when pain was added to the model, the models suggested that pain was mediators in the model (Bennett et al., 2002). Therefore, it is possible that some comorbidity cause symptoms that influence the level of mobility. Thus, it can be hypothesized that comorbidity has indirect effect on mobility through pain.

Indirectly effect of comorbidity on mobility through fatigue

In addition, fatigue is a common symptom that results from a variety of comorbidities, such as arthritis, hypertension, stroke, and heart disease (Alikari et al., 2017; Eckhardt et al., 2014; Harbison et al., 2009) so, patients with comorbidity face with fatigue symptom. For instance, most patients with rheumatoid arthritis (RA) have some fatigue. The patients with RA have high elevated inflammatory markers; elevated cytokines may cause a person to feel tired or even exhausted (Pope, 2020). In addition, fatigue is a problem following myocardial infarction. After myocardial infarction found that 30% of the patients reported fatigued led them reduced motivation and reduced activity (Alsen & Brink, 2013).

The study indicated that comorbidity effect on physical functioning (e.g., walking, climbing stairs) was mediated by fatigue Because the direct relationships between comorbidity and physical functioning changed from moderate to small when fatigue was added to the model, the models suggested that fatigue was mediators in the model. Therefore, it is possible that some comorbidity cause symptoms that influence the level of mobility (Bennett et al., 2002). Thus, it can be hypothesized that comorbidity has an indirect effect on mobility through fatigue.

Directly effect of cognitive function on mobility

Based on the TOUS, cognitive function is recognized as a psychological factor. Cognitive abilities are crucial for ongoing planning, decision-making, and monitoring movements necessary for successful mobility. There is a temporal relationship between low levels of a broad range of cognitive abilities and the subsequent development of mobility impairments (Buchman et al., 2011). Cognitive function was significantly

correlated with mobility (the ability of lower extremity to walk and climb stairs) ($r = 0.52$, $p < 0.001$) (Lenze et al., 2004). Ariza-Vega et al. (2017) conducted a prospective study, and the study showed that cognitive function was associated with mobility ($\beta = 5.11$, $p < 0.01$). Moreover, Mariconda et al. (2016) indicated that cognitive score markedly influenced mobility (R^2 3-5%, $p < 0.001$). Because a low cognitive status was the most common reason for not obtaining independent mobility and not completing physiotherapy. These were associated with difficulties in cooperating with early physiotherapy for some of them. Therefore, patients with cognitive impairment may be seen to have less potential, and therapists may reduce the intensity of rehabilitation compared to patients without cognitive impairment and lead to decreased mobility (Münter et al., 2018). Thus, it can be hypothesized that cognitive function has direct effect on mobility.

Indirectly effect of cognitive function on mobility through sleep

Quality of sleep is defined as patient's subjective perception of sleep effectiveness, sleep disturbance, and sleep supplementation. Good sleep quality is indicated by both the quantity and quality of sleep, such as enough sleep time, the ease of falling sleep, no waking after sleep onset, sleeping deeply, waking refreshed, and a good night's sleep. Poor sleep quality is considered as the reverse (Snyder-Halpern & Verran, 1987). There is evident showed that sleep efficiency is one pathway associated with cognitive function (working memory $\beta = 0.27$, switching $\beta = 0.31$, verbal fluency $\beta = 0.32$, recall $\beta = 0.21$ and processing speed $\beta = 0.17$, $p < 0.05$) across young and older adults (Wilckens et al., 2018).

McKinnon et al. (2014) conducted a cross-sectional study. They found that two-thirds of patients with mild cognitive impairment have poor sleep quality. 63% of patients with mild cognitive impairment demonstrated sleep disturbance, a significantly higher rate than that of the patients without cognitive impairment ($p = .003$). Cognitive function was significantly positively associated with sleep quality ($r = .225$, $P = .005$) and significant predictor explained the variance in sleep quality ($b = .422$, $p = .007$). The circadian alterations in patients with mild cognitive impairment are associated with reduced overnight memory consolidation and affect sleep quality (Naismith et al., 2014). Sleep disturbances in quality and quantity of sleep and disruption of the sleep-wake rhythm frequently occur in older adults with cognitive impairment (Cassidy-Eagle & Siebern, 2017).

After surgery, patients with hip fracture experience poor sleep with multiple disruptions per night. On average, the patients slept 5.4 hours per night and experienced 5.3 awakenings (Reppas-Rindlisbacher et al., 2021). Approximately 36% of the patients had a sleeping problem (Cho et al., 2020) 78% of the patients had abnormal sleep durations (Kuo et al., 2016). Sleep and waking may be related to sleep-related deterioration in executive functions that regulate walking variability and control walking ability (Clark, 2015). In addition, the performance is sensitive to the reversal of executive function (Yogev-Seligmann et al., 2008). So, the sleep disturbance causes distress or functional impairment. For this reason, sleep problem is related to mobility.

Observational studies have confirmed an association between low sleep quality (short sleep and sleep apnea) and increased inflammation, insulin resistance, metabolic syndrome (Morselli et al., 2012; Punjabi & Beamer, 2007; Van Cauter, 2011). Changes

in immunology, metabolic, and endocrinologic systems may predispose to functional decline, either directly or through muscle strength loss (Barzilay et al., 2009; Ferrucci et al., 2002). Moreover, sleep disorder (longer sleep duration ≥9 hours) was associated with a decreased walking speed ($p = .04$). And sleep disorder (shorter sleep duration ≤6 hours) was associated with higher odds for mobility limitation (OR = 3.62, 95% CI = 1.40–9.37). Low sleep quality may lead to nocturnal arterial oxygen saturation and affect poor balance resulting in mobility limitation. Therefore, sleep disorder was independently associated with both decreased walking speed and mobility limitation (Stenholm et al., 2010). Agmon et al. (2016) conducted a cross-sectional study in older adults. They found that sleep is associated with walking speed ($r = 0.35$, $p < 0.05$). Promchat et al. (2015) conducted a correlational study in patients with hip fracture after surgery. They reported that sleep correlated with mobility ($r = -.33$, $p < .01$).

Cognitive function and sleep are positively associated with mobility. Wilckens et al. (2018) conducted a cross-sectional study in a community-dwelling population. The study indicated that sleep efficiency significantly mediated the relationship between cognitive function and physical activity. Physical activity is defined by any bodily movement that results in energy expenditure and exercise (Caspersen et al., 1985). Thus, sleep quality is a candidate that may mediate the relationship between cognitive function and mobility. Therefore, it can be hypothesized that cognitive function has an indirect effect on mobility through sleep quality.

Directly effect of social support on mobility

Social support is a situational factor in term of social-environmental factor that influences mobility (Lenz et al., 2014). In Thai culture, the family serves as the central

role of support for persons with chronic illness. The value of filial piety among Thai people regarding looking after their family member is strongly culturally believed (Tan et al., 2011). Positive family action can also reinforce a persons' participation and encourage them to be independent (Tan et al., 2011), enhancing mobility. Shyu et al. (2010) reported that better walking and climbing stairs are predicted by better social support (OR = 1.93, $p < .05$). Nuotio et al. (2016) indicated that the patients who had pre-fracture not living at home (no social support) were associated with a decline in mobility (OR =2.44, $p < .001$). So, it can be hypothesized that social support has a positive direct effect on mobility.

Directly effect of pain on mobility

Based on the TOUS, pain is recognized as a symptom. Hip fracture-related pain, another potentially changeable factor, seems to reduce mobility. Patients experiencing pain are subject to greater physical risks such as limited function ability, level of function, and reduced walking distance (Bennett et al., 2002; Brennan, 2011). There were significant negative correlations between pain score on hip flexion and functional mobility ($r = -0.43$, $p < 0.001$) and walking ($r = -0.36$, $p = 0.004$) (Foss et al., 2009). Salpakoski et al. (2011) conducted a cross-sectional study. They showed that in patients with severe pain, the risk for mobility decrease (walking, moving, sitting, and standing) compared to those with less or no pain (OR= 3.5, $p < .05$). Because the patients with hip fracture after surgery during rehabilitation are still experiencing pain and reported moderate pain or higher on either hip flexion (sitting) or walking. Therefore, pain interferes with mobility. So, it can be hypothesized that pain has a negative direct effect on mobility.

Indirectly effect of pain on mobility through fatigue

The hip fracture-related pain seems to reduce the early mobilization level (Foss et al., 2009; Kristensen, 2013). Fatigue, followed by hip fracture-related pain in patients with hip fracture, are the most frequent reasons, as perceived primarily by the patients, for not regaining basic mobility independence and not completing planned physiotherapy during the postoperative days. Pain affects patients with fatigue and hemoglobin levels that may decrease after surgery (Münter, 2018). Moreover, the patients who have pain are often inactive due to fear of causing their pain getting worse (Gatchel et al., 2016); this contributes to the pain cycle and causes fatigue. The less the body is active, the less the muscles are used, including the heart and lungs; this leads to fatigue and muscle weakening result in mobility decline (Davis & Walsh, 2010). So, it can be hypothesized that pain has an indirect effect on mobility through fatigue.

Directly effect of sleep on mobility

Based on the TOUS, sleep quality is recognized as a symptom. Patients with hip fractures commonly experience compromised sleep quality (Reppas-Rindlisbacher et al., 2021). The patients exhibited sleep disturbances (Cho et al., 2020) and atypical sleep durations (Kuo et al., 2016). Poor sleep has been associated with a decline in executive functions and walking ability (Clark, 2015). Furthermore, the patient's performance is susceptible to the reversal of executive function, indicating sensitivity to changes in this cognitive domain (Yogev-Seligmann et al., 2008). Therefore, the quality of sleep is closely linked to mobility. Sleep disorder was independently associated with decreased walking speed and mobility limitation (Stenholm et al., 2010). The study found that sleep is associated with walking speed ($r = 0.35$, $p < 0.05$)

(Agmon et al., 2016) and correlated with mobility ($r = -.33$, $p < .01$) (Promchat et al., 2015). Thus, it can be hypothesized that sleep has a negative direct effect on mobility through fatigue.

Indirectly effect of sleep on mobility through fatigue

Fatigue occurs commonly in patients with hip fracture after surgery (Münter et al., 2018). Fatigue has been associated with a wide range of sleep disorders and behaviors (Goldman et al., 2008). Sleep disorders are also common in patients with hip fracture, with prevalence rates estimated as high as about 30-70% (Cho et al., 2020; Kuo et al., 2016). The study supports that insomnia-related symptoms and fatigue are independently related to mobility limitation. The weakness or tiredness thoroughly explained the association between sleeping disorders and mobility limitation (Stenholm et al., 2010). Moreover, Goldman et al. (2008) conduct a prospective cohort study in community-dwelling older adults. The study found that individuals who had poor sleep had a higher fatigue score than those who had a good sleep ($p < .001$). Therefore, the explanation for the relationship between sleeping disorders and decreased mobility may stem from poor sleep and fatigue. Thus, it can be hypothesized that sleep has an indirect effect on mobility through fatigue.

Directly effect of fatigue on mobility

Approximately 20-40% of patients have experienced fatigue symptoms after surgery. Fatigue symptoms may occur from blood loss, poor nutrition, and low hemoglobin level (Münter et al., 2018). More than 85% of patients with fatigue did not achieve independent mobility (Münter et al., 2018). The patients perceived that the factor also associated with reduced mobility was fatigue (Taylor et al., 2010).

Moreover, the study indicated that the patients (including hip fracture patients) who have fatigue symptoms walked shorter distance than those non-fatigued ($B = -39.12$, $p < 0.05$) (Mueller-Schotte et al., 2016). The reason is fatigue is the feeling of tiredness or exhaustion, often involving muscle weakness. It requires the frequent necessity of sitting or lying down. Many physical capacities are affected by fatigue from patients, such as walking and dressing (Pope, 2020). Fatigue was reported as the reason for training session failure. The patient complains that fatigue and feeling tired lead them to need hours of rest and not achieve physical activity (Alsen & Brink, 2013). Thus, it can be hypothesized that fatigue has a negative direct effect on mobility.

Scope of the study

This correlation study aimed to explore a path model of mobility. Population focus was adults and older adults with hip fracture post-surgery at 3rd to 12th surgery. Independent variables were comorbidity, cognitive function, social support, pain, sleep quality, and fatigue. The dependent variable was mobility.

Operational definition

Mobility referred to the ability of person with hip fracture after surgery to get in and out of bed, change position, sit-to-stand-to-sit in a chair, stand, walk indoors and outdoors (ability and distance) independently or use an assistive device, and balance. Mobility was measured by the de Morton Mobility Index (DEMMI) (de Morton et al., 2008).

Comorbidity referred to the illness-related more than one disease or condition that presents at the same time in the person with hip fracture after surgery and

conditions described as comorbidities are often chronic or long-term conditions. Comorbidity was measured by the Charlson Comorbidity Index (Charlson et al., 2008).

Cognitive function referred to the multiple mental abilities of person with hip fracture after surgery, including time orientation, clock drawing, information processing, and recall. The cognitive function was measured by the General Practitioner Assessment of Cognition (Brodaty et al., 2002).

Social support referred to a perception of the person with hip fracture after surgery that has received care from others whom he/she loved and valued, such as family members and friends, by sharing informational, emotional, and tangible support or instrumental support. Social support was measured using the Groningen Orthopedic Social Support Scale (Van Den Akker-Scheek et al., 2004).

Pain referred to an unpleasant sensory and emotional experience of person with hip fracture after surgery associated with actual or potential tissue damage in severity and frequency dimension. Pain was measured by the numerical rating scale (McCaffery & Pasero, 1999) and the pain frequency scale (recommended by content experts).

Sleep quality referred to the perception of a patient after hip fracture surgery that he/she had difficulty sleeping, used sleep medication, experienced poor sleep quality, had altered sleep duration, experienced sleep efficiency issues, faced sleep disturbances or trouble sleeping, experienced daytime dysfunction, or suffered from excessive daytime sleepiness. It was measured by the Pittsburgh Sleep Quality Index (Buysse et al., 1989).

Fatigue referred to the perception of the patient after hip fracture surgery toward the subjective, persistent, and overwhelming feeling of tiredness or lack of energy,

which is highly severely and negatively interferes with an ability to function normally. In this study, fatigue was measured by using the Fatigue Severity Scale (FSS) (Krupp et al., 1989).

Expected outcomes and benefits of the study

1. Findings from this study would help nurses and other healthcare providers have a comprehensive understanding of the characteristics of mobility among persons with hip fracture after surgery. The findings would assist them in assessing, monitoring, and identifying the persons who were at risk for mobility decline after hip fracture surgery.

2. This study provides plenty of descriptions of comorbidity, cognitive function, social support, pain, fatigue, and sleep quality among persons with hip fracture after surgery in Thailand. Thus, this valuable information would help nurses and researchers understand those problems' current situation.

3. Nurses and other healthcare providers can use the findings from this study which explain the connection between various factors in the same model to establish the specific intervention following those influencing factors for enhancing mobility of the persons with hip fracture after surgery

CHAPTER II
LITERATURE REVIEW

This part presents an integrative review of the theoretical and empirical literature describing interesting concepts and interrelationships among factors affecting mobility among persons with hip fracture after surgery. The review covers the following topics:

1. Prevalence and incidence of hip fracture
2. Surgical treatment for hip fracture
   - 2.1 Total hip arthroplasty
   - 2.2 Hemi hip arthroplasty
   - 2.3 Internal fixation
3. Rehabilitation for persons with hip fracture after surgery in Thailand
   - 3.1 In-patient rehabilitation care
   - 3.2 Out-patient rehabilitation care
   - 3.3 Home visit in the community rehabilitation care
4. Nursing care for persons with hip fracture after surgery in Thailand
5. Mobility in persons with hip fracture after surgery
   - 5.1 Definition of mobility
   - 5.2 Changes in mobility among persons with hip fracture after surgery
   - 5.3 Measurements of mobility
6. Theory of Unpleasant Symptom
7. Factors related to mobility among persons with hip fracture after surgery
8. Summary

1. Prevalence and incidence of hip fracture

The prevalence of persons with hip fracture is increasing. In most Asian countries, the number of persons with hip fracture was 1,124,060 in 2018. It is expected that by the year 2050, the number of persons will reach 2,563,488. Thus, an approximately the number of persons with hip fracture was a 2.28-fold increase (Cheung et al., 2018). In Thailand, the prevalence of persons with hip fracture from the Ministry of Public Health Thailand (2016-2020), the data from the year 2015-2019 were 37,693, 40,711, 41,948, 42,932, and 45,704, respectively. If we estimate that 80% of persons with hip fracture require surgery (Sucharitpongpan et al., 2019). The prevalence of persons with hip fracture after surgery was 30,155, 32,569, 33,559, 34,346 and 36,564 respectively.

For an incidence in Thailand, persons with hip fracture incidence increased from 151.9 in 1997 to 181.0 per 100,000 in 2006. Moreover, the incidence rate increased by an average of 2% per year. Presume that this increase is constant. The estimated future numbers of the persons with hip fracture could increase from 181.0 per 100,000 in 2006 to 264.6 per 100,000 in 2025, and 436.1 per 100,000 in 2050 (Wongtriratanachai et al., 2013), as well as the study of Sucharitpongpan et al. (2019) found that the incidence of persons with hip fracture in Nan province increased every year from 211.6 per 100,000 in 2015 to 238.5 per 100,000 in 2017.

2. Surgical treatment for hip fracture

2.1 Total hip arthroplasty

Total hip arthroplasty (THA) was used for the treatment of displaced femoral neck fractures. The prime indications for total hip arthroplasty were pain relief and hip function improvement. In total hip arthroplasty, the damaged bone and cartilage were removed and replaced with prosthetic components. Typically, persons with hip fracture after surgery were able to weight-bear as tolerated after surgery. Alternate weight-bearing options could be considered based on individual patient status and clinical concerns (Steven et al., 2018). The hip dislocation was uncommon. The risk for dislocation was greatest in the first few months after surgery when treating displaced femoral neck fractures with hip arthroplasty (Roberts et al., 2015).

2.2 Hemi hip arthroplasty

Hemi hip arthroplasty was used to treat displaced low femoral neck fractures (base of the neck) inappropriate for reduction and internal fixation. In hemi hip arthroplasty, the femoral head is removed and replaced with prosthetic components. Weight-bearing as tolerated is most common after hip hemiarthroplasty. However, Weight-bearing status depends on fixation, the trochanter's integrity, the presence of any other associated fractures, and the risk for dislocation was beware after surgery in the first few months (Steven et al., 2018).

2.3 Internal fixation

Internal fixation was used to treat hip fractures. The internal fixation was the utilization of implants to stabilize the fractured hip and maintain its alignment. Internal fixation of the hip may involve the utilization of screws, wires, pins, rods, or other hardware that aids in enhancing stability within the hip. Weight-bearing depends on the fracture stability, adequacy of the reduction, and the bone quality, and mobilization can commence with either non–weight bearing, toe-touch weight bearing, or weight bearing as tolerated (Steven et al., 2018).

3. Rehabilitation for persons with hip fracture after surgery in Thailand

According to the guidelines provided by the Sirindhorn National Medical Rehabilitation Institute and Ministry of Public Health in Thailand, a service plan was established to rehabilitate persons with hip fracture after surgery. The objective was to encourage hospitals in each health region to enhance the care and rehabilitation of persons with hip fracture after surgery, to reduce the occurrence of disability, and improve the mobility and ability to perform daily activities (Sirindhorn National Medical Rehabilitation Institute, 2022)

3.1 In-patient rehabilitation care

Persons with hip fractures after surgery should be received a rehabilitation program for at least 1-2 hours per day, at least 3-5 days per week, continuing for 1-2 weeks. However, in real situations, the persons with hip fracture after surgery may receive a rehabilitation program for 1-3 days after surgery in the hospital and were discharged to their homes due to the limitation of the length of stay in the hospital (Sirindhorn National Medical Rehabilitation Institute, 2022).

3.2 Out-patient rehabilitation care

If the persons with a hip fracture after surgery experiences impairments in physical abilities such as mobility and activities. The persons with hip fracture needed continuous rehabilitation in an outpatient department-based program. They received rehabilitation for at least 45-60 minutes per session, at least 1-3 times a week. However, some persons were unable to visit the rehabilitation unit regularly for rehabilitation due to the inconvenience of traveling to the hospital**.** There may be referrals for home visits (Sirindhorn National Medical Rehabilitation Institute, 2022).

3.3 Home visit in the community rehabilitation care

If the persons with a hip fracture continued to experience impairments in physical abilities after surgery, a multidisciplinary team visited the patients and provided or taught rehabilitation in the community. The rehabilitation program was conducted at least twice a month during the first three months and once a month during the 4th-6th month. Occasionally, there were limitations on the patient's practice potential and progress, as well as the availability or capacity of healthcare providers (Sirindhorn National Medical Rehabilitation Institute, 2022).

4. Nursing care for persons with hip fracture after surgery in Thailand

Orthopedic nurses are crucial in caring for persons after hip surgery. As outlined in the Clinical Nursing Practice Guideline (CNPG) developed by the Thai Orthopedic Nurses' Society (2018), nurses play a key role in providing care for these persons. In the orthopedic ward, nursing care actively supports rehabilitation and mobilization, encompassing activities such as repositioning in bed, transferring positions, sitting in a chair, standing, and walking.

During the discharge and continuing care, nurses assessed the physical readiness to return home and guided caregivers. This guidance included instructions on surgical wound care, pain management, and measures to prevent hip dislocation, such as avoiding hip flexion beyond 90 degrees. Nurses also emphasized the importance of preventing complications like falls and re-fractures. They actively promoted mobility and rehabilitation and scheduled regular follow-up appointments at the outpatient department to assess the surgical wound, mobility and provide ongoing treatment as necessary.

According to nursing care, orthopedic nurses played crucial roles in facilitating mobility for persons with hip fractures. Firstly, the nurse's role was to provide direct care for mobility. It was well-known that early mobilization after hip fracture surgery helped prevent complications (Morris et al., 2010). As a result, orthopedic nurses regularly evaluated mobility during follow-up visits. Nurses guided them on proper bed mobility techniques. The standard practice involved assisting them to sit out of bed and begin standing the day after surgery, as long as it was medically appropriate. Nurses also instructed patients on safely getting out of bed and taught them the importance of mobility. During this process, nurses engaged patients by asking questions and educating them about the significance of maintaining mobility.

Secondly, the coordination involved in developing a care plan for persons with hip fractures was essential and required the involvement of multidisciplinary teams (Chow, 2017; Holte et al., 2015). Nurses played a crucial role in facilitating effective communication among various professionals involved, including the case manager for patients, the medical team responsible for the hip operation, the rehabilitation team for improving mobility, and the provision of essential resources such as walking aids.

Thirdly, nurses collaborated with multidisciplinary teams and communicated with patients and families to provide care throughout hip fracture illness. They educated and individualized care, tailoring it to meet the specific needs of patients and families. Nurses enhanced health literacy and identified mobility risks by developing communication skills and using a patient-centered approach.

5. Mobility in persons with hip fracture after surgery

5.1 Definition of mobility

To understand mobility in the context of persons with hip fracture after surgery, it is necessary to examine various definitions of mobility found in the literature. There is not a consistent or universal definition of mobility. Generally, mobility is defined as "the ability to move freely; and is one of the majors means we express ourselves to respond to the individual's internal or external environment" (Newfield et al., 2007). Various definitions have been noted in the literature for persons with hip fracture after surgery.

Kos et al. (2011, p 2266) defined mobility as “walking ability and walking distance indoor and outdoor independently (with or without walking aid and help).”

Portegijs et al. (2012, p 2341) defined mobility as “ability to rise from a chair, walking, turn around, and return to the chair.”

Jansen et al. (2013, p 452) mobility defined as “ability to moves from bed to chair and walking with or without aids/wheelchair.”

Vochteloo et al. (2013, p 335) defined mobility as “mobile in- and outdoors without use of an aid, mobile in- and outdoors with the use of an aid in-and/or outdoors, only mobile indoors regardless of the use of an aid.”

Woodward et al. (2014, p 2) defined mobility as “walking, use of assistive walking device, and sit to stand.”

González-Zabaleta et al. (2016, p 564) defined mobility as “the ability to move."

Nuotio and Luukkaala (2016, p 1126) defined mobility as “ability to move indoor and outdoor with or without help.”

Ariza-Vega et al. (2017, p 2) defined mobility as “the ability of balance, gait and movement including sitting, standing, reaching up, picking up object, walking, and turning.”

Steihaug et al. (2018, p.2) defined mobility as “a person’s ability to walk indoors, outdoors, or while shopping.”

Jennison and Yarlagadda (2019, p 88) defined mobility as “ability on mobilizing indoor independently.”

Kristensen (2019, p 279) defined mobility as “getting in and out of bed, sit to stand in a chair and indoor walking with or without walking aids.”

Ong et al. (2019, p 1710). defined mobility as “able to get about the house, indoor walking, outdoor walking and with or without aid and with or without another person.”

Hao et al. (2020, p 614) defined mobility as 13 “walking ability and able to walk across a room without human assistance.”

For the current study, the mobility definition was derived based on the reviewed literature, leading us to conclude that the definition for persons with hip fracture after surgery was defined as “the ability of a person with hip fracture to get in and out of bed, change position, perform sit-to-stand-to-sit in a chair, and stand and walk indoors and outdoors (both ability and distance), either independently or with the use of an assistive device.”

5.2 Changes in mobility among persons with hip fracture after surgery

Mobility is essential to individuals' independence (Dyer et al., 2016; Maggi et al., 2010). Mobility is most certainly an essential clinical nursing outcome (Maggi et al., 2010; Newfield et al., 2007). One of the significant problems of persons with hip fracture after surgery is mobility.

Jansen et al. (2013) conducted a longitudinal study among patients with hip fractures after surgery. Data were collected at 3rd month, 6th month, and 12th months after the surgery. Findings revealed that patients' mobility scores were very low, especially at the 3rd month after the surgery.

Ariza-Vega et al. (2016) conducted a prospective cohort study among patients with hip fracture. Data were collected at 1st and 3th months post-surgery. The results showed that patients' mobility scores were very low at the 1st and 3th months post-surgery. Steihaug et al. (2018) conducted a prospective observational study among patients with hip fracture after surgery. The findings indicated that the mobility score at the 3rd month was lower than the 12th month. Rosendahl-Riise et al. (2020) employed a prospective study among patients with hip fractures. Data was collected at the 2nd month post-surgery. The findings showed that the mobility score was low. Lastly, there was a scoping review conducted by Pitzul et al. (2017). Using a scoping review methodology, the specific research question to be addressed was: "What patient, institutional, and system-level indicators are currently in use or could potentially be used for measuring quality of care in the acute period, post-acute period, and across the continuum for individuals following a hip?" The authors reported that mobility was one of the indicators used for measuring quality of care.

Regarding pre-facture mobility level, the patients with hip fracture post-surgery are not able to achieve pre-fracture mobility. Vochteloo et al. (2013) conducted a prospective cohort study among patients with hip fracture after surgery. The study found that at 3rd months post-surgery only 45.5% of them could regain pre-fracture mobility. However, 54.5% of them could not. At 12th months post-surgery only 47.8 % regained pre-facture mobility whereas 52.2% were not able to regain. Hansson et al. (2015) conducted a retrospective cohort study. The study found that at 12th months post-surgery only 29% of patients regained their pre-fracture mobility.

Dyer et al. (2016) conducted a critical review. Thirty-eight studies were identified through PubMed and Scopus searches and contact with experts. Cohort studies of hip fracture patients reporting outcomes 3 months post-fracture or longer were included for review. Mobility was synthesized narratively. Risk of bias was assessed according to four items from the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement. The results indicated that 1) mobility following hip fracture was significantly worse for 1-2 years; 2) 26 % of the participants could be able to walk for 3 meters only; 3) 22 % could be able to walk for bed transfer only; 4) the mean increased in the number of limitations in those with hip fracture was 0.93 for the lower body ($p = 0.0001$) and 0.26 for the upper body ($p = 0.02$); and 5) only 40 to 60 % of patients regained their pre-fracture level of mobility within 1 year.

About one month after the surgery studies reported that only 16% of patients with hip fracture after surgery could walk independently; 54% could walk with aids and required assistance; 23% of the patients were unable to walk; and 75 of the patients were unable to move or being bedridden (Hao et al., 2020; Lee et al., 2014). Most

patients lost one level of mobility. For example, before the onset of hip fracture surgery the patients could walk independently. However, after surgery they walked with one aid; some walked with two sticks; and some used a wheelchair (Jennison & Yarlagadda, 2019). Some patients (who were mobile outdoors before surgery) became mobile indoor only.

In Thailand, studies about mobility in persons with hip fracture after surgery have been limited. Many studies have focused on complications, activity of daily living and quality of life among persons with hip fracture (Ninlerd et al., 2020). None of them has examined mobility in these population.

5.3 Measurements of mobility

1) Two Minute Walk Test (2MWT). The 2MWT is a test to use measure gait endurance in individuals with lower extremity amputation. Participants are instructed to walk and cover as much distance as possible within a span of 2 minutes. The 2MWT has been shown to have a moderate correlation with the total Houghton score at discharge from rehabilitation ($r = 0.493$, $p \leq .001$). Additionally, there was a moderate correlation between the 2MWT and the SF-36 subscale ($r = 0.479$, $p < 0.001$) (Brooks et al., 2001).

2) Timed Up and Go test (TUG). The TUG use to assess mobility in older adults. In this test, the subject rise from a chair, walks a distance of 3 meters, turns around, returns, and sits down again. The subject wears footwear and can use walking aids if necessary. Completing the test in 20 seconds or less indicates that the patient is independent; a time greater than 30 seconds indicates that the patient may be more

dependent and require assistive. Previous studies have provided support for the validity and reliability of the TUG. (Sebastião et al., 2016; Yuksel et al., 2021).

3) 5-Time Sit-to-Stand (TSTS) Test. The 5-TSTS was developed by Csuka and McCarty (1985). The 5-TSTS is used to examine the functional status and evaluate balance in older adults. This test was performed by measuring five times to stand up and sit down from chair while keeping one's arms folded across the chest. The inability to do the test may lead to institutionalization as well as impaired function and mobility (Csuka & McCarty, 1985).

4) The Clinical Outcome Variable Scale (COVS) (Menezes et al., 2017). COVS was designed for the assessment of mobility status. COVS provides assessment of a broad range of mobility tasks, including the negotiation of environmental barriers, multiple transfers (to and from both the bed and floor) and wheelchair skill. There is 13-item selected as representative of mobility, which include task such as, of bed mobility, transfer, sitting balance, ambulation, ambulation (endurance), ambulation (velocity), wheelchair mobility and arm function. Each item or functional task has its own 7-point rating scale. Items can be considered individually or summed to provide a composite score ranging from 13 (total dependence) to 91 (independence). The COVS demonstrated positive results for reliability (ICC > 0.80) and presented excellent criterion validity (Salter et al., 2010).

5) The de Morton Mobility Index (DEMMI) (de Morton et al., 2008) was designed for evaluating mobility. It is administered through clinician observation of performance on 15 mobility challenges. The DEMMI assessment of mobility tasks includes 5 hierarchies 1) bed mobility, 2) chair, 3) static balance, 4) walking (ability and distance), and 5) dynamic balance. There are 15-item selected as a representative

of mobility. Each item scored from 0 (unable) to 2 (independent). The total raw score ranges from 0 to 19 and this score is then converted to a total DEMMI score ranging from 0 (indicating poor mobility) to 100 (indicating independent mobility). The DEMMI has been used in various populations, including patients with hip fracture (Davenport & de Morton, 2011; de Morton et al., 2013; de Morton & Lane, 2010; Unnanuntana et al., 2018). The DEMMI demonstrated reliable results, with a Pearson's correlation coefficient of 0.87. (de Morton & Lane, 2010) It presented good convergent validity, as evidenced by a Spearman's correlation coefficient of 0.76 with the six-minute walk test and a Spearman's correlation coefficient of 0.60 with the Barthel Index (de Morton et al., 2013). The DEMMI demonstrated discriminant validity, as indicated by a Spearman's correlation coefficient of 0.15 with the Mini Mental State Examination (de Morton et al., 2013).

To conclude, the de Morton Mobility Index (DEMMI) was used in the current study to measure mobility for many reasons. Firstly, the DEMMI reflected the operational definition of mobility among patients with hip fracture after surgery. Secondly, several studies had used this scale in their research. Thirdly, the number of questions is not too much and spend less than 10 minutes to complete. Fourthly, it was unlikely to burden the patients, especially in a clinical setting. Finally, the DEMMI demonstrated good psychometric properties.

6. Theory of Unpleasant Symptoms

Theory of Unpleasant Symptoms (TOUS) is the middle-range theory and developed by Elizabeth Lenz and colleagues (Lenz et al.,1997; Lenz et al., 2014). TOUS presents three main elements: 1) the symptoms that the patient is experiencing; 2) the factors that influence them, both in their nature and in their evolution; and 3) the consequences of that experience.

Experienced symptoms are the central focus of the theory, conceived as indicators of change in the individual's health status, which often occurs either in isolation one at a time or in combination and potentially in interaction with other symptoms, and although they are different from each other. TOUS has focused on subjectively perceived symptoms rather than objectively observable signs, and they present four common dimensions: intensity/severity, time/frequency, distress, and quality.

Influencing factors. TOUS points to three influential categories of these dimensions: the physiological, psychological, and situational factors that relate to each other beyond their individual relationships with the symptoms. Physiological factors include anatomical/structural, physiological/genetic, illness-related, and treatment-related factors. For instance, structural anomalies, pathology or disease states, comorbidities, stage and duration of illness, infection, trauma, fluctuations in the hormone, energy level, hydration, race/ethnicity, age, developmental stage, type and duration of treatment.

Psychological factors include affective and cognitive factors. The affective and factors, for instance, mood, level of anxiety, depression, anger, emotional. Cognitive

factors, for instance, mental state, degree of uncertainty, level of knowledge about knowledge, the meaning of the symptom, cognitive skill, and perceived coping.

Situational factors include physical and social environment factors. The physical environment factors such as altitude, temperature, humidity, noise level, and light pollutants in the air and water. The social environment factors such as social support, caregiver knowledge and skill, equipment, socioeconomic status, access to healthcare.

The performance or consequence is the final component and the outcome of the Theory. Performance is the individual's ability to function in physical, cognitive, and role performance given the experience of the symptoms. The physical performance or functional status includes physical functioning, physical activity, the activity of daily living, capability, ability to function, ability to walk, climb a step. Cognitive performance includes memory, learning, concentration, and problem-solving. Role performance includes the ability to caring for personal care, ability to caring out a social role, employment-related roles.

The theory explains the symptoms experience. Three factors may interact to influence the symptom experience, and these relationships may be reciprocal. The performance has a reciprocal relation to the symptom experience, and performance can have feedback to the influential factors. According to unpleasant symptoms, several factors affect the symptom and contribute to mobility.

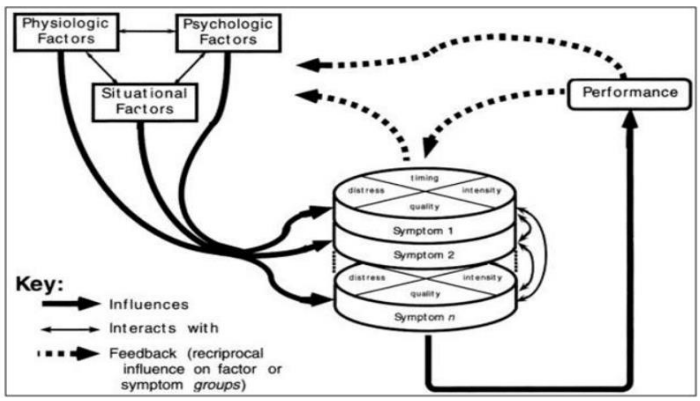


Figure 2.1 The Theory of Unpleasant Symptoms (Lenz et al., 2014)

7. Factors related to mobility among persons with hip fracture after surgery

7.1 Comorbidity

7.1.1 Definition: Comorbidity is defined as individual's illness-related (Lenz et al., 2014) or presence of additional diseases in relation to an index disease in one individual (Valderas et al., 2009)

7.1.2 Concept of comorbidity: Feinstein introduced comorbidity in 1970 (Feinstein, 1970). It is often used interchangeably with other terms, such as, "coexisting diseases," "multiple pathology," "multimorbidity," "co-occurring diseases," "concomitant diseases," and "disease clustering" (Gijsen et al., 2001; Starfield, 2006). Comorbidity is considered to unidimensional. These concepts can link to classification systems, such as the International Classification of Diseases (ICD) or the Diagnostic and Statistical Manual of Mental Disorders (DSM). Comorbidity is most often defined as a specific index condition. The comorbidities may have important implications for genesis, prognosis, and treatment (Valderas et al., 2009). Comorbidity has also been used to assess the burden of illness or disease, which is defined by the overall burden of physiological dysfunction (Karlamangla et al., 2007) or the total

burden of conditions that affect an individual's physiology (Ritchie, 2007). This concept is related to its impact on patient-reported outcomes, including functioning (Valderas & Alonso, 2008).

7.1.3 Relationship between comorbidity and mobility among persons with hip fracture after surgery: The prevalence of comorbidity in persons with hip fracture is about 28-40% (Cary et al., 2016; Deng et al., 2021). Concerning gender, male constituted a significantly higher proportion of patients at comorbidity severities than female ($p < 0.05$). The patients who suffered from femur neck fracture showed a significantly higher frequency of comorbidities than those who suffered from intertrochanteric fracture ($p < 0.05$) (Deng et al., 2021). González-Zabaleta et al. (2016) conducted a prospective study and found that the indicator capable of predicting mobility was comorbidity (OR = 1.407, p = .031). Cary et al. (2016) conducted a retrospective cohort study and found that comorbidities were associated with mobility. Moreover, Tam et al. (2020) conducted a retrospective observational cohort study and indicated that comorbidities predicted mobility, each increase in comorbidity corresponds to a 33% decrease in the likelihood of walking independently (OR = 0.67, $p < .05$).

Multiple studies showed that a significant correlation between comorbidities of hip fracture patients with decreased mobility. Patients with more comorbidities will have mobility decreased than those with less comorbidities. For instance, endocrine disorders can lead to fragile bones, such as an overactive thyroid, which can reduce the absorption of vitamin D and calcium and lead to weakened bones; low vitamin D levels are associated with impaired muscle strength, leading to mobility decrease (Moo et al., 2020). Comorbidity that affects the brain and nervous system, including Parkinson's

disease, also affects mobility (King et al., 2014). High blood pressure, hyperlipidemia, and diabetes are associated with a metabolic disorder. In addition, adipose tissue secretes hormones leptin and inflammatory agents into the systemic circulation. Such as tumor necrosis factor and C-reactive protein induce a pro-inflammatory state, mediate insulin resistance, and increase lipolysis, causing inflammation around the hip joint. As a result, the patient has mobility and activities decrease (Gandhi et al., 2010).

Comorbidity affects physical functioning by increasing symptoms rather than through direct association. For example, the study indicated that medical conditions or comorbidity affected physical functioning (e.g., walking, climbing stairs) mediated by pain. The direct relationships between comorbidity and physical functioning changed from moderate to small when the pain was added to the model, the models suggested that pain was a mediator in the model (Bennett et al., 2002). Therefore, it is possible that some comorbidities cause symptoms that influence the level of mobility. Thus, it can be stated that comorbidity has a negative direct effect on mobility and an indirect effect on mobility through pain. Similarly, comorbidity affects physical functioning (e.g., walking, climbing stairs) mediated by fatigue. Because the direct relationships between comorbidity and physical functioning changed from moderate to small when fatigue was included in the model, the models implied that fatigue acted as a mediator in the model (Bennett et al., 2002). Thus, it can be noted that comorbidity has a negative direct effect on mobility and an indirect effect on mobility through fatigue.

7.1.4 Measurement

1) The Charlson Comorbidity Index (ICC) categorizes patients' comorbidities using the International Classification of Diseases diagnosis codes from medical records. The original was developed with 17 comorbidities (Charlson et al., 1987) and later modified to 21 comorbidities (Charlson et al., 2008). Each comorbidity category has an associated weight from 1 to 6 based on mortality risk and predicted costs. A score of zero indicates that patients have no comorbidity. While a higher score indicates high comorbidity and an increased risk of mortality. The CCI is considered reliable and valid in various healthcare settings (Bernardini et al., 2004; De Groot et al., 2003; Hall et al., 2004; Quan et al., 2011; Roffman et al., 2014).

2) The Functional Comorbidity Index (FCI) was developed by Groll et al. (2005). The FCI is a self-administered comorbidity measure associated with physical function as the outcome. It consists of an 18-item list of diagnoses. The measurement showed stronger association with physical function (model $R^2 = 0.29$) compared with the Charlson (model $R^2 = 0.18$), and Kaplan-Feinstein (model $R^2 = 0.07$) indices. The design of the FCI and its rating scale are function-based, requires the clinical judgment of the clinician. This is in contrast to many measurements that use an administration-based method of assessing comorbidity.

3) Elixhauser Comorbidity Index (ECI) is based on 31 individual conditions classified by physician data diagnoses. The ECI utilizes the International Classification of Diseases diagnosis codes. It employs binary indicator variables to ascertain the presence or absence of each disease in the data source(s). The index score

is calculated based on the cumulative number of conditions present. The index can be used to predict hospital resource use and in-hospital mortality (Elixhauser et al., 1998).

In this study, the ICC was selected to measure comorbidity for many reasons. First, the ICC is one of the most widely used indices. Second, the scale proved to be an effective measurement for detecting comorbidity among patients. Third, the different scoring weights represent the complexity of co-occurring diseases. Finally, the number of questions was not too much, thus minimizing the burden on the patients to complete it.

7.2. Cognitive function

7.2.1 Definition: Cognitive function is defined as a mental function with orientation, registration, attention and calculation, recall, and language (Folstein et al., 1975)

7.2.2 Concept of cognitive function: Cognitive function is typically conceptualized in terms of domains of functioning. Cognitive function refers to more basic sensory and perceptual processes and is closely relates to executive functioning and cognitive control elements. Cognitive function is multidimensions. These include sensation and perception, motor skills and construction, attention and concentration, memory, executive functioning, processing speed, and language/verbal skills (Harvey, 2019). The details are as follow:

Sensation refers to the ability of a person to detect a stimulus that occurs in one of the five sensory modalities. These modalities consist of visual, auditory, tactile, gustatory, and olfactory senses. In the domain of perception, sensory information is processed and integrated. Perception can be assessed in terms of

recognizing objects and sounds. Attention is a multifaceted construct and is generally divided into two subdomains: selective attention and sustained attention. Selective attention involves attending to relevant information and ignoring other nonrelevant information. Sustained attention is the ability to maintain attention over time. Concentration is generally considered a component of sustained attention.

Memory functioning is the most complex and multifaceted of cognitive domains. It comprises multiple subdomains, including:

1. Working memory: The ability to hold information in consciousness for adaptive use.
2. Episodic/declarative/explicit memory: This subdomain interacts with working memory storage processes to encode, maintain, and retrieve information into and out of longer-term storage
3. Encoding: This involves taking information contained in working memory and processing it for longer-term storage.
4. Storage: It is the process of retaining information after encoding.
5. Retrieval: This refers to the various ways in which information can be retrieved after encoding.
6. Procedural memory: It involves memory for motor actions or skills.
7. Semantic memory: This is the process of long-term storage of verbal information, often referred to as long-term memory.
8. Prospective memory: It is the ability to remember and perform tasks in the future.

Executive functioning involves reasoning, problem-solving, and processes that exert control over other cognitive abilities. It enables the effective utilization of cognitive resources to efficiently solve problems. Processing speed refers to the assessment of cognitive processing that requires prompt performance of tasks ranging from simple to complex. Language skills encompass the ability to understand language, access semantic memory, identify objects by name, and respond to verbal instructions with behavioral actions.

7.2.3 Relationship between cognitive function and mobility among persons with hip fracture after surgery: In patients with hip fracture after surgery, it was found that 35.3-51.9% had mild to moderate cognitive impairment (CI), and 26.5-29.4% had severe CI. The study showed an inverse association between cognitive function and walking independence in patients after hip fracture surgery ($p = .001$) (Morghen et al., 2011). Patients with CI experienced poorer rehabilitation. Low cognitive function was significantly correlated with a decrease in mobility, specifically the ability of lower extremity to walk and climb stairs) ($r = 0.52$, $p < 0.001$) (Lenze et al., 2004). In a prospective cohort study conducted by Ariza-Vega et al. (2017), cognitive function was found to have a negatively associated with mobility ($\beta = -5.11$, $p < 0.01$). Moreover, Mariconda et al. (2016) indicated that that cognitive score had a significant impact on mobility (R^2 3-5%, $p < 0.001$).

Moreover, cognitive function and sleep were found to be positively associated with mobility. Wilckens et al. (2018) conducted a cross-sectional study in a community-dwelling population, it was indicated that sleep efficiency significant mediating the relationship between cognitive function and physical activity. Thus, sleep

quality emerges as a potential mediator in the relationship between cognitive function and mobility. Therefore, it can be concluded that cognitive function has a positive direct effect on mobility and an indirect effect on mobility through sleep quality.

7.2.4 Measurement: Cognitive function can be assessed through various measurements

1) Short Portable Mental State Questionnaire (SPMS) was developed by Pfeiffer (1975). It is a clinician questionnaire composed of 10-item with a scoring renge from 0 to 10. The scale evaluates orientation, memory-related to self-care, long-term memory, and the ability to perform complex mental operations. The cutoff point is three or more errors for people who can read and write and four or more error for those who cannot. A score exceeding the cutoff suggests cognitive impairment (CI). The test's sensitivity was 86.2% and specificity 99.0% in medical inpatients. In the community sample, the percentages were 66.7% and 100%, respectively. However, the validity of the SPMSQ was not as good for delirium due to its variable clinical picture (Erkinjuntti et al., 1987).

2) Mini-Mental State Examination (MMSE) was developed by Folstein et al. (1975). It included eleven questions, with five dimensions consisting of orientation (2 items), registration (1 item), attention, calculation (1 item), recall (1 item), and language (6 items). The assessment typically takes only 5-10 minutes to complete. The MMSE has a maximum score of 30, with a score of 27 or higher indicating normal cognition. A Thai version of the MMSE was translated by the Institute of Geriatric Medicine in 2002.

3) Cognitive-The Functional Independence Measure (Cognitive-FIM) scale was developed by Keith et al. (1987) to assess cognitive disability. The FIM

consists of 18 items that assess six functions. The items are divided in two domains: Motor (13 items) and Cognitive (5 items). These domains are referring to as the Motor-FIM and the Cognitive-FIM. The 5 cognitive items consist of problem-solving, memory, orientation, concentration, and safety awareness. Each item on the FIM is scored on a 7-point Likert scale. Additionally, a sub-score for the Cognitive domains can be calculated (Linacre et al., 1994).

4) *The General Practitioner Assessment of Cognition (GPCOG)* was developed by Brodaty et al. (2002). GPCOG is a wildly accepted measurement for assessing cognitive function. It consisting of 15 questions, including 9 cognitive test items and 6 historical questions that are asked of an informant. The assessment can be completed within 5-10 minutes. The maximum total score of GPCOG is 9 consisting of four components including 1) time orientation 1 item; 2) clock drawing 2 items; 3) information 1 item and 4) recall 5 items. Scores on the GPCOG are interpreted as follows: 0-4 indicate cognitive impairment (need standard investigation). Cognitive impairment more explains that some function in the brain is impaired not only memory loss, a score of 5-8 suggests the possibility cognitive impairment (requiring more information and informant interview), and a score of 9 indicates no significant cognitive impairment. The reliability of the GPCOG patient section was found to be high, with interrater intraclass correlation coefficients (ICC) of 0.75, test-retest ICC of 0.87, and internal consistency (Cronbach's alpha) of 0.84. The reliability of the GPCOG informant section was satisfactory, with interrater ICC of 0.56, test-retest ICC of 0.84, and internal consistency (Cronbach's) of 0.80. The GPCOG demonstrated a sensitivity of 0.85, specificity of 0.86, misclassification rate of 14%, and a positive predictive value of 71.4%. However, the GPCOG may overestimate sensitivity in detecting

cognitive decline, and the level of education can influence the GPCOG rating (Brodaty et al., 2004). The GPCOG Thai version was translated into Thai by Griffiths et al. (2013).

Finally, in this study, the GPCOG was favored as a measurement tool for assessing cognitive function in patients with hip fracture after surgery due to its match with an operational definition of cognitive function. Several previous studies have utilized this measurement in their study. Furthermore, the GPCOG proved to be a time-efficient assessment that did not burden the patients significantly. Additionally, it has been successfully translated into the Thai language.

7.3. Social support

7.3.1 Definition: Social support is defined as information leading the subject to believe that he is cared for and loved, esteemed, and a member of a network of mutual obligations (Cobb, 1976).

7.3.2 Concept of social support: Social support has multidimensions. It arises from personal relationships and their conduct. Close relationships generate more support than regular relationships. A network perspective provides insights into social integration and social support. In general, close ties with partners and other family members offer intimate expressions of support, including listening, caregiving, and affection. Strong ties tend to share and circulate the same information. The closer the relationship, the stronger the correlation among various types of support, reflecting emotional resonance and interconnectedness. The people we feel close to serve as a repository of various types of support. (Gottlieb & Bergen, 2010). Social support can come from various sources, including (but not limited to): family, friends, romantic

partners, pets, community ties, and coworkers (Taylor, 2011). The source of social support is an essential determinant of its effectiveness as a coping strategy.

The social support attributes are emotional instrumental, informational, and appraisal support. First, emotional support involves the provision of caring, empathy, love, and trust. Emotional support is the most critical category through which the perception of support is conveyed to others. Emotional acts far outnumber all other types of support. Second, instrumental support is the provision of tangible goods and services or actual aid described as substantial assistance, for example, giving financial assistance or performing assigned work for others. Third, informational support is information delivered to another during stress. Informational support helps one to problem-solve during the problem-solving process. Finally, appraisal support involves communicating information relevant to self-evaluation rather than problem-solving (Langford et al., 1997; Glanz et al., 2008; Pedro et al., 2008).

7.3.3 Relationship between social support and mobility among persons with hip fracture after surgery: Patients with hip fracture require good social support as factors that support their post-operative ability to normal, including mobility and mobility aids (Beer et al., 2022). Most of the patients with hip fracture are older adults and live with family. About 30% of patients have low social support during prehospitalization (Ramírez-García et al., 2021). Shyu et al. (2010) reported better walking ability, climbing stairs is predicted by better social support (OR = 1.93, $p < .05$). Nuotio et al. (2016) indicated that pre-fracture living arrangement not at home (no social support) was associated with mobility decrease (OR =2.44, $p < .001$).

In Thai culture, the family serves as the central role of support for persons with chronic illness. The value of filial piety among Thai people regarding looking after

their family member is strongly culturally believed (Tan et al., 2011). Positive family action can also reinforce a persons' participation and encourage them to be independent (Tan et al., 2011), enhancing mobility. Therefore, it can be stated that social support has a positive direct effect on mobility.

7.3.4 Measurement

1) The Social Support List-Interactions (SSL12-I) was developed by Van Sonderen (1991). The SSL12-I consists of 12 items, divided into three subscales; 1) everyday support four items, 2) social support in problem situations four items, and 3) esteem support four items. The SSL12-I have four scales; 1 = seldom or never, 2 = now and then, 3 = regularly, 4 = very often. The internal reliability was 0.83 (Kempen & Van Eijk, 1995).

2) The Groningen Orthopaedic Social Support Scale (GOSSS) was developed by Van Den Akker-Scheek et al. (2004) to measure perceived social support in older adults and are relevant for orthopedic patients after total hip or knee arthroplasty. The GOSS consisted of 12 items, divided into two subscales: Perceived Social support (seven items) and Instrumental support (five items). The reliability and validity of the GOSS was good (Van Den Akker-Scheek et al., 2004).

3) The Multidimensional Scale of Perceived Social Support (MSPSS) was developed by Zimet et al. (1990). It is used to measure the patient's social support from family, friends, and significant others. MSPSS is 12 items, 7 points rating scale. This measurement is also translated into the Thai version, and the reliability and validity of the GOSS was good (Wongpakaran et al., 2011).

This study focuses on The Groningen Orthopaedic Social Support Scale (GOSS) to assess the individual's subjective perception of social support from orthopedic patients with hip fracture after surgery. Because the GOSS matched with operational definition and the number of questions was not too much, it did not disturb the patients to answer the questions, especially in clinical settings and follow up.

7.4. Pain

7.4.1 Definition: Pain is defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage (The International Association for the Study of Pain (IASP) (2020).

7.4.2 Concept of pain: Pain is a specific sensation. The reaction to pain is both physical and psychological. Pain is input from the sensory nerves involved in detecting noxious stimulation (nociceptors) combined both spatially (across areas of the body) and temporally (overtime) (Nielson, 2001). Pain is always a personal experience that is influenced to varying degrees by biological, psychological, and social factors. Although pain usually serves an adaptive role, it may have adverse effects on function and social and psychological well-being. (IASP, 2020). Melzack and Wall (1965) presented the theory for the neural mechanism of pain, which postulates a neural gate in the substantia gelatinosa of the spinal dorsal horn that controls the rostral projection of afferent messages stimulating. The gate-control theory accepts the presence of ascending pathways that carry activity related to pain.

Pain is multidimensions. First, intensity or severity dimension, intensity is the dimension that quantifies the degree, strength, or severity of pain. Pain intensity is valuable information and will ask patients to evaluate how strong their pain feels

(Sharav & Benoliel, 2008; Talbot et al., 2019). Second, the affective dimension, often referred to simply as unpleasantness, captures how ‘bad’ or ‘unpleasant’ the pain is (Talbot et al., 2019). Third, the time dimension includes the way symptoms vary in duration or frequency. The pain persists when the tissue destruction process is ongoing (Ngamkham et al., 2011). Finally, the quality of pain refers to what it feels like to have the symptom, feelings of pain in any location. For instance, burning, stabbing, and stinging (Lenz & Pugh, 2014).

7.4.3 Relationship between pain and mobility among persons with hip fracture after surgery: The study found that patients experiencing pain were subject to greater physical risks such as limited functional ability, level of function, and reduced walking distance (Bennett et al., 2002; Brennan, 2011). Patients after arthroplasty had lower pain than patients after internal fixation surgery. Patients with hip fracture after surgery during rehabilitation were still experiencing pain. They reported moderate pain or higher on either hip flexion (sitting) or walking (Foss et al., 2009). The patients described pain beyond typical fracture healing times. The previous studies indicated that pain causes patients with hip fracture to have a decreased tolerance to walking ability (Gheorghita et al., 2018) and be more likely to have no movement and mobility (Münter et al., 2018).

Salpakoski et al. (2011) conducted a cross-sectional study. They showed that in patients with severe pain, the risk for mobility decreased (walking, moving, sitting, and standing) compared to those with less or no pain (OR = 3.5, $p < .05$). Moreover, there were significant negative correlations between functional mobility and pain on hip flexion ($r = -0.43$, $p < 0.001$) and walking ($r = -0.36$, $p = 0.004$) (Foss et al., 2009). Moreover. Kristensen (2013) conducted a prospective observational study

among patients with hip fractures. The study found pain associated with functional performances on the Time up and go test ($B = 8.7$, $p < 0.001$).

Another point, pain is recognized as a symptom. Pain is a common symptom that results from various comorbidities, such as rheumatoid, arthritis, and liver disease (Rogal et al., 2013; Sarzi-Puttini et al., 2014; Somers et al., 2012). So, patients with comorbidity face pain symptom. For instance, pain is common in patients with liver disease; approximately 34 % of patients had pain. The patients described abdominal pain from hepatic capsular distension, splenomegaly, and ascites with abdominal distension. Additionally, pain with advancing disease included pain at any site (not just the abdomen) (Rogal et al., 2013). In addition, rheumatoid arthritis (RA) is an inflammatory disease of synovial joints. Therefore, pain due to joint inflammation, prostaglandins, and bradykinin being increased in synovial fluids from patients with RA can directly activate sensory nerves within the synovium (Walsh & McWilliams, 2012).

In addition, the study indicated that pain was the mediator between medical conditions or comorbidity and physical functioning (e.g., walking, climbing stairs). Because the direct relationships between comorbidity and physical functioning changed from moderate to small when the pain was added to the model (Bennett et al., 2002). Thus, it can be stated that pain has a negative direct effect on mobility and mediating effect of comorbidity and mobility.

7.4.4 Measurement

1) The numeric rating scale (NRS) is a unidimensional test of pain severity in adults. The 11-item NRS (0-10 integers) reflects their pain intensity (McCaffery & Pasero, 1999). A typical pattern is a horizontal bar or line similar to pain,

NRS being represented by numbers describing the severity of the pain. It is an 11-point numeric scale (NRS 11) with 0 representing “no pain” and 10 representing the “worst pain imaginable.” High test-retest reliability was observed in literate and illiterate patients with rheumatoid arthritis (r = 0.96 and 0.95, respectively). For construct validity, the NRS was highly correlated to the VAS ranged from 0.86 to 0.9 (Hawker et al., 2011). The NRS was a unidimensional measure of pain intensity in adults (Childs et al., 2005; Rodriguez, 2001).

2) The visual analog scale (VAS) is a single-item instrument measuring chronic pain. The VAS is a 100 mm scale anchored with two opposite labels. The patients mark a line at the area most closely associated with their respective pain levels. At baseline, the average VAS score for “best, current, and worst” level scores were 20, 25.75, and 85 (out of 100), respectively. The VAS has moderate to good reliability (correlation coefficient 0.60-0.77) (Boonstra et al., 2008; Crossley et al., 2004). A limitation of the VAS was that patients might not have understood the requirements for achievement, especially if they have impaired cognitive function.

3) The Western Ontario and McMaster Universities (WOMAC) consists of 3 parts: the pain dimension (5 items), stiffness dimension (2 items), function dimension (15 items). Each section has a total score of 10, with the higher score indicating more pain. This measurement has good psychometric properties testing in a sample of femoral hip fracture (Burgers et al., 2015). However, it is a suitable scale for assessing the pain of hip and knee osteoarthritis because of the pain characteristics being correlated with the disease.

In this study, a numerical rating scale (NRS) was appropriately selected for several reason: First, Self-report is the most reliable assessment method of pain.

Second, Self-reporting measurement is particularly suitable for patients with hip fracture, as the patient's perception is an important indicator of the presence and severity of pain. Finally, several previous studies have utilized the NRS for pain assessment in their research.

7.5. Sleep quality

7.5.1 Definition: Sleep quality is defined as a constellation of sleep measures, including sleep latency and duration, sleep efficiency, sleep fragmentation, and disruptive nocturnal events such as apneas, abnormal behaviors, or arousals (Krystal & Edinger, 2008). It can also be defined as an individual's self-satisfaction with all aspects of the sleep experience, including sleep efficiency, sleep latency, sleep duration, and wake after sleep onset (Nelson et al., 2022).

7.5.2 Concept of sleep: Sleep is a global public health topic. Adequate sleep can improve health and wellness. Sleep quality is multidimensions, consisting of sleep efficiency, sleep latency, sleep duration, and wake after sleep onset (Nelson et al., 2022). First, sleep efficiency refers to the ratio of the amount of total time asleep to the total time in bed (Ohayon et al., 2017). Second, Sleep disturbance can result from a combination of events that can happen before sleep and encompass disorders or problems beginning and maintaining sleep. Sleep disturbances can include parasomnias such as nightmares, sleepwalking, periodic limb movements, and automatic awakenings after falling asleep (Krystal & Edinger, 2008). Third, sleep latency refers to the time it takes for an individual to transition from the state of wakefulness to sleep and can vary from person to person. Fourth, sleep duration is the total amount of time spent asleep, excluding any arousals that may occur during the night or over a 24-hour

period (Gellman & Turner, 2013). Finally, wake after sleep onset focuses on the total amount of time spent awake after falling asleep until the final awakening (Krystal & Edinger, 2008; Ohayon et al., 2017).

7.5.3 Relationship between sleep quality and mobility among persons with hip fracture after surgery: The patients with hip fracture after surgery experienced poor sleep with multiple disruptions per night. On average, the patients slept 5.4 hours per night and experienced 5.3 awakenings (Reppas-Rindlisbacher et al., 2021). Approximately 36% of the patients had sleeping problems (Cho et al., 2020), and 78% had abnormal sleep durations (Kuo et al., 2016). Sleep and waking were related to sleep-related deterioration in executive functions that regulate walking variability and control walking ability (Clark, 2015). Additionally, performance was sensitive to the reversal of executive function (Yogev-Seligmann et al., 2008), indicating that sleep disturbances caused distress or functional impairment. As a result, sleep problems were found to be related to mobility. Agmon et al. (2016) conducted a cross-sectional study in older adults and found that sleep was associated with walking speed ($r = 0.35$, $p < 0.05$).

Observational studies have confirmed an association between sleep quality, including short sleep and sleep apnea, and increased inflammation, insulin resistance, and metabolic syndrome (Morselli et al., 2012; Punjabi & Beamer, 2007; Van Cauter, 2011). Changes in the immunology, metabolic, and endocrinologic systems have predisposed individuals to functional decline directly or through muscle strength loss (Barzilay et al., 2009; Ferrucci et al., 2002). Moreover, sleep disorders characterized by longer sleep duration (≥9 hours) were associated with decreased walking speed ($p =$

.04), while sleep disorders characterized by shorter sleep duration (≤6 hours) were associated with higher odds for mobility limitation (OR = 3.62, 95% CI = 1.40–9.37). Low sleep quality may lead to nocturnal arterial oxygen saturation and negatively affect balance, resulting in mobility limitation. Therefore, sleep disorders were independently associated with decreased walking speed and mobility limitation (Stenholm et al., 2010).

Moreover, a recent study reported circadian alterations in patients with mild cognitive impairment, associated with reduced overnight memory consolidation and affected sleep quality (Naismith et al., 2014). Sleep disturbances in both the quality and quantity of sleep and disruptions in the sleep-wake rhythm frequently occur in older adults with cognitive impairment (Cassidy-Eagle & Siebern, 2017). McKinnon et al. (2014) conducted a cross-sectional study and found that two-thirds of patients with mild cognitive impairment had poor sleep quality. 63% of patients with mild cognitive impairment demonstrated sleep disturbances, which was a significantly higher rate than patients without cognitive impairment (p = .003). Cognitive function was significantly and positively associated with sleep quality (r = .225, p = .005), and it was found to be a significant predictor that explained the variance in sleep quality (b = .422, p = .007, 3.5%). Thus, it can be concluded that sleep has direct effect on mobility, with cognitive function mediating this relationship between sleep and mobility.

7.5.4 Measurement

1) The Pittsburgh Sleep Quality Index (PSQI) is a self-rated questionnaire developed in 1989 (Buysse et al., 1989). It assesses sleep quality and disturbances over a 1-month time interval. The PSQI consists of 19 items grouped into seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep

efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. A global score is obtained by summing the scores of these seven components. The reliability and validity of the PSQI were good (Rener-Sitar et al., 2014; Tomfohr et al., 2013).

2) The Epworth Sleepiness Scale (ESS) was developed by Johns (1991). The test consists of eight situations where individuals rate their tendency to become sleepy on a scale of 0 to 3, with 0 indicating no chance of dozing and 3 indicating a high chance of dozing. The total score on the ESS ranges from 0 to 24. A total score of less than 8 is considered normal, a score of 9-12 suggests mild sleepiness, and a score of 13 or higher indicates excessive sleepiness. The ESS has been found to have good validity and reliability in previous studies. As measured by Cronbach's α, internal consistency has been reported to be 0.90 (Cho et al., 2011). Test-retest reliability, assessed by the correlation coefficient (r), has ranged from 0.78 to 0.93 (Haghighi et al., 2013). This broadly used scale allows for a quantitative assessment of sleepiness and excessive daytime sleepiness. Anyway, this measurement is suitable for follow-up treatment for those with obstructive sleep apnea more than sleep quality in patients with hip fracture.

3) Women's Health Initiative Insomnia Rating Scale (WHIIRS) is a five-item sleep disturbance scale that included questions on whether participants had trouble falling asleep over the past four weeks, woke up several times at night, woke up earlier than planned, and had trouble getting back to sleep after awakening early. The response categories for the WHIIRS are as follows: (0) no, not in the past four weeks; (1) yes, less than once per week; (2), yes, 1 to 2 times per week; (3) yes, 3 or 4 times per week; and (4) yes, 5 or more times per week. Possible scores on the WHIIRS

range from 0 to 20, with scores greater than 9 indicating a high risk for insomnia. The WHIIRS demonstrated good validity and reliability (Levine et al., 2003; Levine et al., 2005). But this tool was developed for a specific group of postmenopausal women to assess sleep quality and how often they experience certain sleep problems after menopause

Finally, in this study, the PSQI was applied to measure sleep quality as it aligns with the definition of sleep quality among patients with hip fracture after surgery. Previous studies have utilized this measurement in their research, and it has also been translated into the Thai language.

7.6 Fatigue

7.6.1 Definition: Fatigue is defined as a subjective, unpleasant symptom that cooperates total body feeling ranging from tiredness to exhaustion, creating an unrelenting overall condition that interferes with individuals' ability to function to their normal capacity (Ream & Richardson, 1996).

7.6.2 Concept of fatigue: Fatigue became a severe symptom of many chronic illnesses that could significantly impair a person's functioning. Fatigue was a subjective internal and unpleasant feeling that affected physical, mental, and emotional dimensions, resulting in an overwhelming desire to rest and sleep. It decreased motivation and interest in surroundings and reduced physical and mental work capacity (Trendall, 2000). Fatigue was multidimensions, including the physical dimension, Second, psychological dimension and social dimension.

Piper, Lindsay, and Dodd (1987) identified four dimensions within the concept of fatigue: Firstly, the perception (subjective) dimension of fatigue provided

insight into how patients experienced fatigue. This dimension was given priority over the others (Piper, 1989). The perception dimension of fatigue was identified by Piper et al. (1989) and included seven subdimensions: (1) temporal, (2) intensity/severity, (3) affective, (4) sensory, (5) evaluative, (6) associated symptoms, and (7) relief.

Secondly, the physiological dimension, which could develop due to underlying disease, disease treatment, sleep disorder or extended wakefulness, and chronic pain. Thirdly, the biochemical dimension, which could be created as a result of neuroendocrine transmitter pathway. Finally, there was the behavioral dimension.

7.6.3 Relationship between fatigue and mobility among persons with hip fracture after surgery: The experience of fatigue occurred in approximately 20-40% of patients with hip fracture after surgery. Fatigue in these patients could be attributed to blood loss, poor nutrition, and low hemoglobin levels. Fatigue has been associated with low mobility levels in previous studies (Münter et al., 2018). Fatigue was described as the feeling of tiredness or exhaustion, often accompanied by muscle weakness. It necessitated frequent periods of sitting or lying down. Fatigue was frequently reported as the cause of training session failure. Patients complained that fatigue compelled them to seek rest, thereby hindering their ability to attain their desired level of mobility (Taylor, Barelli, & Harding, 2010). Many physical capacities are affected by fatigue from patients, such as walking and dressing (Pope, 2020).

In the study conducted by Münter et al. (2018), fatigue emerged as the primary reason, affecting over 85% of patients, for their inability to achieve independent mobility. During the rehabilitation phase, fatigue posed a significant challenge for patients recovering from hip fractures. It impacted their ability to

participate fully in rehabilitation exercises and hindered their progress. Furthermore, fatigue continued to be a problem for patients even after they returned home following surgery. This persistent fatigue made it difficult for them to engage in daily activities and adhere to the recommended rehabilitation regimen. In addition, Taylor et al. (2010) conducted a study where patients perceived fatigue as a factor associated with reduced mobility. The study indicated that patients, including those with hip fractures, who experienced fatigue symptoms had lower mobility compared to non-fatigued individuals (Mueller-Schotte et al., 2016). These findings suggest that fatigue had a detrimental effect on patients' mobility, including those recovering from hip fractures.

Furthermore, the study indicated that fatigue mediated the effect of comorbidity on physical functioning, including activities such as walking and climbing stairs. The direct relationships between comorbidity and physical functioning changed from moderate to small when fatigue was included in the model. These findings suggest that fatigue served as a mediator in the relationship between comorbidity and physical functioning. Therefore, it was possible that certain comorbidities caused symptoms that influenced the level of mobility (Bennett et al., 2002). Thus, it could be stated that fatigue had a negative direct effect on mobility and acted as a mediator between comorbidity and mobility.

7.6.4 Measurement

1) The Fatigue Severity Scale (FSS) was developed by Krupp et al. (1989). It is a 9-item self-report measure. Participants rate each item on a 7-point Likert scale, ranging from 1 for "strongly disagree" to 7 for "strongly agree." The questionnaire assesses the extent to which fatigue interferes with various activities. The

total score on the questionnaire can range from a minimum of 9 to a maximum of 63. The cut-off score for abnormal fatigue on the FSS is a score of 4 or higher. The discriminant validity of the FSS, which indicated its ability to differentiate between healthy individuals and those with chronic illnesses, was found to be significant ($p < .0001$) (Whitehead, 2009). Item analysis of the FSS reported excellent internal consistency and reliability, with Cronbach's alpha values ranging from 0.88 to 0.93 (Valko et al., 2008; Whitehead, 2009). Additionally, the internal consistency of the FSS, specifically within the hip fracture population was evaluated, and Cronbach's alpha coefficient was found to be 0.91 (Folden & Tappen, 2007).

2) The Multidimensional Assessment of Fatigue (MAF) was developed by Belza et al. (1993) for the purpose of evaluating fatigue in adults with rheumatoid arthritis. The MAF is not only used in adults with rheumatoid arthritis but also in other adult populations. This multidimensional assessment tool consists of 16 self-report items that measure fatigue across five dimensions: degree of impact, severity, distress, impact on activities of daily living, and timing. The MAF consists of 14 items measured on a 100 mm visual analog scale (VAS), where respondents mark their level of fatigue on a line ranging from 0 to 100 mm. Additionally, there are 2 multiple-choice items included in the questionnaire. The maximum score on the 16-item MAF is 30. In a study conducted by Turan et al. (2007), a cutoff score of 5 or higher was used to indicate clinically significant fatigue. The MAF demonstrated excellent test-retest reliability with an intraclass correlation coefficient (ICC) of 0.98 (Bahouq et al., 2012). Construct validity in divergent validity between MAF and SF 36 r = -0.787 (Nicassio et al., 2012).

3) The Fatigue subscale of EORTC-QLQ-C30 (Fayers & Bottomley, 2002) is a 30-item quality-of-life questionnaire. The 3-item fatigue subscale has been independently validated as a separate fatigue measure. It has been noted to have a ceiling effect in advanced cancer patients and is not recommended as a single measure in this group. This scale is burdensome to the respondents, especially those with advanced cancer, due to its length (30 items).

In this study, the Fatigue severity scale (FSS) was selected to measure fatigue in patients with hip fracture after surgery for reasons. First, the FSS close association with the operational definition in this study. Secondly, this measurement was tested in different populations such as multiple sclerosis patients (Moreira et al., 2008), patients with liver cirrhosis (Rossi et al., 2017), and patients with hip fracture (Folden & Tappen, 2007; Pozzi et al., 2017). Finally, the psychometric properties of the Fatigue Severity Scale (FSS) were good, as demonstrated in a study by Impellizzeri et al. (2013). Additionally, the FSS was tested and validated in Thai persons with liver cirrhosis by Maninet (2020).

8. Summary

Persons with hip fracture were a major health problem in Thailand. Persons with hip fracture after surgery encounter with many problems that can deteriorate mobility. The overall goal of hip fracture care is to maintain or improve mobility. However, few studies were conducted to investigate specifically mobility in persons with hip fracture. In other words, there was little information regarding factors influencing mobility among persons with hip fracture.

From literature review, there were many factors that influence mobility. Based on TOUS and a significant amount of literature, the current study selected the factors that could be modified by nursing intervention including comorbidity, cognitive function, social support, pain, sleep quality, fatigue to describe and predict mobility among persons with hip fracture. Although these factors had had a strong correlation with mobility, no study investigated completely the interrelationships among these factors. The interrelationships among these factors that affect mobility are complex. Thus, the studies have focused on direct effects. Hence it is not sufficient to explain the reality of the relationships. Most of the previous studies investigated direct effects of these factors on mobility, while only a limited number of studies have focused on their indirect effects. Some interrelationships were inconsistency because of the use of different instruments to assess and gather data or conduct in different settings and population.

Understanding the factors affecting mobility among persons with hip fracture was necessary in the development of a nursing intervention to maintain or improve mobility. No study has explained whether the interrelationships among these factors and mobility existed in persons with hip fracture. However, previous studies helped to provide a hypothesized model for explaining mobility among persons with hip fracture. Therefore, in the present study, a path model was conducted to test and explain the influence of comorbidity, cognitive function, social support, pain, sleep quality, fatigue on mobility among persons with hip fracture after surgery.

CHAPTER III
METHODOLOGY

This chapter clarified the research design and method used in the current study. The research design, population, sampling technique, sample selection, measurements, protection of human subjects, data collection, and data analysis procedure were described in the following sections.

Research design

A correlational research design was used to test a proposed path model of factors contributing to mobility among persons with hip fracture after surgery. Additionally, relationships among variables were explored, including comorbidity, cognitive function, social support, pain, sleep quality, fatigue, and mobility. Gray, Grove, and Sutherland (2017, p. 98) indicated that in correlational research, the researchers measured the numerical strength of relationships among variables to discover whether a change in the value of one was likely to occur when another increased or decreased. The current study demonstrated the relationships among comorbidity, cognitive function, social support, pain, fatigue, sleep, and mobility. Moreover, it involved the specific population at a single point in time.

Population and sample

Population

The target population was the group of Thai adults and older adults with hip fracture after surgery in Thailand, and were scheduled for a visit at the outpatient department at public hospitals. Since it was impossible to recruit all persons with hip

fracture after surgery across Thailand, *a study population* was considered. The study population was the subset of the target population from whom an accessible sample was taken throughout data collection based on specific inclusion criteria that the researchers was interested in and had access to. Therefore, the population in this study consisted of Thai individuals with hip fracture after surgery and were aged 50 years old and older. These persons were originally scheduled for a clinic visit at the outpatient department at public hospitals.

Sample

The sample of this study was a group of Thai persons after hip fracture surgery and were recruited for the study based on inclusion and exclusion criteria. The inclusion criteria were as follows:

1. Aged 50 or older (persons who were older than 60 years could effectively communicate, including asking questions and providing information)
2. Experiencing hip fracture with low-energy trauma for the first time
3. Being scheduled to visit a doctor at the outpatient department during the 3rd month to the 12th month after hip fracture surgery. (The intermediate care or rehabilitation phase typically started at day 1 to 6 months after surgery (Sirindhorn National Medical Rehabilitation Institute, 2022). Furthermore, studies (Jansen, 2013), Kammerlander, 2018), and Steihaug, 2018) showed that mobility decline continue to present until 12 months after surgery).
4. Being able to communicate in Thai.
5. Willing to participate in this study.

Exclusion criteria are as follows:

1. Being presented with a life-threatening condition such as myocardial infarction.
2. Having a history of the disease which affects cognitive ability such as severe psychotic disorder, Alzheimer's disease, Dementia.
3. Being presented with high blood pressure (≥ 160/100 mmHg) before mobility assessment.
3. Being unable to walk before the hip fracture occurred.

Sample size

According to the well-known researchers Bentler and Chou (1987), the sample size ratio to the number of free parameters could be as low as 5:1 in path analysis. However, due to the rarity of the population sample, some scholars recommended a minimum sample size of at least 200 for SEM models (Kline, 2016). Therefore, the sample size in this study were 260 participants, which was deemed acceptable.

Sampling technique

Based on the general statistical assumption of the path analysis, which assumes a normal distribution of the sample (LoBiondo-Wood & Haber, 2014), a three-stage random sampling was used to obtain a probability sample of Thai persons after hip fracture surgery (Figure 3.1).

Thailand had 13 health regions (National Health Commission Office, 2015). For each health region, hospitals were classified into advanced-level (A-level), standard-level (S-level), and middle-level (M-level). Based on the memorandum of cooperation between the Royal College of Orthopedic Surgeons of Thailand and the Ministry of Public Health (The Royal College of orthopedic surgeons of Thailand,

2017), only A-level, S-level, and M-level hospitals were able to provide surgeries for Thai persons with hip fracture.

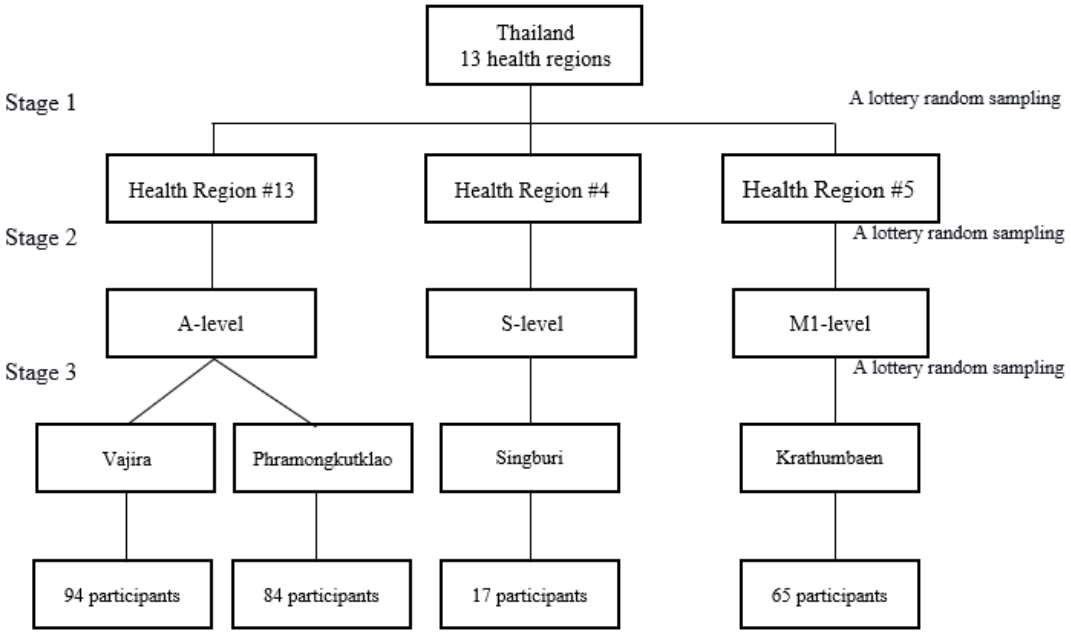


Figure 3.1 Three-stage random sampling

The sampling technique used in this study was as follows:

Stage one: Three health regions were selected from 13 health regions using a lottery random sampling without replacement. The selected health regions were the 4th health region, 5th health region, and 13th health region.

Stage two: Three hospital levels were selected from each health region using a lottery random sampling without replacement. There were four hospital levels in each health region, including A-level, S-level, M1-level, and M2-level. The M2-level had no orthopedic specialists. Therefore, the selected hospital levels were A-level from the 13th health region, S-level from the 4th health region, and M1-level from the 5th health region.

Stage three: A lottery random sampling without replacement was used. Vajira Hospital and Phramongkutklao Hospital were selected from the 13th health region. Singburi Hospital was selected from the 4th health region, and Krathumbaen Hospital was selected from the 5th health region. The researcher changed the setting from Siriraj Hospital to Phramongkutklao Hospital. This change occurred due to Siriraj Hospital's request to modify the mobility measurements. Despite the researcher's inability to fulfill the request, they determined that altering the setting would be a viable solution.

The probability proportional to sampling size was employed. Consequently, larger sampling units had a higher probability of being selected for the sample (Cheung, 2014).

In this step, the researcher contacted the officers who worked in the medical informatics center of each selected hospital. Data were requested with permission to be used for study purposes only. The total number of persons with hip fracture who visited the doctor at outpatient departments were retrieved from 2020 to 2021. The total number of persons with hip fracture was 451 participants. Due to the small number of persons, the researcher recruited the participants based on inclusion and exclusion criteria.

Table 3.1 displayed the number of persons after hip fracture surgery in each setting, along with the total sample size. The formula used to calculate the sample size was represented as follows:

$$\text{Probability number of persons in each setting} = \frac{\text{The required sample size X Number of persons with hip fracture in each setting}}{\text{Total number of persons with hip fracture from all selected settings}}$$

Table 3.1 Number of persons with hip fracture after surgery in each hospital and the total participants in this study

Hospital	**Persons with hip fracture after surgery**	**Study participants**
1. Vajira hospital	162	94
2. Phramongkutklao hospital	145	84
3. Singburi hospital	30	17
4. Krathumbaen hospital	114	65
Total	**451**	**260**

Measurements

Eight measurements were utilized to collect data in this study (Appendix D). Seven measurements were used with permission from the original developers. Furthermore, two measurements, namely the Groningen Orthopedic Social Support Scale and the de Morton Mobility Index, were translated into Thai by the researchers with original developers' permissions. The variables and their measurements were presented as follows (Table 3.2).

Table 3.2 Variables and their measurements in this study

Variables	Measurements
1. Comorbidity	Charlson Comorbidity Index
2. Cognitive function	The General Practitioner Assessment of Cognition
3. Social support	The Groningen Orthopedic Social Support Scale
4. Pain	The Numeric Rating Scale and pain frequency
5. Fatigue	The Fatigue Severity Scale
6. Sleep quality	The Pittsburgh Sleep Quality Index
7. Mobility	The de Morton Mobility Index

The content validity of the seven measurements was assessed. Content validity assessment recommended by Lynn (1986) involved selecting and inviting experts, quantifying content validity, and revising and reconstructing the measurements. The researchers set the minimum adequate score for the item-content validity index (I-CVI) at 0.78. However, an I-CVI score of 0.80 was considered excellent. The scale-content validity index (S-CVI) represented the content validity of the overall scale. Typically, a minimum S-CVI value of 0.80 to 0.90 was considered acceptable (Polit & Beck, 2017).

Five experts in caring for persons after hip fracture surgery were asked to review the content validity including one doctor, two advanced practice nurses, and two nursing instructors. Details of experts were described (Appendix E).

The experts were contacted via emails. A package containing a cover letter, a copy of the brief description of the measurements and their scoring, and a content validity report was sent to them. The standard procedure involved having the experts rate the items on a 4-point relevance scale, with options ranging from 1=not relevant; 2=somewhat relevant; 3=quite relevant; and 4=highly relevant (Polit & Beck, 2017). In addition, face validity was tested among persons after hip fracture surgery to ensure that the measurements were easily understandable and relevant to the study population.

A description of each measurement was presented in the following.

1 Demographic data form

The researcher developed the demographic data form to collect information regarding personal and illness-related characteristics of persons after hip fractures surgery.

The form comprised of self-reported questions asking about characteristics, including age, gender, marital status, education, religion, occupation, income, living arrangement, number of family members, smoking status, alcohol consumption, causes of hip fracture, family history of hip fracture, fracture type, and the operation.

2. Charlson Comorbidity Index (CCI) originally developed by Charlson et al. (1987) was based on the International Classification of Diseases (ICD) diagnosis codes. A revised version was introduced in 2008 by Charlson et al. (2008). The Thai version of the CCI used in the current study was translated into Thai by Suwanno et al. (2009).

The CCI contained 21 comorbidities. It functioned as a weighted index, indicating the risk of death within one year of hospitalization. The CCI was validated in different disease subgroups, such as intensive care, liver disease, and COVID-19 demonstrating its predictive capability for mortality (Kuswardhani et al., 2020; Myers

et al., 2009; Quach et al., 2009). For discriminant validity testing, the CCI demonstrated its capacity to discriminate between patients with and without prior myocardial infarction (Radovanovic et al., 2014). Additionally, the CCI exhibited high validity, with the discriminant validity ranging from 0.73 to 0.89 (Quan et al., 2011). Finally, the CCI was reported to have a moderate to good inter-rater reliability ranging from 0.74 to 0.945 (De Groot et al., 2003; Hall et al., 2004). The reliability of the Thai version of the CCI was assessed in patients with heart failure, and the inter-rater reliability was found to be 0.98 (Suwanno et al., 2009).

Scoring and interpretation

The CCI comprised 21 items, with each category assigned a weight ranging from 1 to 6 based on the adjusted risk of mortality or resource use. The total score was calculated by summing up the weights, resulting in a score ranging from 0 to 32. A higher score indicated a greater likelihood of predicted outcomes resulting in mortality or higher resource utilization. The Charlson comorbidity index was categorized into 0 indicated no comorbidity, scores of 1-2 indicated low comorbidity, scores of 3-4 indicated moderate comorbidity and a total score of 5 or more indicated severe comorbidities (Charlson et al., 1987).

The score of CCI	Interpretation
0	no comorbidity
1-2	low comorbidity
3-4	moderate comorbidity
≥ 5	severe comorbidities

Validity testing

In the current study, the content validity of the CCI was tested. The CCI scale-content validity index (S-CVI) was 0.96, and the item-content validity index (I-CVI) ranged from 0.80 to 1.00, which indicated excellent content validity.

Construct validity of the CCI was tested using CFA. It was found that the model demonstrated a good fit to the empirical data (Chi-Square (df = 1) = 1.275, p = 0.2588., $\chi 2$ /df = 1.275, CFI = .999, TLI = .996, RMSEA = .033, SRMR = .014). The factor loading ranged from .780 to .788. (APPENDIX H1)

Reliability testing

In the current study, the inter-rater reliability of the CCI was 0.96.

3. ***The General Practitioner Assessment of Cognition (GPCOG)*** was developed by Brodaty et al. (2002). The researcher obtained permission from the original developer to use the GPCOG measurement. The GPCOG Thai version was translated into Thai by Griffiths et al. (2013).

There were two components: a cognitive assessment conducted with the patient, and an informant questionnaire (only considered necessary if the results of the cognitive section are equivocal, i.e., score 5-8 inclusive). The GPCOG consisted of 15 questions, including 9 cognitive test items: name and address recall, time orientation, clock drawing, information, and recall. Additionally, 6 questions were responded by caregivers or informants, including short-term memory, word-finding ability, and instrumental activities of daily living. The instrument took less than 10 minutes to complete the assessment.

The GPCOG demonstrated a sensitivity of 0.85, a specificity of 0.86, a misclassification rate of 14%, and a positive predictive value of 71.4%. The GPCOG

patient section and MMSE were strongly correlated, with a Pearson's r of 0.683 (Brodaty et al., 2002). Additionally, the GPCOG Thai version was found to have construct validity using the known group technique. Significant differences ($p < .01$) in GPCOG Thai version scores were observed between healthy older people and older people with dementia. (Griffiths et al., 2013). In terms of content validity and concurrent validity, there was a significant correlation between the scores of The GPCOG Thai version and the Mini-Mental State Examination (MMSE) Thai version (2002) in the patient section, with a correlation coefficient of 0.87 ($p < 0.01$) (Griffiths et al., 2013).

The reliability of the GPCOG cognitive test score for the patient section was high, with interrater intraclass correlation coefficients (ICC) of 0.75, test-retest ICC of 0.87, and internal consistency (Cronbach's alpha) of 0.84. The reliability of the GPCOG informant section was satisfactory, with interrater ICC of 0.56, test-retest ICC of 0.84, and internal consistency (Cronbach's alpha) of 0.80 (Brodaty et al., 2002). Additionally, the reliability of the GPCOG Thai version was very high, with a KR-20 coefficient of 0.80 in the patient section and a KR-20 coefficient of 0.83 in the informant section (Griffiths et al., 2013).

Scoring and interpretation (Brodaty et al. 2002, 2004).

For patients' section, the GPCOG cognitive test score was the total number of correct responses, with a maximum score of 9. Therefore, the score interpretation was as follows: 0-4 indicated that a person might have a potential of cognitive impairment and standard medical investigation was needed; 5-8 suggested the possibility of cognitive impairment and further information and informant interview needed; and 9 indicated no significant cognitive impairment. However, the GPCOG may overestimate

sensitivity in detecting cognitive decline, and the level of education can influence the GPCOG rating (Brodaty et al., 2004).

The informant interview test score had a maximum total score of 6. Therefore, the score interpretation was as follows: 0-3 indicated cognitive impairment, 4-6 indicated no significant cognitive impairment or higher scores indicated better cognitive function.

Validity testing

In the current study, the total CVI of the GPCOG was 0.97, and item CVI ranged from 0.80 to 1.00.

Construct validity of the GPCOG was tested using CFA. It was found that the model demonstrated a good fit to the empirical data (χ^2 (df = 1) = 1.547, p = .2136, χ^2/df = 1.547, RMSEA = .046, CFI = .999, TLI = .991, SRMR = .010). The factor loading ranged from .548 to .838. (APPENDIX H2)

Reliability testing

The present study tested the internal consistency of the GPCOG using the Kuder-Richardson 20 (KR-20) coefficient. The KR-20 of the GPCOG was 0.86.

4. The Groningen Orthopedic Social Support Scale (GOSSS) was developed by Van Den Akker-Scheek et al. (2004). It was used to measure perceived social support among older people, and orthopedic patients after total hip or knee arthroplasty. The scale consisted of 12 items, which are divided into two sub-scales: perceived social support (7 items) and instrumental support (5 items).

The original version of the GOSSS produced construct validity analysis using factor analysis, which resulted in two factors. The first factor (perceived social support) accounted for 48.3% of the explained variance, while the second (instrumental support)

accounted for 12.1%. Together, these two factors accounted for 60.4% of the explained variance. The evidence supported the validity of the GOSSS, with a moderate Pearson's correlation coefficient of 0.61 ($p < 0.001$) between the two subscales. Concurrent validity was considered satisfactory, with a Pearson's correlation of 0.72 ($p < 0.001$) between the GOSSS and the Social Support List 12-Interactions (Van Den Akker-Scheek et. al., 2004)

The reliability of the GOSSS was found to be satisfactory, with internal consistency calculated using Cronbach's alpha. For the entire questionnaire, the internal consistency was 0.89. However, when calculated separately for the two subscales, the internal consistency was 0.86 for the Perceived Social Support subscale and 0.83 for the Instrumental Support subscale (Van Den Akker-Scheek et al., 2004).

Scoring and interpretation

The GOSSS was a 12-item scale. Each item was rated on a 4-point Likert scale, ranging from 1 point (never/rarely), 2 points (now and then), 3 points (regularly), to 4 points (often). The total score was calculated by summing the responses to all 12 items, resulting in a range of scores from 12 to 48. A higher GOSSS score indicated that the patient perceived high social support, while a lower score indicated a perception of low social support.

Measurement translation of the GOSSS

In the current study, the original GOSSS was translated into the Thai using the forward-back translation method described by Sperber et al. (1994).

Forward translation: Two bilingual nursing faculty translated the original version of the measurement into Thai. These individuals were well-known in Thai and English cultures. The researchers then compared both translated versions, checking for

similarities and differences. Discussions were held among research team, and a final version of the Thai measurement was drafted.

Backward translation: Two bilingual translators from Faculty of Art, Chulalongkorn University, translated the instrument from Thai into English.

Third: The original English version of the measurement was compared with the back-translated English version. The research team examined all the items, ensuring the language comparability and interpretability similarity.

Fourth: The research team assessed the accuracy of the translated Thai version, ensuring appropriate wording and clarification. This process continued until a final Thai version was reached through consensus.

Psychometric properties testing

Validity testing

In the current study, content validity testing of the GOSSS was conducted. The I-CVI for all the items was 1.00. No item was removed or revised. The total CVI of the GOSSS was 1.00, which indicated excellent content validity.

Construct validity of the GOSSS was tested using CFA yielding two subscales with adequately fit indices: χ^2 (df=1) = 1.023; p = 0.3117; χ^2 /df = 1.023; CFI = 1.000; TLI = 1.000; RMSEA = .009; and SRMR = .016. Factor loading of the perceived social support and instrumental support were .802 and .808, respectively. (APPENDIX H3)

Reliability testing

In the current study, the Cronbach's alpha coefficient of the GOSSS was 0.85.

5. The Fatigue Severity Scale (FSS) was designed by Krupp et al. (1989). It was used to assess fatigue severity among patients with hip fracture (Folden & Tappen,

2007; Pozzi et al., 2017). The FSS consisted of a 9-item statement that measured fatigue experienced in the previous seven days. Each item was ranked on a scale from 1 point (very strongly disagree), 2 points (strongly disagree), 3 points (mildly disagree), 4 points (neutral), 5 points (mildly agree), 6 points (strongly agree), to 7 points (very strongly agree). The Thai version of the FSS was translated into Thai by Sawasdee, Preechawoong, & Jitpanya (2017).

Previous studies reported the results of validity testing of the FSS. For example, factor analyses of the FSS have verified the presence of one factor (Lerdal et al., 2005; Kleinman et al., 2000). Additionally, convergent validity was tested, and the FSS demonstrated strong correlations with other fatigue scales (ranging from .41 to .94) (Krupp et al., 1989; Kleinman et al., 2000; Gencay-Can & Can, 2012). The FSS also demonstrated discriminant validity by differentiating between healthy individuals and those with chronic illnesses (Lerdal et al., 2005; Valko et al., 2008). Similarly, the FSS was able to distinguish scores from different groups ($p = 0.009$) and showed a correlation with the Modified Fatigue Impact Scale ($r = 0.606$, $p = 0.002$) (Rossi et al., 2017).

Many studies have demonstrated high internal consistency in the FSS, as examined with Cronbach's alpha, with values ranging from 0.81 to 0.94 (Krupp et al., 1989; Kleinman et al., 2000; Mattsson et al., 2008). Folden and Tappen (2007) reported an internal consistency of 0.91 for the FSS in patients with hip fracture. Rossi et al. (2017) also reported good psychometric properties of the FSS, with a Cronbach's alpha of 0.93 and an Intraclass Correlation Coefficient of 0.905 (95% CI: 0.813-0.952). The FSS Thai version showed internal consistency, analyzed with Cronbach's alpha of 0.92 (Sawasdee et al., 2017).

Scoring and interpretation

Each item of the FSS was scored on a 7-point Likert scale, with one point indicating strong disagreement and seven points indicating strong agreement. The scale assessed the level of agreement with each statement. The total score was obtained by summing the scores of all nine items. The total scores ranged from 9 to 63. The cutoff point for indicating fatigue on the scale was set at four or higher (Krupp et al., 1989).

Psychometric properties testing

Validity testing

In the current study, the validity of the FSS was assessed, and the content validity index (CVI) for the total FSS was reported as 0.98, indicating excellent content validity. The item-CVI for all the items ranged from 0.80 to 1.00.

Reliability testing

In the current study, Cronbach's alpha coefficient of FSS was 0.88

6. The Pittsburgh Sleep Quality Index (PSQI) The Pittsburgh Sleep Quality Index (PSQI) was developed by Buysse et al. (1989) to assess sleep quality in clinical populations.

The PSQI was a standardized self-administered questionnaire that assesses overall sleep quality over one month. It consisted of 19 items organized into seven components, including 1) subjective sleep quality, 2) sleep latency, 3) sleep duration, 4) habitual sleep efficiency, 5) sleep disturbances, 6) use of sleeping medication, and 7) daytime dysfunction. Each item was weighed on a four-point Likert scale. Each item was rated from 0 points (very good), 1 point (fairly good), 2 points (fairly bad), and 3 points (very bad). The Thai version of the PSQI was translated into Thai by Jirapramukpitak and Tanchaiswad (1994).

Previous studies reported the results of validity testing of the PSQI. The PSQI was found to have adequate content validity. In addition, convergent validity was tested, and it was found that the PSQI was strongly correlated with related sleep constructs (r = 0.31-0.80) (Mollayeva et al., 2016). Magee et al. (2008) evaluated the factor structure of the PSQI using confirmatory factor analysis. They found the goodness of fit indexes that indicated a good fit between the hypothesized model and the observed data. The three-factor model was tested with the use of the sleeping medication component being removed. Nicassio et al. (2014) evaluated the factor structure of the PSQI using confirmatory factor analysis. They found the goodness of fit indexes that indicated a good fit between the hypothesized model and the observed data, the three factors were tested, but Cronbach's alpha was unacceptable (Cronbach's alpha = 0.58). The original study showed a sensitivity of 89.6% (Buysse et al., 1989). The Thai version of PSQI scored greater than five and yielded a diagnostic sensitivity of 77.8 to 89.6% and a specificity of 86.5 to 93.3% in distinguishing between good and poor sleepers (Jirapramukpitak & Tanchaiswad, 1997; Sitasuwan et al., 2014). The PSQI had seven component scores concerning multiple sleep quality aspects (Mollayeva et al., 2016).

Previously, Mollayeva et al. (2016) conducted a meta-analysis and reported that nine studies contained Cronbach's alpha coefficients greater than or equal to 0.70. Test-retest reliability ranged from 0.58 to 0.90. The Thai-PSQI revealed excellent internal consistency (Cronbach's alpha = 0.84) and test-retest reliability (intraclass correlation coefficient = 0.89). An analysis of covariance demonstrated a significant difference in Thai-PSQI global scores between good and bad sleepers ($p < 0.001$). Furthermore, the PSQI had internal consistency and a reliability coefficient (Cronbach's alpha) of 0.61 (Sawasdee et al., 2017).

Scoring and interpretation

An overall sleep quality score was calculated by summing the score of each item. The total score ranged from 0 to 21, with 0 indicating no difficulty and 21 indicating severe difficulties. The PSQI cut-off point score of ≥ 5 was considered indicative of "poor sleep quality" (Buysse et al., 1989).

Psychometric properties testing

Validity testing

In the current study, I-CVI for all the items was 1.00. Construct validity was tested using CFA. The findings of CFA illustrated that 19 items remained in the PSQI forming 7 factors ($\chi 2$ (df = 12) = 17.517, p > .05; $\chi 2$/df = 1.459, RMSEA = .042, CFI = .994, TLI = .989, SRMR = .025). The factor loading for each component ranged from .646 to .815. (APPENDIX H4)

Reliability testing

In the current study, the Cronbach's alpha coefficient of the PSQI was 0.84.

7. The numeric rating scale (NRS-11) was developed by McCaffery & Pasero (1999). The NRS was a unidimensional measure of pain intensity in adults and older adults. A horizontal scale with 1 item an 11-rating scales reflected the intensity of their pain. The patient was asked to report a number or mark the scale. The NRS has been used extensively to assess pain in people across various disorders and age groups, including older populations, because it was easy to use, and there was better responsiveness than visual analog and verbal rating scales (Hjermstad et al., 2011). In addition, pain frequency was also assessed with the question, "Within one week, how often did the pain occur?"

The validity of the NRS was well established. It was found to have excellent validity. For construct validity, the NRS was highly correlated to the Visual Analogue Scale (VAS) in patients with rheumatic and other chronic pain conditions correlations ranging from 0.86 to 0.9 (Hawker et al., 2011). Moreover, Alghadir et al. (2018) showed a good-to-excellent correlation between the VAS and NRS (r = 0.941). Furthermore, a correlation between NRS and verbal rating scale (VRS) scores was r = 0.925.

The NRS demonstrated excellent test-retest reliability. Previously, Ferraz et al. (1990) reported high test-retest reliability in literate and illiterate patients with rheumatoid arthritis (r = 0.96 and 0.95, respectively) before and after medical consultation. Moreover, Alghadir et al. (2018) reported that the intraclass correlation coefficient of the NRS was 0.95. The minimum detectable change (MDC) of the NRS for the measurement of OA knee pain was 1.33, and the standard error of measurement (SEM) was 0.48.

Scoring and interpretation

An 11-point numeric scale (NRS 11) was used, with 0 representing "no pain" and 10 representing the "worst possible pain" to interpret the level of pain. This study categorized the pain severity level into four levels (no pain, mild, moderate, severe, and worst possible pain) (Pasero & McCaffery, 2011). For pain frequency, 0 indicated no pain frequency, and a high score indicated high pain frequency.

Scores of pain severity	Interpretation
0	No pain
1-3	Mild pain
4-6	Moderate pain
7-9	Severe pain
10	Worst possible pain

Psychometric properties testing

Validity testing

In the current study, the total CVI of the NRS 1.00, which indicated excellent content validity. Item CVI was 1.00.

Reliability testing

In the current study, the test-retest reliability of the NRS and pain frequency was 0.89.

8. The de Morton Mobility Index (DEMMI)

The de Morton Mobility Index (DEMMI) was developed by de Morton et al. (2008). The DEMMI included bed mobility, lying to sit, sitting, standing, balance, walking (ability and distance), picking up objects, and jumping. Additionally, 15 items were selected as representatives of mobility. The DEMMI was used in various populations, including patients with hip fracture (Davenport & de Morton, 2011; de Morton et al., 2013; de Morton & Lane, 2010; Hulsbæk et al., 2019).

Many studies have reported the results of validity testing of the DEMMI. For instance, de Morton et al. (2008) presented that convergent validity was tested and found that the DEMMI correlated strongly with other mobility scales (r = 0.76 to 0.92). The DEMMI revealed evidence of convergent validity ranging from 0.50 to 0.81 (de Morton & Lane, 2010). The DEMMI showed good convergent validity with a six-minute walk test (Spearman's rho = 0.76) and Barthel Index (Spearman's rho = 0.60) (de Morton et al., 2013). Hulsbæk et al. (2019) reported a strong positive correlation between the DEMMI and Cumulated Ambulation Score (CAS) (r = 0.76, 95% CI: 0.69-0.81) since both measurements measured the construct of "mobility." Moreover, the DEMMI showed discriminant validity with other scales (r = 0.04 to 0.25) (de Morton et al., 2008; de Morton & Lane, 2010).

The internal consistency, as analyzed with the Minimal Detectable Change (MDC90), was 8.90 (95% CI 6.3-12.7) (de Morton et al., 2008). The DEMMI showed reliable results (Pearson's r = 0.87, 95% CI 0.76-0.94). The inter-rater reliability was excellent, with intra-class correlation coefficient of 0.94 (95% confidence interval: 0.88-0.97) (Braun et al., 2015). The Cronbach's alpha was 0.85-0.92 (Braun et al., 2015; Braun et al., 2018; New et al., 2017).

Scoring and interpretation

The DEMMI consisted of 15 items, each weighted on a two and three-point Likert scale. The item was rated from 0 points (unable), 1 point (able, minimal assistance, and supervision), and 2 points (independent). An overall mobility score was calculated by summing the score of each item. The raw score ranged from 0 to 19, with 0 indicating dependent mobility and 19 indicating independent mobility. The transformed or converted scale values to interval scores for the DEMMI score ranged

from 0 to 100, with 0 indicating poor mobility and 100 indicating independent mobility (de Morton et al., 2008).

Measurements translation of the DEMMI

Authorization for the translation and utilization of the DEMMI was approved by the measurements' developer, Dr. Natalie A de Morton, Professor Jennifer L Keating, and Dr. Megan Davidson. The original DEMMI was translated into the Thai using the forward-back translation methods of Sperber et al. (1994), as follows:

Forward translation: Two bilingual nursing faculty translated the original version of the measurement into Thai. These individuals were well-known in Thai and English cultures. The researchers then compared both translated versions, checking for similarities and differences. Discussions were held among research team, and a final version of the Thai measurement was drafted.

Backward translation: Two bilingual translators from Faculty of Art, Chulalongkorn University, translated the instrument from Thai into English.

Third: The original English version of the measurement was compared with the back-translated English version. The research team examined all the items, ensuring the language comparability and interpretability similarity.

Fourth: The research team assessed the accuracy of the translated Thai version, ensuring appropriate wording and clarification. This process continued until a final Thai version was reached through consensus.

Psychometric properties testing

Validity testing

In the current study, the total CVI of the DEMMI was 0.96 which indicated excellent content validity. Item-CVI for all of the items ranged from 0.80-1.00.

Concerning construct validity, the DEMMI was tested by the confirmatory factor analysis (CFA). It was seen that the model indicated a good fit to the empirical data ($\chi 2$ (df = 4) = 5.101, p = .2771, $\chi 2$/df = 1.275, RMSEA = .033, CFI = .998, TLI = .995, SRMR = .016). The factor loading for each factor ranged from .699 to .784 (APPENDIX H5)

Reliability testing

In the current study, the Inter-rater reliability of the DEMMI was 0.98.

To summarize, 7 measurements were employed. All measurements and their psychometric properties were as follows (Table 3.3).

Table 3.3 Psychometric properties of the measurements (N = 260)

	Items	Reliability
Charlson Comorbidity Index	21	Inter-rater = 0.96 (N = 30)
General Practitioner Assessment of Cognitive	15	Kuder-Richardson (KR 20) = 0.88
Groningen Orthopedic Social Support Scale	12	Cronbach's alpha = 0.87
Numerical Rating Scale and pain frequency	2	Test-retest = 0.89 (N = 30)
Fatigue Severity Scale	9	Cronbach's alpha = 0.88
Pittsburgh Sleep Quality Index	19	Cronbach's alpha = 0.84
de Morton Mobility Index	15	Inter-rater = 0.96 (N = 30)

Ethical issues

The research proposal was submitted to the IRB of Chulalongkorn University and the IRB of four hospital settings.

1. The Research Ethics Review Committee for Research Involving Human Research Participants, Group 1, Chulalongkorn University. COA. No 137/65
2. The Institutional Review Board of the Faculty of Medicine Vajira Hospital. COA. 140/2565
3. The Human Research Ethics Committee of Krathumbaen Hospital. No. 009/65
4. The Human Research Ethics Committee of Singburi Hospital. EC.No 10/2022
5. The Institutional Review Board, Royal Thai Army Medical Department. No. IRBRTA.1644/2022

The written and verbal informed consent was obtained in Thai for data gathering. In addition, the participants were informed that they could withdraw from the study at any time without any impact on the medical services from healthcare providers.

Data collection procedure

After IRB approval, the researcher clarified the study purpose, data collection procedures, expected outcomes, and study benefits to doctors and nurses in each selected setting. Next, the researcher requested cooperation from nurses in selecting participants who met the inclusion criteria. The nurses then introduced the researcher to the participants. Once potential participants were identified, the researcher

approached each selected participant individually. The participants were then invited to be interviewed in a prepared and quiet room. The researcher introduced herself, established rapport, explained the objectives, and emphasized the contributions the participants would make. The researcher also discussed the confidentiality and anonymity of the information provided. Finally, after the participants agreed to participate in the study, they were asked to sign a consent form and were interviewed. The interview process took approximately 30 to 45 minutes to completed.

Data analysis

The data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 26.0 for Windows and Mplus software version 7 (Muthén et al., 2016). Details about data analysis were as follows:

1. All data was double-checked by the researcher and the advisor to ensure the accuracy of the data file.

2. Missing data and outliers were investigated. A box plot was used to detect univariate outlier for the outliers. For multivariate analysis, the outliers were detected by Mahalanobis distance. Mahalanobis distance was distributed as a Chi-square ($\chi 2$) variable with a degree of freedom (df) equal to the number of variables (Hair, Black, Babin, & Anderson, 2014) (APPENDIX I)

3. To describe participants' general characteristics, illness–related characteristics, and other major variables in the study, descriptive statistics such as frequency, percentage, mean, standard deviation, minimum value, maximum value, range of score, and median were used.

4. Assumptions of path analysis were tested. (APPENDIX J)

4.1 Kurtosis, and skewness were obtained to confirm the normality of the major variables constituting the study model.

4.2 Multicollinearity testing: In this study, convergent validity, and discriminant validity were used to examine multivariate collinearity. Convergent validity was assessed by estimating the mean of the extracted variance (AVE) ranged from 0.42 to 0.61. AVE should be 0.50 or greater to suggest adequate convergent validity (Hait et al., 2019). One constructs (comorbidity) was below the minimum acceptable value of 0.50. However, when considering the composite reliability (CR), the minimum value for this construct measurements is 0.70 could acceptable (Hair et al., 2019). The discriminant validity ranged from 0.65 to 0.78, well higher than the correlation between variables. The variables correlation in this study ranged from -.148 to .603. Thus, there was no evidence of multicollinearity in this study.

5. Path analysis was used to analyze direct and indirect effect paths throughout the model while testing the overall fit of the data to the hypothesized model (Byrne, 2016).

The Mplus software was used to estimate the parameters of the path model associated with the study's specific aims. Then, the overall model-fit-index was investigated to determine how well the hypothesized model fit the existing data. According to Muthén et al. (2016), statistical criteria could be used to evaluate the overall model-fit-index, so the researcher determined some statistical criteria to evaluate the hypothesized model as follows:

5.1 The first set of the goodness of fit statistics was the Chi-square (χ^2) value. The χ^2 test statistics was used in hypothesis testing to evaluate the appropriateness of the hypothesized model. A non-significant $\chi 2$ value at a level with a

corresponding p-value > .05, and preferably a value close to 1.00, was suggested for the hypothesized model to indicate a good fit to the data. However, chi-square was notably sensitive to sample size. Therefore, the ratio χ^2/df should have been as small as possible for a good model fit. A ratio between 2 and 3 would have indicated a "good" or "acceptable" data-model fit, respectively. Thus, the first set criteria for testing goodness of fit statistics that χ^2 was non-significant ($p > .05$), and χ^2/df should have been less than 5 (Khine, 2013).

5.2 The second set of the goodness of fit statistics was based on the difference between the sample covariance matrix and the model-implied covariance matrix. The indices were descriptive measures of overall model fit: Root Mean Square Error of Approximation (RMSEA) and Standardized Root Mean Square Residual (SRMR). RMSEA values ≤ .06 were considered a good fit model. SRMR values ≤ .08 were considered a good fit model (Khine, 2013).

5.3 The following criteria were used for the last set of goodness of fit statistics. A Comparative Fit Index (CFI) was assessed to indicate the extent to which the theoretical model better fit the data compared to a base model where all constructs were constrained to correlate with one another. A CFI value greater than 0.95 indicated a good model fit, while a value of 0.90 indicated adequate fit. Tucker-Lewis Index (TLI) values were also considered, with values greater than 0.95 indicating good model fit.

5.4 In this study, once it was determined that the hypothesized model fitted the data, the path coefficients and R^2 values were calculated, and the effects of the independent variables on the dependent variable were determined to answer the research questions and test the hypotheses. The goodness-of-fit indices were used to determine whether the model adequately fit the data.

CHAPTER IV
RESULTS

Descriptive characteristics of the participants

Demographic characteristics

Two hundred sixty participants after 3rd to 12th month of hip fracture surgery participated in this study. Data were collected between July 2022 and February 2023. The out-patient participants were recruited from four general public hospitals across three health regions of Thailand, including the 4th, 5th, and 13th health regions. There was no missing data in the current study.

The finding revealed that the age of the participants ranged from 52 to 97 years; mean age of the participants equaled to 76 years (SD 9.47); and median was 77 years. Most of the participants were female (79.6 %). Almost half of them were widowed (43.1%); being Buddhist (98.8 %); completing elementary school (60.4 %); and being unemployed (78.1 %). The monthly income of the participants ranged from ≤ 15,000 to 45,001 Thai Baht. Regarding living arrangements, 45% of them lived with their children and 43 % lived with their relatives (Table 4.1).

Table 4.1 Demographic characteristics of the participants (N = 260)

Characteristics	n	%
Age (years) * (Mean=76, SD 9.47, Min=52, Max=97)		
- 50-59 (adult)	18	6.9
- 60-69 (young-old)	49	18.8
- 70-79 (middle-old)	81	31.2
- 80 and older (oldest-old)	112	43.1
Gender		
- Male	53	20.4
- Female	207	79.6
Marital status		
- Single	41	15.8
- Married	89	34.2
- Separated	6	2.3
- Widow/Widower	112	43.1
- Divorced	12	4.6
Religion		
- Buddhist	257	98.8
- Christian	2	0.8
- Muslim	1	0.4
Education attainment		
- No formal education	33	12.7

Characteristics	n	%
- Lower than bachelor degree	206	79.2
- Bachelor degree and higher	21	8.1
Occupation		
- Unemployed	203	78.1
- Retired	18	6.9
- Employee	14	5.4
- Housewife	14	5.4
- Merchant	5	1.9
- Government officer/ government employee	3	1.2
- Private officer	2	0.8
- Business owner	1	0.4
Living condition		
- With family members	251	96.5
- With significant others (not family members)	9	3.5

Note: * Ref: Department of Health (2022)

Clinical characteristics of the participants

The participants 's body mass index (BMI) ranged from 13.20 to 32.87 kg/m^2 with mean BMI of 22.08 kg/m^2 (SD = 3.90). Time after surgery mean was 6.73 months (SD 3.52). The average length of hospital stay was 8.75 days (SD 3.74). The intracapsular hip fracture was the predominant type of fracture (59.6 %). Approximately 61.9 % of the participants after hip arthroplasty. Almost of the participants (94.6 %) had no family history of hip fractures.

Table 4.2 Clinical characteristics of the participants (N = 260)

Medical history	n	%
BMI (kg/m^2) * (Mean=22.08, SD 3.90 Min=13.20, Max=32.87)		
- < 18.5 (underweight range)	47	18.1
- 18.5-24.9 (healthy weight range)	155	59.6
- 25 - 29.9 (overweight range)	52	20
- 30 – 39.9 (obese range)	6	2.3
Duration after surgery		
- 3-5 months	126	48.5
- 6-8 months	43	16.5
- 9-12 months	91	35.0
Types of fractures		
- Neck femur fracture	155	59.6
- Intertrochanteric fracture	104	40.0
- Subtrochanteric fracture	1	0.4

Note: * Ref: WHO (2023)

Medical history	n	%
Operation		
- Total hip arthroplasty	31	11.9
- Hemi hip arthroplasty	130	50.0
- Internal fixation	99	38.1
Cause of hip fractures		
Fall		
- Slipping	134	51.5
- Tripping	69	26.5
- Fall from chair/bed	18	6.9
- Loss of balance	7	2.7
- Being attack from person/dog	7	2.7
Fainting	15	5.8
Leg weakness	10	3.9
Length of hospital stay (days) (Mean=8.75, SD=3.74, Min=3, Max=26)		
- 1-7 days	109	41.9
- 8-14 days	130	50
- 15-30 days	21	8.1

Findings of the study

1. Mobility of the participants after hip fracture surgery

Measured by the Parker Mobility Score (PMS), Table 4.3 showed that at the time of post hip fracture surgery, the percentages of the participants who able to walk during shopping decreased to 23.1 % (compared with pre-fracture 70.4 %). The percentage of the participants able to walk outdoors also decreased to 21.9 % (compared with pre-fracture 23.1 %). In contrast, the percentage of the participants who were only able to walk indoors increased to 55 % (compared with pre-fracture 6.5 %).

Before hip fracture the percentages of the participants who were able to walk independently without any aids were 71.5 %. After hip fracture surgery the percentages dropped to 16.9 %. The percentages of the participants who were able to walk with the use of a walking aid were 28.1% when compared with 79.6% post hip fracture surgery. Moreover, after hip fracture surgery 2.7 % of the participants were able to move using wheelchair, and 0.8 % of them were bedridden (Table 4.3)

Table 4.3 Description of mobility of the participants (N = 260)

Description of mobility	n	%
Pre-fracture mobility (measured by the Parker Mobility Scale)		
- Able to get about the house (indoor walking)	17	6.5
- Able to get out of the house (outdoor walking)	60	23.1
- Able to go shopping (walking during shopping)	183	70.4

Description of mobility	n	%
Post-fracture mobility (measured by the Parker Mobility Scale)		
- Able to get about the house (indoor walking)	143	55.0
- Able to get out of the house (outdoor walking)	57	21.9
- Able to go shopping (walking during shopping)	60	23.1
Walking aids used before fracture		
- Not at all	186	71.5
- Cane	50	19.2
- Walker	23	8.9
- Walker with help from another person	1	0.4
Walking aids used after fracture		
- Not at all	44	16.9
- Cane	64	24.6
- Crutches	8	3.1
- Walker	123	47.3
- Walker with help from another person	12	4.6
- Wheelchair	7	2.7
- Bed ridden	2	.8

Concerning mobility measured by the DEMMI, total raw score of mobility ranged from 1 to 18 with mean of 47.51 (SD = 15.63). In the current study, it was found that the mean raw score of five hierarchies was categorized as including bed ($\bar{x}$ 3.73 SD 0.58), chair ($\bar{x}$ 2.93 SD 0.87), static balance ($\bar{x}$ 1.70 SD 1.06), walking ($\bar{x}$ 1.98 SD 1.22), and dynamic balance ($\bar{x}$ 0.75 SD 0.88), respectively (Table 4.4).

Table 4.4 Possible range, actual range, mean, standard deviation of mobility score in the participants (N = 260)

Mobility	**Possible range**	**Actual range**	**Mean**	**SD**
Bed (3 items)	0-4	1-4	3.73	0.58
Chair (3 items)	0-4	0-4	2.93	0.87
Static balance (4 items)	0-4	0-4	1.70	1.06
Walking (2 items)	0-4	0-4	1.98	1.22
Dynamic balance (3 items)	0-3	0-3	0.75	0.88
Total raw score of the participants	0-19	1-18	11.09	3.91
DEMMI score (converted)	0-100	8-85	47.51	15.63

For the DEMMI, details of 15 items were presented. *First,* the bed, most participants (95.8 %) could perform bridge position, 98.1 % were able to roll onto side, and 79.6% independently lying to sitting. *Second*, regarding the chair, most participants (98.1 %) could achieve sit unsupported in a chair, 68.8 % could perform independent sit-to-stand from a chair with arms, and only 29.2 % could sit to stand from a chair without using arms, while 70.8 % were unable to complete. *Third,* the static balance found that 79.6 % of the participants could finish standing unsupported. 70.4 % of the participants could finish standing feet together. Only 13.1 % of the participants could finish standing on their toes. Moreover, only 6.9 % of the participants could complete tandem stands with closed eyes.

Fourth, walking, only 15.4 % could walk independently without gait aids. At the same time, 84.6 % of the participants could not walk independently (18.8 % could not walk or needed minimal assistance or supervision, and 65. 8% walked with gait aids). The mean distance walked was 21.24 meters (SD = 18.92 range 0 to 50). 28.1 % of the participants could walk a distance of less than 5 meters. 43.8 % of the participants could walk a distance of 10 to 20. 28.1 % of the participants could complete the walking distance of 50 meters. *Lastly*, the dynamic balance showed that 34.6 % of the participants could take the walks four steps backward. 37.7 % of the participants could pick up a pen from the floor, and only 2.7 % could take a jump (Table 4.5).

Table 4.5: Frequency and percentage of the participants categorized by DEMMI items (N=260)

DEMMI items	n	%
Bed		
Bridge (0-1)		
- unable	11	4.2
- able	249	95.8
Roll onto side (0-1)		
- unable	5	1.9
- able	255	98.1
Lying to sitting (0-2)		
- min assist/supervision	53	20.4
- independent	207	79.6
Chair		
Sit unsupported in chair (0-1)		
- unable	5	1.9
- 10 sec	255	98.1
Sit to stand from chair (with arm) (0-2)		
- unable	9	3.5
- min assist/supervision	72	27.7

DEMMI items	n	%
- independent	179	68.8
Sit to stand without using arm (0-1)		
- unable	184	70.8
- able	76	29.2
Statistic balance		
Stand unsupported (0-1)		
- unable	53	20.4
- 10 sec	207	79.6
Stand feet together (0-1)		
- unable	77	29.6
- 10 sec	183	70.4
Stand on toes (0-1)		
- unable	226	86.9
- 10 sec	34	13.1
Tandem stand with eyes closed (0-1)		
- unable	242	93.1
- 10 sec	18	6.9
Walking		
Walking distance +/- gait aids (0-2)		

DEMMI items	n	%
- unable/5 m	73	28.1
- 10 m/20 m	114	43.8
- 50 m	73	28.1
Walking independence (0-2)		
- unable/min assist/supervision	49	18.8
- independent with gait aid	171	65.8
- independent without gait aid	40	15.4
Dynamic balance		
Walks 4 steps backwards (0-1)		
- unable	170	65.4
- able	90	34.6
Pick up pen from floor (0-1)		
- unable	162	62.3
- able	98	37.7
Jump (0-1)		
- unable	253	97.3
- able	7	2.7

The de Morton Mobility Index (DEMMI) investigated mobility in the participants after hip fractures surgery. Concerning age and mobility, the mean DEMMI scores of ages 50-59 ($\bar{x}$ = 62.39, SD = 16.54) were higher than ages 60-69 ($\bar{x}$ = 59.10, SD = 15.05), age 70-79 ($\bar{x}$ = 46.51, SD = 14.86), and age above 80 ($\bar{x}$ = 40.77, SD = 11.36), respectively. The mean DEMMI scores of males higher than women were found in this study ($\bar{x}$ = 55.34, SD = 18.02 vs $\bar{x}$ = 45.50, SD = 14.33). The mean DEMMI scores in the participants with extracapsular fracture (intertrochanteric and subtrochanteric fracture) were lower than those with intracapsular fracture (femur neck fracture) ($\bar{x}$ = 44.05, SD = 15.91 vs. $\bar{x}$ = 49.85, SD = 15.03). Regarding the surgical treatment, the mean DEMMI scores in the participants after hip arthroplasty were higher than those who after internal fixation (total hip arthroplasty $\bar{x}$ = 55.10, SD = 14.73 vs. hemi hip arthroplasty $\bar{x}$ = 47.34, SD = 14.71 vs. internal fixation $\bar{x}$ = 45.35, SD = 16.48 (Table 4.6)

Table 4.6 Frequency and percentage of participants' DEMMI score categorized by age, gender, types of fractures, and surgery (N=260)

The participants' characteristics	DEMMI score	
	Mean (SD)	**n (%)**
Age		
- 50-59	62.39 (16.54)	18 (6.9)
- 60-69	59.10 (15.05)	49 (18.8)
- 70-79	46.51 (14.86)	81 (31.2)
- 80 and older	40.77 (11.36)	112 (43.1)
Gender		
- Male	55.34 (18.02)	53 20.4)
- Female	45.50 (14.33)	207 (79.6)
Types of fractures		
- Intracapsular fracture	49.85 (15.03)	1559.6)
- Extracapsular fracture	44.05 (15.91)	105 (40.4)
Surgery		
- Total hip arthroplasty	55.10 (14.73)	31 11.9)
- Hemi hip arthroplasty	47.34 (14.71)	1300)
- Internal fixation	45.35 (16.48)	99 (38.1)

2. Descriptive characteristic of the factors

There were six independent variables in this study including comorbidity, cognitive function, social support, pain, fatigue, and sleep. The details about the characteristics of each study variable were shown as follows.

Comorbidity

Regarding comorbidities, the mean Charlson Comorbidity Index (CCI) score was 2.15 SD 1.67 (range 0 to 6). Most participants (82.7 %) had comorbidity. While 17.3 % did not have a comorbidity. 20.4 % had a score of one. 29.6 % had a score of 2. 12.7 % had a score of 3. 9.2 % had a score of 4. Moreover, 10.8 % had a score of 5 or more (Table 4.7).

Table 4.7 Charlson Comorbidity score of the participants (N = 260)

Comorbidity	n	%
No comorbidity (0 score)	45	17.3
Having comorbidity (1-6 score)	215	82.7
- Low comorbidity (1-2 score)	130	50.0
- Moderate comorbidity (3-4 score)	57	21.9
- High comorbidity (≥ 5 score)	28	10.8

Charlson's Comorbidity score mean = 2.15, SD = 1.67, Min = 0, Max = 6

Cognitive function

Concerning cognitive function, the average GPCOG score was 5.17 (SD = 2.37), range from 1 to 9. Considering the participants who had GPCOG scores ranging from 0 to 4 in each dimension, it was found that most of them (n = 109) had problems with clock drawing, time orientation (n = 67), and information (n = 48). Only 5 participants had recall or memory problems, as shown in Table 4.8.

Table 4.8 GPCOG of the participants with cognitive impairment (N = 114)

Dimensions of GPCOG (patients' section)	n
Time orientation	67
Clock drawing	109
Information	48
Recall	5

Social support

The Groningen orthopedics social support (GOSSS) was scaled possible range from 12 to 48. The participants had good supports with GOSSS mean score equal to 39.22 (SD = 4.80) The perceived social support score mean was 22.63 (SD = 3.37), and the instrumental support score mean was 16.58 (SD = 2.29), respectively (Table 4.9).

Table 4.9 Possible range, actual range, mean, and standard deviation of social support

Social support	Possible range	Actual range	Mean	SD
Perceived Social Support score (7 items)	7-28	15-28	22.63	3.37
Instrumental Support score (5 items)	5-20	7-20	16.58	2.29
GOSSS total score (12 items)	12-48	27-48	39.22	4.80

Pain

In the current study, Table 4.10 and Table 4.11 showed that 81.5 % of the participants had pain symptoms. The mean score on pain severity was 2.74 (SD = 1.87), range from 0 to 7. 46.9 % of the participants experienced mild pain. 32.7 % of them perceived pain at moderate level. Moreover, 1.9 % of them reported pain at "worst pain". Approximately one-third of the participants had more than three times a week for pain frequency.

Table 4.10 Possible range, actual range, mean, and standard deviation of pain (N = 260)

Pain	Possible range	Actual range	Mean	SD
Pain severity	0-10	0-7	2.74	1.87
Pain frequency	0-3	0-3	1.84	1.11

Table 4.11 Pain score of the participants (N= 260)

Pain	n	%
Pain severity		
- No pain (0)	48	18.5
- Mild pain (1-3)	122	46.9
- Moderate pain (4-6)	85	32.7
- Severe pain (7-10)	5	1.9
Pain frequency		
- No pain frequency	48	18.5
- once a week	38	14.6
- twice to three times a week	82	31.5
- more than three times a week	92	35.4

Fatigue

In the current study, nearly half of the participants (45.4%) reported fatigue with FSS score ≥ 4

Table 4.12 Fatigue severity score of the participants (N = 260)

Fatigue	n	%
FSS score < 4 (no fatigue)	142	54.6
FSS score ≥ 4 (fatigue)	118	45.4
FSS score mean = 3.71, SD = 1.19, Min = 1, Max = 7		

Sleep

Lastly, 88.5 % of the participants complained about "poor sleep quality" (score ≥ 5) with a mean score equal to 10.12 (SD = 4.41), range from 2 to 20. The participants reported sleeping on average 5.72 hours per night (SD = 1.20). 20.8 % of the participants slept < 5 hours per night. For seven components of sleep quality found that the habitual sleep efficiency components had highest mean score was 1.83 (SD = 1.07)

Table 4.13 Possible range, actual range, mean, and standard deviation of sleep (N = 260)

Sleep	Possible range	Actual range	Mean	SD
Sleep components				
- Subjective sleep quality	0-3	0-3	1.46	0.59
- Sleep latency	0-3	0-3	1.66	0.89

Sleep	Possible range	Actual range	Mean	SD
- Sleep duration	0-3	0-3	1.65	0.93
- Habitual sleep efficiency	0-3	0-3	1.83	1.07
- Sleep disturbances	0-3	0-3	1.21	0.42
- Use of sleeping medication	0-3	0-3	0.94	1.25
- Daytime dysfunction	0-3	0-3	1.38	0.88
PSQI score total	0-21	2-20	10.12	4.41

Table 4.14 Sleep quality score of the participants (N = 260)

Sleep	n	%
PSQI score < 5 (good sleep quality)	30	11.5
PSQI score ≥ 5 (poor sleep quality)	230	88.5

In summary, it can be concluded that the mean comorbidity score was 2.15 (SD =1.67). The mean cognitive function score was 5.17 (SD =2.37). The mean social support score was 39.22 (SD = 4.80). In addition, the mean pain score was 2.74 (SD = 1.87). The mean fatigue score was 33.39 (SD = 10.68). Moreover, the mean sleep score was 10.12 (SD = 4.41)

Table 4.15 Descriptive statistics for independent variables (N = 260)

Variables	Possible range	Actual range	Mean	SD
Comorbidity	0-6	0-6	2.15	1.67
Cognitive function	0-9	1-9	5.17	2.37
Social support	12-48	27-48	39.22	4.80
Pain severity	0-10	0-3	2.74	1.87
Pain frequency	0-3	0-3	1.84	1.10
Fatigue	9-63	9-58	33.39	10.68
Sleep	0-21	2-20	10.12	4.41

3. Testing and modification of the path model

3.1 Model identification

Identification path model was crucial since path analysis required the model to be over-identified. When the number of observations exceeded the number of parameters being estimated, the model is over-identified. If the number of observations equaled the number of estimated parameters, the model was called just-identified. Finally, the model was under-identified if the number of parameters was higher than the number of observations (Kline, 2011, p. 126).

According to Tabachnick and Fidell (2007), over-identification occurred when one with more data points than free parameters. The number of data points was {p (p+1)}/2, where p equaled the number of observed variables. In the hypothesized model, there were thirty-two observed variables and seventy-eight parameters. Therefore, the number of data points was 528 = {32(32+1)}/2. The hypothesized model

had 450 fewer parameters than data points. Thus, this hypothesized model was over-identified, indicating that the path analysis could be tested in this study.

3.2 Model testing and model modification

In this step, path analysis was performed. From the hypothesized model, the exogenous variable was comorbidity, cognitive function, and social support. Pain, fatigue, sleep, and mobility were severed as endogenous variables. The process of model testing was shown as follows:

3.2.1 The initial hypothesized model

In the initial hypothesized model (Figure 4.1), the researcher did not constrain or fix any parameter. The result showed that the model did not fit well with empirical data (χ2 (df = 450) = 1557.321, p = 0.000, χ2/df = 3.460, RMSEA = .097, CFI = .829, TLI = .811, SRMR = .051). There were only the results of equation χ2/df lower than 5, and SRMR lower than .08 fit indices. The others several fit indices were not at the acceptable level, the chi-square test was non-significant. Therefore, model modification was necessary.

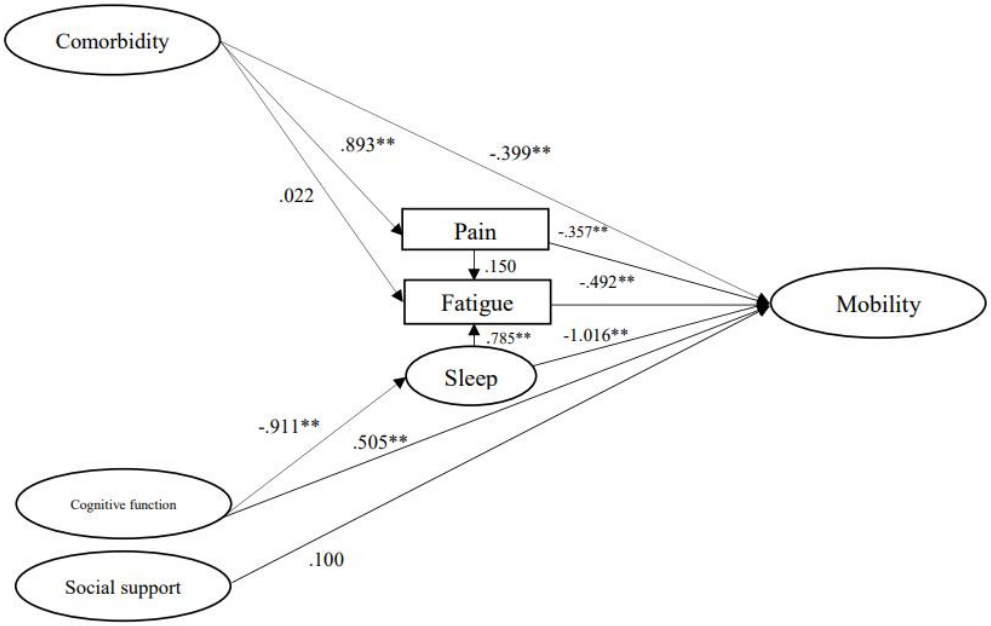


Figure 4.1 The initial hypothesized model of mobility among persons with hip fracture after surgery

3.2.2 The modification of hypothesized model

At this step, the researcher tried to find a new model that fitted the observed data by modifying the model using theoretical justifications based on model modification indices (MIs). In the model modification indices, the model was modified by using a command of fix a parameter. The researcher allowed the error term to be correlated by using the "with statement" in the Mplus result, fix for 78 error term. (APPENDIX L). An adequate assessment of statistical criteria based on information pooled from various fit indices was considered until the model testing yielded satisfaction and fit with empirical data.

3.2.3 The final model

It was found that the fit index statistics were in the acceptable range more than the initial and modified hypothesized models. The final model explained 90.4% of the total variance in mobility. Model testing yielded the following results: χ^2 (df = 372) = 415.198; p =.0605; χ^2 /df = 1.116; RMSEA = .021; CFI = .993; TLI = .991; SRMR = .036. At this step, the model fits well with the empirical data.

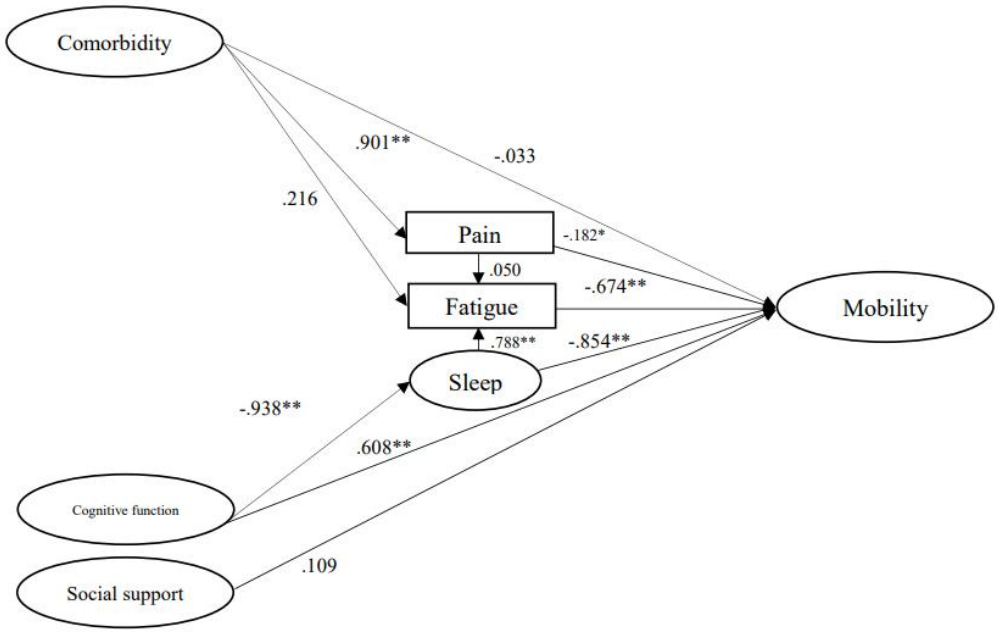


Figure 4.2 The final model of mobility among persons with hip fracture after surgery

According to Byrne (2012), there was no standard rule for stopping re-specification the model. Thus, the researcher's best yardsticks included (a) a thorough knowledge of the substantive theory, (b) an adequate assessment of statistical criteria based on information pooled from various indices of fit, and (c) a watchful eye on parsimony. In this consideration, the researcher should consider between incorporating

a sufficient number of parameters to yield a model that adequately represented the data and incorporating too many parameters to attain the best-fitting model statistically. The fit statistics were all at the acceptable threshold in the current model. Notably, the proposed modification helped improve model fit, but at this step, the model appeared to be parsimonious with the initial hypothesized model. Therefore, the model was accepted at this stage, and no further modifications were proposed. The fit indices comparison between the initial and final models were presented in Table 4.16.

Table 4.16 Comparison of the goodness of fit statistics among the initial hypothesized model and final model of mobility among persons with hip fracture after surgery.

Model-Fit criterion	**Cut-off points**	**Initial model**	**Final model**
χ^2		1557.321	415.198
df		450	372
χ^2 / df	< 5.0	3.460	1.116
p-value	> .05	0.000	0.060
CFI	> .95	0. 829	0.993
TLI	> .95	0.811	0.991
SRMR	<.08	0.051	0.036
RMSEA	<.06	0.097	0.021

Table 4.17 Standardized path coefficients of the final model of mobility among persons with hip fracture after surgery (N = 260).

Path diagram	Standardized path coefficients	SE	T-value
Comorbidity ⟶ Mobility	-0.033	0.120	-0.273
Cognitive function ⟶ Mobility	0.608**	0.199	3.058
Social support ⟶ Mobility	0.109	0.119	0.921
Pain ⟶ Mobility	-0.182*	0.086	-2.114
Fatigue ⟶ Mobility	-0.674**	0.137	-4.923
Sleep ⟶ Mobility	-0.854**	0.181	-4.730
Comorbidity ⟶ Pain	0.901**	0.029	30.926
Pain ⟶ Fatigue	0.050	0.126	0.396
Comorbidity ⟶ Fatigue	0.216	0.159	1.359
Sleep ⟶ Fatigue	0.788**	0.150	5.235
Cognitive function ⟶ Sleep	-0.938**	0.015	-61.432

* Significant at the 0.05 level (2-tailed). ** Significant at the 0.01 level (2-tailed).

In conclusion, based on the results of the final model of this study, the path model of mobility among persons with hip fractures after surgery was shown in Figure 4.3.

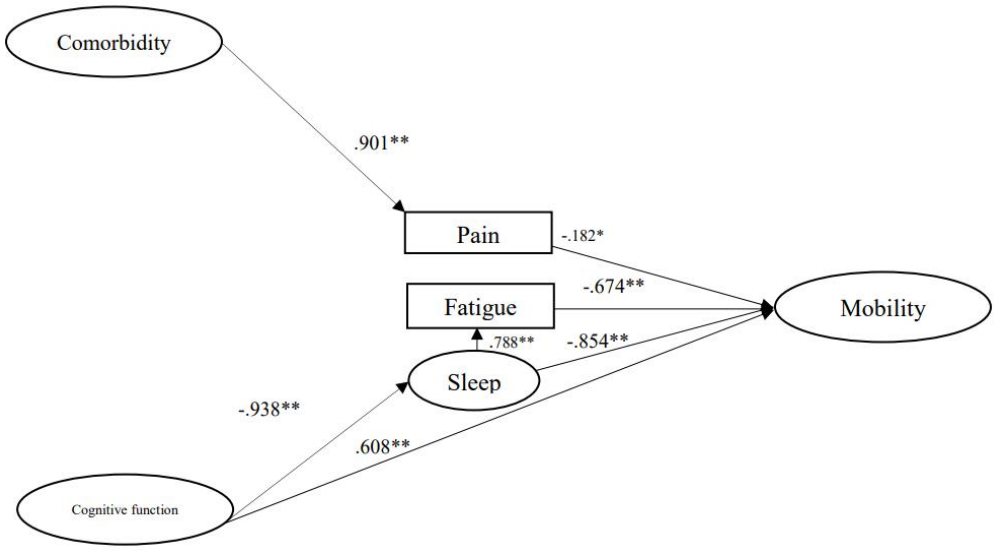


Figure 4.3 The path model of mobility among persons with hip fracture after surgery

Hypothesis testing

The summary of hypothesis testing was shown in accordance with hypothesized model (Table 4.18).

Hypothesis 1: Comorbidity has a negative direct effect on mobility among persons with hip fracture.

The result showed that the standardized direct effect from comorbidity to mobility was -.033. The effect was non-statistically significant ($p > .05$). The empirical data not supported the hypothesis.

Hypothesis 2: Comorbidity has an indirect effect on mobility through pain among persons with hip fracture.

The result showed that the standardized indirect effect on mobility through pain was .164 ($p < .05$). This suggested that the indirect impact of comorbidity on mobility was found via pain. Therefore, the empirical data supported the hypothesis.

Hypothesis 3: Comorbidity has an indirect effect on mobility through fatigue among persons with hip fracture.

The result showed that the standardized indirect effect on mobility through fatigue was .146 ($p > .05$). This suggested that the indirect impact of comorbidity on mobility was not found via fatigue. Therefore, the empirical data not supported the hypothesis.

Hypothesis 4: Cognitive function has a positive direct effect on mobility among persons with hip fracture.

The result showed that the standardized direct effect from cognitive function to mobility was .608 ($p < .01$) Thus, the empirical data support the hypothesis.

Hypothesis 5: Cognitive function has an indirect effect on mobility through sleep among persons with hip fracture.

The result showed that the standardized indirect effect of cognitive function on mobility through sleep was .682 ($p < .01$). This suggested that the indirect impact of cognitive function on mobility was found via sleep. Therefore, the empirical data supported the hypothesis.

Hypothesis 6: Social support has a positive direct effect on mobility among persons with hip fracture.

The result showed that the standardized total effect from social support to mobility was .109. The effect was non-statistically significant ($p > .05$). Therefore, it was concluded that this result did not support the hypothesized model.

Hypothesis 7: Pain has a negative direct effect on mobility among persons with hip fracture.

The result showed that the standardized direct effect from pain to mobility was -.182. The effect is statistically significant ($p < .05$). This suggested that the pain had directly impacted on mobility. Therefore, empirical data supported hypothesis in the current study.

Hypothesis 8: Pain has an indirect effect on mobility through fatigue among persons with hip fracture

The result showed that the standardized indirect effect from pain to mobility through fatigue was .034 ($p > .05$). The pain did not have an indirectly effected on mobility through fatigue. Therefore, empirical data not supported the hypothesis.

Hypothesis 9: Sleep has a negative direct effect on mobility among persons with hip fracture.

The result showed that the standardized direct effect from sleep to mobility was -.854 ($p < .01$). The above-zero standardized regression weights represented a negative impact. Therefore, empirical data supported the hypothesis.

Hypothesis 10: Sleep has an indirect effect on mobility through fatigue among persons with hip fracture.

The result showed that the standardized indirect effect from sleep to mobility through fatigue was -.531 ($p < .01$). This suggested that sleep had indirect impacted on

mobility via fatigue. Furthermore, empirical data supported this hypothesis in the current study.

Hypothesis 11: Fatigue has a negative direct effect on mobility among persons with hip fracture.

The result showed that the standardized total effect from fatigue to mobility was -.674. The effect was statistically significant ($p < .01$). The effect was directed. The above-zero standardized regression weight represented a negative impact. Therefore, it was concluded that the hypothesis toward the negative and direct effect from fatigue to mobility was supported by empirical data.

In conclusion, the study findings also revealed that the empirical data obtained fully supported seven of the eleven hypotheses, while four hypotheses were rejected.

Table 4.18 Summary of total, direct, and indirect effect of variables of mobility (N = 260)

DV / IV	Mobility			Pain			Fatigue			Sleep		
	TE	IE	DE	TE	IE	DE	TE	IE	DE	TE	IE	DE
Comorbidity	.247 (1.627)	.280* (1.985)	-.033 (-.273)	.901** (30.926)	-	.901** (30.926)	.216 (1.359)	-	.216 (1.359)	-	-	-
Comorbidity through pain	-	.164* (2.054)	-	-	-	-	-	-	-	-	-	-
Comorbidity through fatigue	-	.146 (1.133)	-	-	-	-	-	-	-	-	-	-
Comorbidity through pain & fatigue	-	-.030 (-.390)	-	-	-	-	-	-	-	-	-	-
Cognitive function	.792** (3.692)	.184* (2.394)	.608** (3.058)	-	-	-	-	-	-	-.938** (-61.432)	-	-.938** (-61.432)
Social support	.109 (.921)	-	.109 (.921)	-	-	-	-	-	-	-	-	-

DV / IV	Mobility			Pain			Fatigue			Sleep		
	TE	**IE**	**DE**	**TE**	**IE**	**DE**	**TE**	**IE**	**DE**	**TE**	**IE**	**DE**
Pain	-.148* (-1.983)	.034 (.392)	-.182* (-2.114)	-	-	-	.050 (.396)	-	.050 (.396)	-	-	-
Fatigue	-.674** (-4.923)	-	-.674** (-4.923)	-	-	-	-	-	-	-	-	-
Sleep	-1.385** (-8.267)	-.531** (-5.749)	-.854** (-4.730)	-	-	-	.788** (5.235)	-	.788** (5.235)	-	-	-
Model fit index: chi-square (n=260, df = 372) = , p = 0.0605, $\chi 2$ /df = 1.116 , RMSEA = 0.021 , CFI = 0.993, TLI = 0.991 , SRMR = 0.036												
R - SQUARE	.904 **			. 797**			.887**			.851**		

Noted: *p < .05, **p < .01, Value in parentheses (…) = t-value: ID = Independent variable, DV = Dependent variable, TE = Total effect, IE = Indirect effect, DE = Direct effect

Summary

Descriptive statistic characteristics of variables of the present study were described. The preliminary analysis reported that no violation about assumption of the path analysis occurred. The hypothesized path model of mobility among persons with hip fractures after surgery was tested. The hypothesized model fitted the empirical data of mobility among persons with hip fracture after surgery. Some research hypotheses were supported by the empirical data expanding the usefulness of the model. Finally, all variables in the model presented approximately 90.4% of the variance of mobility.

CHAPTER V
DISCUSSION

This study aimed to describe and examine direct and indirect paths of mobility among persons with hip fracture after surgery. The dependent variable was mobility. The independent variables were comorbidity, cognitive function, social support, pain, fatigue, and sleep. This chapter emphasized the discussion of the study findings. The discussion topics contained the characteristics of the study sample and variables, the path model, the hypothesis testing, and the study's limitations. Also, the obtained results were interpreted and evaluated regarding nursing implications. The latter section in this chapter also provided recommendations for further study and a conclusion of the study.

Characteristics of the participants

The study presented in the previous chapter revealed that the participants' age range was 52 to 97 years old. The mean age value was 76.0 (SD = 9.47) years old. The majority of the sample was female (79.6%). Mariconda et al. (2016) conducted a study in patients with hip fractures in Italy and found that the average age of the patients was 78.3 years old (range 50-105). Most patients were female (77.3%). One study in Korea, Cho, Song and Ryu (2020) conducted a retrospective study in 283 patients with hip fractures and revealed that average age of the patients was 78.7 years old (SD = 7.33). Most patients were female (71.7%). In Thailand, Sucharitpong et al. (2019) conducted a cohort study on 876 patients with hip fractures and found that more than haft of the sample were females (71.7%) with a mean age of 78.8 (SD = 8.9) years old. Worldwide studies also supported that most patients with hip fractures worldwide were female and diagnosed at adult to older adult age (Kanis et al., 2012). This could be attributed to the

higher female to male ratio in the general population as age increases and lower bone density (BMD) in women compared with men (Sigurdsson et al., 2006; Kanis et al., 2017).

This study indicated that the participants had normal BMI. The mean BMI was 22.08 kg/m2 (SD = 3.90), similar to a previous study from Thailand, the participants' mean BMI was 21.70 kg/m2 (SD = 3.60) (Adulkasem et al., 2021) and the study from Korea, the participants' mean BMI was 21.50 kg/m2 (SD = 3.55) (Cho, Song and Ryu, 2020) and also the study from the United States of America, the main participants were normal weight (67%) (Akinleye et al., 2018).

Characteristics of the study variable

In the present study, seven major variables included mobility, cognitive function, social support, pain, fatigue, and sleep. The discussions of these variables are presented as follows:

Mobility

The findings in this study revealed that the mean mobility score was 47.51 (SD = 15.63). This mean mobility scores in this study are similar to another finding in the previous study. de Morton et al. (2013) conducted a descriptive study of 109 patients with hip fractures from a rehabilitation ward in Australia. It was found that the mean mobility score was 48.70 (SD = 8.90). Moreover, In the current study, the mobility by Parker mobility scale found that the percentage of the participants who could perform outdoor walking and shopping decreased after hip fractures, while the percentage of the participants who could perform indoor walking increased, and the number of the participants using walking aids had increased. This finding agrees with prior studies,

which found that persons with hip fractures after surgery had decreased mobility (Hansson et al., 2015; Vochteloo et al., 2013).

In addition, the mean raw score of five mobility hierarchies, including bed ($\bar{x}$ = 3.73, SD = 0.58), chair ($\bar{x}$ = 2.93, SD = 0.87), static balance ($\bar{x}$ = 1.70, SD = 1.06), walking ($\bar{x}$ = 1.98, SD = 1.22), and dynamic balance ($\bar{x}$ = 0.75, SD = 0.88), respectively. These results indicated that most participants had the highest ability in bed, followed by the chair, walking, static balance, and dynamic balance. Dynamic balance is the lowest mean score in the mobility hierarchy. The reason may be that maintaining balance requires coordinating from numerous sensory systems, including the vestibular, somatosensory, and vision systems. Their deterioration is associated with older age and poorer balance (Noohi et al., 2019). Most participants (93.1%) were older adults with impaired mobility. The physiological changes with advancing age lead to decreased muscle strength and balance impairments (Rantakokko, Mänty, & Rantanen, 2013). Partly the physiological abnormalities from hip fractures and impairments in lower-limb muscle strength and balance performance. Moreover, most hip fractures in the current study are caused by falls, and from the mobility assessment of some items, such as jumps, the participants did not dare to do it.

Person with hip fractures after surgery who were older reported more decreased mobility compared to younger persons. This might reflect mobility changes associated with aging. This result was consistent with a previous study that found an association between age and mobility (Cary et al., 2016; Lee et al., 2014) and the walking independently decreased by 7% for each year of age increment (Tam, Tsang, and Lee, 2020). Patients with hip fractures who had low BMI (underweight) described lower mobility when compared with those who had normal (healthy weight) and high

BMI (overweight). The cause may be that patients with underweight had weaker grip strength and leg strength than normal weight patients, leading to poor physical function (Reider et al., 2013). The present study also found that the participants with hip fractures who had extracapsular fractures explained lower mobility when compared with those who had intracapsular fractures. This finding is supported by previous studies revealing that extracapsular fracture has been reported to be associated with poorer mobility outcomes than intracapsular fracture (Kristensen et al., 2010; Lee et al., 2014). These may be explained by intertrochanteric and subtrochanteric fractures having a larger hidden blood loss, large edema in the fracture site, and more hip pain than femoral neck fractures (Kristensen., 2011).

The hypotheses testing

Hypothesis 1: Comorbidity has a negative direct effect on mobility among persons with hip fracture.

This study found that comorbidity had a non-statistically significant direct effect on mobility ($\beta = -.033$, $p > .05$). The finding did not support the study's hypothesis. One possible explanation may be that the participants in the current study had low comorbidity scores (mean 2.15, SD = 1.67). After surgery, the participants may have received condition management, leading to controlled comorbidity. As a result, there may be no difference in mobility ability between the participants with no comorbidity and those with low or high comorbidities. For instance, the most common comorbidity in this study was hypertension (71.9%). Hypertension is associated with cerebral microvascular disease in the brain, and difficulties with mobility indicate a particular type of impairment that indicates damage to the frontal subcortical regions of the brain caused by microvascular issues. However, after surgery, they may have received

condition management, leading to controlled blood pressure; therefore, it does not affect the participants' mobility.

The result was different from the retrospective study of Tam et al. (2020) indicating that comorbidity could predict mobility. However, the result of the current study was consistent with the study of Promchat et al. (2015) who conducted a correlational study. They indicated that comorbidity had non-significant correlation with mobility ($r = -.16$; $p > .05$). A relational study by Klaewklong et al. (2014) also found that comorbidity had non-significant correlation to functional recovery ($r = - .06$, $p > .05$).

Hypothesis 2: Comorbidity has an indirect effect on mobility through pain among persons with hip fracture.

This study found that comorbidity had a positive indirectly effected on mobility through pain ($\beta = .164$, $p < .05$). Thus, this result supported the hypothesis model. The coefficient between comorbidity, pain, and mobility was significant. It explains the phenomenon of mobility among persons with hip fractures regarding pathophysiological issues. For instance, In the current study, there were the persons who had bone metastasis, the cancerous cells in persons with hip fractures originate in different tissues, such as the prostate and breast cancer. Tumor within the bone causes breakthrough pain. Cancer-induced bone pain has revealed the neurochemistry of cancer, such as nerve growth factor (NGF) and brain-derived neurotrophic factor (BDNF), that can lead to nociceptive pain. Moreover, cancer-induced acidity within the bone correlated with a significant increase in inflammation, contributing to neuronal hypersensitive states and pain (Lozano-Ondoua, Symons-Liguori, and Vanderah, 2013). According to renal disease, pain is one of the most common symptoms among

persons with end-stage renal disease (Coluzzi, 2018). In this study, approximately 65% of persons with renal disease had musculoskeletal pain. Prior studies by Davison, Koncicki, and Brennan (2014) showed that musculoskeletal diseases were the main reason for pain in patients with renal disease. This can be explained by biochemical parameters such as serum uric acid and calcium x phosphate. In addition, it was significantly correlated with chronic musculoskeletal pain in patients with CKD (Hsu et al., 2014), participants experiencing pain were at a higher risk of reduced mobility (Salpakoski et al., 2011).

Hypothesis 3: Comorbidity has an indirect effect on mobility through fatigue among persons with hip fracture.

This study found that comorbidity had an indirectly effected on mobility not through fatigue ($\beta = .146$, $p > .05$). Thus, this result not supported the hypothesis model.

Fatigue can be a symptom of heart as a result of high blood pressure. The study has shown that fatigue is related to the hemodynamic system (Nelesen et al., 2008). One potential reason could be that in the present study, the participants exhibited low comorbidity scores (mean 2.15, SD = 1.67), with hypertension (71.9%) being the most prevalent comorbidity. After surgery, the participants may have received condition management to control comorbidities. It is possible that controlled comorbidity, including controlled blood pressure, did not result in fatigue symptoms among the participants. Consequently, comorbidity did not indirectly impact mobility, specifically through fatigue. This finding contrasted with the previous study conducted by Bennett et al. (2002), which indicated a direct relationship between comorbidity and physical functioning mediated by fatigue.

Hypothesis 4: Cognitive function has a positive direct effect on mobility among persons with hip fracture.

This study found that cognitive function had a positive direct effect on mobility ($\beta = .608$, $p < .01$). The finding supports the study's hypothesis. Declining mobility from cognitive impairment can be explained because cognitive impairment is a barrier to the rehabilitation of older adults after hip fracture surgery (Morghen et al., 2011). Patients with cognitive impairment may not understand the rehabilitation process and weight-bearing instructions. At the same time, patients with good cognitive function can understand the step of rehabilitation and weight-bearing recommendation. Moreover, a low cognitive function was the most common reason for not obtaining independent mobility and not completing physiotherapy. Some of these were associated with difficulties in cooperating with early physiotherapy. Therefore, patients with cognitive impairment may be seen to have less potential, and therapists may reduce the intensity of rehabilitation compared to patients without cognitive impairment (Münter et al., 2018). On the contrary, the persons with hip fractures who had good cognitive function and could complete the rehabilitation session led to increased muscle strength, improved range of motion, enhanced flexibility, and enhanced stability. It also improved balance, gait, walking distance, and mobility (Hertz, & Santy-Tomlinson, 2018).

The result of the study is consistent with the study of Lenze et al. (2004), which found that cognitive function was significantly correlated with the ability of the lower extremity to walk and climb stairs ($p < 0.001$). A prospective study by Ariza-Vega et al. (2017) also found that cognitive function was associated with mobility ($p < 0.01$). In addition, Mariconda et al. (2016) conducted a prospective observational cohort study

on patients with hip fractures after surgery. They demonstrated that cognitive scores markedly influenced mobility ($p < 0.001$).

Hypothesis 5: Cognitive function has an indirect effect on mobility through sleep among persons with hip fracture

In the current study, cognitive function had a positive indirectly effected on mobility through sleep ($\beta = .682$, $p < .01$). On the other hand, it was found that sleep mediated the relationship between cognitive function and mobility. The cognitive function affect sleep, which in turn limits mobility. This study's results can be explained by the fact that the circadian alterations in participants with cognitive impairment are associated with reduced overnight memory consolidation and affect sleep quality (Naismith et al., 2014).

The result of current study consistent with previous studies. They provided evidence for the relationship between cognitive function and sleep. For instance, the study of Wilckens et al. (2018) showed that sleep efficiency is one pathway associated with cognitive function (working memory $\beta = 0.27$, switching $\beta = 0.31$, verbal fluency $\beta = 0.32$, recall $\beta = 0.21$ and processing speed $\beta = 0.17$, $p < 0.05$) across young and older adults. McKinnon et al. (2014) conducted a cross-sectional study. They found that the patients with mild cognitive impairment demonstrated a significantly higher rate of sleep disturbance than those without cognitive impairment ($p = .003$). Cognitive function was significantly positively associated with sleep quality ($r = .225$, $P = .005$), and a significant predictor explained the variance in sleep quality ($p = .007$).

Hypothesis 6: Social support has a positive direct effect on mobility among persons with hip fracture.

The current study revealed that social support had a non-significant direct effect on mobility ($\beta = .109$, $p > .05$). Put another way, social support did not have a direct effect on mobility. Surprisingly, once considering social support in each sub-scale, it was found that instrumental support is non-significantly correlated with mobility ($r = -.110$, $p > .05$). It shows that participants who received care from relatives related to mobility activities such as providing meals, shopping, transportation, and household chores therefore, the participants did not have the mobility to perform those activities and resulting in decreased mobility.

Findings in the present study is consistent with the study in Brazil, and the developing countries are the same as Thailand. Corseuil et al. (2011) conducted a cross-sectional study to evaluate the association between the social environment and physical activity in the elderly population. The study revealed that social support from relatives was non-significant associated with physical activity. Concerning living conditions, mobility problems may begin with increasing age for participants living with relatives before surgery. Poorer hip function prior to the fracture is associated with poorer functional recovery, although having previously been living with a relative or receiving social support is also associated with functional decline (Vergara et al., 2014). However, the finding in this study inconsistent with the findings of Shyu et al. (2010) show that social support helps persons with hip fractures have better walking and climbing stairs. And previous studies show that patients who were not living at home (with no social support) were associated with a decline in mobility (Nuotio et al., 2016).

Hypothesis 7: Pain has a negative direct effect on mobility among persons with hip fracture.

Pain had a negative direct effect on mobility ($\beta = -.182$, $p < .05$). This study's results can be explained by the fact that 38% of the participants in the current study reported pain in the hip area (APPENDIX K4). Additionally, the patients experiencing pain are more susceptible to physical risks, such as limited function ability, reduced level of function, and decreased walking distance (Bennett et al., 2002; Brennan, 2011). Even during rehabilitation after hip fracture surgery, patients still experience pain and report discomfort during activities like hip flexion (sitting) or walking (Salpakoski et al., 2011). Therefore, pain significantly interferes with mobility.

This result is supported by previous studies showing an association between pain and mobility. Foss et al. (2009) conducted a prospective study that revealed significant negative correlations between pain and hip flexion as well as functional mobility ($r = -0.43$, $p < 0.001$) and walking ($r = -0.36$, $p = 0.004$). In addition, Salpakoski et al. (2011) conducted a cross-sectional study, demonstrating that patients with pain had decreased mobility in terms of walking, moving, sitting, and standing compared to those with less or no pain (OR = 3.5, $p < 0.05$). In summary, the results from this study indicate that pain is associated with mobility. The persons who report these symptoms should be assessed and monitored for potential changes in mobility.

Hypothesis 8: Pain has an indirect effect on mobility through fatigue among persons with hip fracture.

This study found that pain did not have an indirect effect on mobility through fatigue ($\beta = .034$, $p > .05$). Therefore, this result does not support the hypothesis model. The coefficient between pain, fatigue, and mobility was not significant, which explains

the phenomenon of mobility among persons with hip fractures from a pathophysiological perspective. In the current study, the persons reported low pain severity scores (mean 2.74, SD = 1.87) and low pain frequency (mean 1.84, SD = 1.11) when the pain was less intense. Consequently, it may not significantly impact fatigue and mobility. Additionally, a study by Løke et al. (2022) found that pain and psychological distress had significant direct effects on fatigue ($p < .001$), indicating that psychological distress may mediate the influence of pain on fatigue. Therefore, further consideration of the effects of psychological distress on fatigue in this pathway is considered.

Hypothesis 9: Sleep has a negative direct effect on mobility among persons with hip fracture.

Sleep had a negative direct effect on mobility ($\beta = -.854$, $p < .05$). The result of this study can be explained by the fact that low sleep quality is related to deterioration in executive functions that regulate walking variability and control walking ability (Clark, 2015). On the contrary, high sleep quality increases executive functions, resulting in better mobility. Moreover, observational studies have confirmed an association between low sleep quality (short sleep and sleep apnea) and increased inflammation, insulin resistance, and metabolic syndrome (Morselli et al., 2012; Punjabi & Beamer, 2007; Van Cauter, 2011). Alterations in the immunology, metabolic, and endocrinology systems contribute to muscle strength deterioration and ultimately lead to functional decline. (Barzilay et al., 2009; Ferrucci et al., 2002).

This finding is supported by previous studies showing that sleep was associated with mobility. Stenholm et al. (2010) conducted a cross-sectional study. They revealed that sleep disorder was associated with a decreased walking speed in older women ($p =$

0.04) and higher odds for mobility limitation (OR = 1.68, 95% CI = 1.02-2.75), and sleep disorder with a higher odd for mobility limitation in adult and older adult men (aged 55–64 years) (OR = 3.62, 95% CI = 1.40–9.37). Agmon et al. (2016) conducted a cross-sectional study among older adults. They found that sleep is correlated with walking speed ($r = 0.35$, $p < 0.05$). Bernstein et al. (2020) revealed that a poorer sleep quality was associated with greater gait asymmetry ($\beta = 0.16$, $p < 0.05$). Greater daytime sleepiness was associated with increased gait variability and postural control ($\beta = 0.12$, $p < 0.05$). In addition, Promchat et al. (2015) conducted a correlational study in patients with hip fracture after surgery. They reported that sleep correlated with mobility ($r = -.33$, $p < .01$).

In sum, the results from this study provide a preliminary insight into the sleep quality of persons with hip fracture after surgery that sleep quality was associated with mobility. Persons who report these symptoms should be assessed and monitored for possible changes in mobility.

Hypothesis 10: Sleep has an indirect effect on mobility through fatigue among persons with hip fracture.

Sleep has an indirect effect on mobility through fatigue ($\beta = -.531$, $p < .01$). These findings supported the hypothesis model. Previous studies have reported that the community-dwelling older adults who had poor sleep had a higher fatigue score than those who had a good sleep ($p < .001$) (Goldman et al., 2008), which in turn, fatigue occurs in patients with hip fracture and can affect mobility (Münter et al., 2018). Moreover, the study supports that insomnia-related symptoms and fatigue are independently related to mobility limitation. The weakness or tiredness thoroughly

explains the association between sleeping disorders and mobility limitations (Stenholm et al., 2010).

Similarly, Hawker et al. (2010) conducted a cohort study among older people with osteoarthritis patients. They reported that poor sleep was significantly associated with greater fatigue ($p = 0.0003$). Sleep disturbance contributes to fatigue. It means that patients with poor sleep quality seem more likely to fatigue and have negatively affected mobility. Therefore, identifying the nature of sleep disturbances and managing sleep disturbances in patients is important and may reduce fatigue and enhance mobility.

Hypothesis 11: Fatigue has a negative direct effect on mobility among persons with hip fracture.

Fatigue has a negative direct effect on mobility ($\beta = -.674$, $p < .01$). This finding supported the hypothesis. In persons with hip fracture after surgery fatigue symptoms may occur from blood loss, poor nutrition, and low hemoglobin level, the patients with fatigue did not achieve independent mobility (Münter et al., 2018). Moreover, in the current study, the most common comorbidities of the participants were hypertension, diabetes, and renal disease. There are 17.7% of the persons with hip fractures have renal disease. They often complain that they commonly experience fatigue, especially close on dialysis day as a result, they have decreased mobility. Possibly because the patient complains that fatigue and feeling tired lead them to need hours of rest and not achieve physical activity (Alsen & Brink, 2013), the results of this study may point out that fatigue is associated with mobility. The findings in this study are harmonious with previous literature. For instance, Mueller-Schotte et al. (2016) reported that the patients (including hip fracture) who have fatigue symptoms walked shorter distances than those

non-fatigued (B = -39.12, $p < 0.05$). Folden and Tappen (2007) indicated that a significant negative correlation was found between fatigue and functional ability ($r = -0.65$, $p < 0.001$).

In summary, the current study constructed its model based on the Theory of Unpleasant Symptoms and existing empirical evidence. It examined factors including comorbidity, cognitive function, pain, fatigue, and sleep quality. Notably, there is a lack of prior studies exploring a path model of mobility among persons with hip fractures after surgery. Therefore, the findings of this study contribute to confirming the consistency theory and empirical data, which explain the variance of mobility and verify several variables in the same model.

The finding is consistent with the Theory of Unpleasant Symptoms (TOUS) proposed by Lenz et al. (2014), which suggests that the perception of unpleasant symptoms, such as pain, fatigue, and sleep quality, can be influenced by physiological factors (comorbidity) as well as psychological factors (cognitive function). These factors ultimately impact performance, where mobility is considered a form of physical performance in the context of the TOUS.

Implications for nursing

The implications of this study encompass various aspects of nursing, including nursing science, nursing practice, nursing education, and nursing research. These implications can be summarized as follows:

Implications for nursing science

One of the strengths of this study is the utilization of the theoretical model of TOUS, proposed by Lenz et al. (2014). The application of this model provided valuable guidance for various aspects of the study, including the selection of concepts to be

investigated, the theoretical and operational definition of these concepts, and the direction of data analysis. Furthermore, the TOUS served as the theoretical framework for collecting empirical data and constructing a path model to examine the effects of comorbidity, cognitive function, social support, pain, fatigue, and sleep quality on mobility among persons with hip fracture after surgery. The TOUS is a middle-range theory that offers the necessary specificity for its usefulness in research and practice. The current study can be regarded as a test of the TOUS among persons with hip fractures, contributing to the development of knowledge in nursing science that change in mobility is a result from

unpleasant symptoms and its influencing factors. The majority of the findings align with the TOUS and empirical literature, demonstrating that cognitive function and sleep quality enhance mobility. Comorbidity, pain, and fatigue are significant factors impacting mobility of persons with hip fractures after surgery.

This study's findings confirm the practicality and feasibility of utilizing this model to investigate factors associated with mobility. This study has contributed new knowledge that explains the impact of each variable in the model on mobility in persons with hip fractures. Moreover, these findings provide valuable insights that can guide the development of interventions to promote mobility among persons with hip fracture after surgery.

Implications for nursing practice

The present study highlights the understanding of the influence of comorbidity, cognitive function, pain, fatigue, sleep, and mobility among persons with hip fractures. The findings of this study have significant implications for nursing practice. For instance, gaining insight into the predictors of mobility among persons with hip

fractures offers valuable information that can assist nurses and other healthcare professionals in planning effective interventions to enhance mobility.

In this study, sleep quality was found to have the strongest effect on mobility among persons with hip fractures. The results indicated that higher sleep quality could decrease fatigue severity and increase mobility among persons with hip fractures in the current study. Furthermore, good sleep quality, which is associated with improved executive function, contributes to better balance regulation and, consequently, enhanced mobility.

Nurses and healthcare providers play a crucial role in providing essential assistance and care to individuals with hip fractures. Nurses, in particular, should prioritize implementing effective programs tailored for persons with hip fractures. These interventions should encompass the effective management of comorbidity, sleep, pain, and fatigue symptoms. Additionally, nurses should promote social support by encouraging them to engage in instrumental activities such as exercising, preparing meals independently, and performing household chores to enhance self-mobility. Telephone counseling provided by nurses or healthcare providers can also serve as a valuable source of information and support for individuals facing health challenges in the community.

Implications for nursing education

Nowadays, healthcare providers know mobility is crucial for ensuring quality care among persons with hip fractures after surgery. Sustaining and promoting mobility in these persons can pose a challenge for nurses. This study has provided valuable insights into the predictors of mobility among persons with hip fractures after surgery, which can assist nurses in enhancing strategies for sustaining and promoting mobility

in this population. Nurse educators can utilize these findings to introduce new perspectives and approaches in teaching and learning about promoting mobility in persons with hip fractures after surgery. Nurses educator should be teaching about providing appropriate management for persons with comorbidity and poor cognitive function and intervene in pain, fatigue, and poor sleep quality to enhance mobility. Nursing students should be trained to investigate and critically analyze all the relevant issues about mobility among persons with hip fractures after surgery.

Implications for nursing research

The current study is the first to examine the influence of comorbidity, cognitive function, social support, pain, fatigue, and sleep on mobility among persons with hip fractures after surgery. The findings of this study will serve as a valuable reference for developing interventions aimed at exploring and promoting mobility in this specific population group. For instance, the developing intervention program will include nursing interventions for pain and fatigue management, an enhanced sleep quality program for persons with hip fractures, and a multidisciplinary intervention program to improve mobility in persons with cognitive impairment following a hip fracture. Given that this study was conducted in three health regions of Thailand, the significant associations observed among the central concepts proposed in the model suggest the need for further investigations across all thirteen health regions.

Implications for healthcare policy

Persons with hip fractures after surgery require continuous care throughout their disease trajectories due to the various symptoms and influencing factors that can impact their mobility. It is essential to establish an effective rehabilitation referral system for persons with hip fracture within the healthcare system and propose it to healthcare

policymakers. Healthcare providers should advocate for policymakers to develop an action plan that supports the seamless transition of care for persons with hip fracture from the secondary and tertiary care system to home care, particularly those after surgery. Additionally, healthcare providers in the primary, secondary, and tertiary care systems should coordinate their efforts in providing comprehensive care for persons with hip fractures after surgery.

The findings from the current study suggest that sleep, pain, fatigue symptoms, comorbidity, and cognitive function have an impact on mobility. Hip fractures are a significant health issue in Thailand. The primary goal of care for persons with hip fractures is to maintain or improve mobility. Therefore, policymakers, especially the Ministry of Public Health (MOPH), are key to formulating and implementing Thailand's healthcare policies and public health programs. They must carefully consider various variables, including comorbidity, cognitive function, pain, fatigue, and sleep quality, influencing mobility when developing an action plan to enhance mobility among persons with hip fractures after surgery.

Limitations of the study

1. Generalizations of this study should be approached with caution due to several reasons. Firstly, the participants were recruited from three specific health regions in Thailand, which may limit the generalizability of the findings to other regions. For instance, it should be noted that approximately 90% of the participants identified as Buddhist, whereas there is a significant population of approximately three million Muslims residing in the southern regions near the border with Malaysia. Therefore, careful consideration should be given when applying the implications of the findings to this particular group.

Secondly, it is important to acknowledge that the participants were recruited from the outpatient department, which means that some frail individuals with hip fractures may not have visited the outpatient department due to the inconvenience of traveling to the hospital. Thus, generalizing the findings to this specific subgroup should be approached cautiously.

2. The measurement issue should be approached with caution due to the use of different scales for measuring pain severity and frequency. Pain severity was measured on an 11-point rating scale, while pain frequency was measured using a three-point Likert scale. As a result, the total scores could not be directly combined. To address this, the researcher had to convert the pain severity and frequency scores into standard scores (z-scores). Future studies should consider selecting a measurement approach that allows pain severity and frequency to be measured on the same scale for better interpretation.

3. The issue of confounding variables should be approached with caution for several reasons. Firstly, concerning age and mobility, there were observed variations in the mean mobility scores across different age groups. Specifically, older persons had lower mobility scores compared to younger persons. This suggests that age could be a factor influencing mobility. However, it is important to note that age was not the primary focus of this study. Future studies should consider including age as an independent variable in the model to explicitly examine the effect of age on mobility and further clarify its impact.

Secondly, the duration of time after surgery and its potential impact on mobility is worth considering. It is important to note that the subjects in this study had varying durations after surgery, which could influence their mobility. However, it is crucial to

highlight that the primary focus of this study was not on the duration after surgery. For future studies, it is recommended to include the duration after surgery as an independent variable in the model. This would allow for a specific examination of the effect of duration after surgery on mobility and provide further clarity on its impact.

Thirdly, variations in mean mobility scores were observed among the fracture groups when considering different types of fractures and their impact on mobility. Especially persons with extracapsular fractures had lower mobility scores than those with intracapsular fractures. This suggests that the type of fracture could influence mobility. However, it is essential to note that the primary focus of this study was not on fracture types. Future studies should consider including fracture types as an independent variable in the model to explicitly examine their effect on mobility and further explain their impact.

Recommendations for future research

1. This study was an exploratory study conducted among Thai persons with hip fractures after surgery and were followed up within the 3rd to 12th-month post-surgery period. The participants were recruited from outpatient departments in public hospitals across Thailand. According to the evidence, it has been indicated that mobility following a hip fracture is significantly impaired for a period of 1-2 years (Dyer et al., 2016). Therefore, future studies should be conducted to validate the findings on mobility in Thai persons with hip fractures beyond the 1-year mark in different settings, such as the community among persons who did not visit the hospital for follow-up.

2. Since this study collected data at a single time point, a longitudinal study was needed to assess the changes in comorbidity, cognitive function, pain, fatigue, sleep, and mobility among persons after hip surgery over time.

3. Further studies should be conducted to replicate the present study's findings in various settings and with large sample sizes, employing random sampling techniques. This will enhance the generalizability of the results. Additionally, subgroup analyses should be performed when testing the proposed model, comparing different age groups, duration after surgery and various fracture or surgery types. This approach will increase the trustworthiness and reliability of the tested model

4. A nursing intervention study to promote mobility among persons with hip fracture after surgery should be developed and tested. The rehabilitation program should be initiated as soon as possible, particularly for persons with comorbidity and poor cognitive function. It should incorporate interventions to enhance sleep, manage fatigue, provide effective pain therapy, and promote perceived social support from family members and significant others. These interventions will help increase the level of mobility among persons with hip fractures after surgery.

REFERENCES

Adulkasem, N., Phinyo, P., Khorana, J., Pruksakorn, D., & Apivatthakakul, T. (2021). Prognostic Factors of 1-Year Postoperative Functional Outcomes of Older Patients with Intertrochanteric Fractures in Thailand: A Retrospective Cohort Study. *International Journal of Environmental Research and Public Health*, *18* (13), 6896. https://doi.org/10.3390/ijerph18136896.

Agmon, M., Shochat, T., & Kizony, R. (2016). Sleep quality is associated with walking under dual-task, but not single-task performance. *Gait & posture*, *49*, 127-131. http://doi.org/10.1016/j.gaitpost.2016.06.016.

Akinleye, S. D., Garofolo, G., Culbertson, M. D., Homel, P., & Erez, O. (2018). The role of BMI in hip fracture surgery. *Geriatric orthopaedic surgery & rehabilitation*, *9*, 1-6. http://doi:10.1177/2151458517747414.

Alghadir, A. H., Anwer, S., Iqbal, A., & Iqbal, Z. A. (2018). Test–retest reliability, validity, and minimum detectable change of visual analog, numerical rating, and verbal rating scales for measurement of osteoarthritic knee pain. *Journal of pain research*, *11*, 851-856. https://doi.org/10.2147/JPR.S158847

Alikari, V., Sachlas, A., Giatrakou, S., Stathoulis, J., Fradelos, E., Theofilou, P., ... & Zyga, S. (2017). Fatigue in arthritis: a multidimensional phenomenon with impact on quality of life: fatigue and quality of life in arthritis. *Genetics and Neurodegeneration*, *987*, 243-256. http:// doi 10.1007/978-3-319-57379-3_22.

Alsen, P., & Brink, E. (2013). Fatigue after myocardial infarction–a two-year follow-up study. *Journal of Clinical Nursing*, *22*(11-12), 1647-1652. http://doi.org/10.1111/jocn.12114.

Ariza-Vega, P., Lozano-Lozano, M., Olmedo-Requena, R., Martín-Martín, L., & Jiménez-Moleón, J. J. (2017). Influence of cognitive impairment on mobility recovery of patients with hip fracture. *American journal of physical medicine & rehabilitation*, *96*(2), 109-115. http://doi:10.1097/PHM.0000000000000550.

Armstrong, M. E., Spencer, E. A., Cairns, B. J., Banks, E., Pirie, K., Green, J., ... & Million Women Study Collaborators. (2011). Body mass index and physical activity in relation to the incidence of hip fracture in postmenopausal women. *Journal of bone and mineral research*, *26*(6), 1330-1338. https://doi.org/10.1002/jbmr.315.

Bahouq, H., Rostom, S., Bahiri, R., Hakkou, J., Aissaoui, N., & Hajjaj-Hassouni, N. (2012). Psychometric evaluation of the Arabic version of the multidimensional assessment of fatigue scale (MAF) for use in patients with ankylosing spondylitis. *Rheumatology international*, *32*(12), 3969-3976. http://doi.org/10.1007/s00296-011-2306-z.

Barzilay, J. I., Cotsonis, G. A., Walston, J., Schwartz, A. V., Satterfield, S., Miljkovic, I., ... & Health ABC Study. (2009). Insulin resistance is associated with decreased quadriceps muscle strength in nondiabetic adults aged≥ 70 years. *Diabetes care*, *32*(4), 736-738. http://doi.org/10.2337/dc08-1781.

Beer, N., Riffat, A., Volkmer, B., Wyatt, D., Lambe, K., & Sheehan, K. J. (2022). Patient perspectives of recovery after hip fracture: a systematic review and qualitative synthesis. *Disability and Rehabilitation*, *44*(21), 6194-6209. http://doi.org/10.1080/09638288.2021.1965228.

Belza, B. L., Henke, C. J., Yelin, E. H., Epstein, W. V., & Gilliss, C. L. (1993). Correlates of fatigue in older adults with rheumatoid arthritis. *Nursing Research, 42*(2), 93–99.

Bennett, J. A., Stewart, A. L., Kayser-Jones, J., & Glaser, D. (2002). The mediating effect of pain and fatigue on level of functioning in older adults. *Nursing research, 51*(4), 254-265.

Bentler, P. M., & Chou, C. P. (1987). Practical issues in structural modeling. *Sociological methods & research*, *16*(1), 78-117. http://doi: 10.1177/0049124187016001004.

Bernardini, J., Callen, S., Fried, L., & Piraino, B. (2004, January). Inter-rater reliability and annual rescoring of the Charlson comorbidity index. In *Advances in peritoneal dialysis. Conference on Peritoneal Dialysis, 20*, 125-127.

Bernstein, J. P., De Vito, A., Weitzner, D. S., MacAulay, R., Calamia, M., Brouillette, R., ... & Keller, J. N. (2020). Examining relationships between multiple self-reported sleep measures and gait domains in cognitively healthy older adults. *Gerontology*, *66*(1), 47-54. https://doi.org/10.1159/000499737.

Blackburn, J., & Yeowell, G. (2020). Patients' perceptions of rehabilitation in the community following hip fracture surgery. A qualitative thematic synthesis. *Physiotherapy*, *108*, 63-75. https://doi.org/10.1016/j.physio.2020.02.001.

Boonstra, A. M., Preuper, H. R. S., Reneman, M. F., Posthumus, J. B., & Stewart, R. E. (2008). Reliability and validity of the visual analogue scale for disability in patients with chronic musculoskeletal pain. *International journal of*

rehabilitation research, *31*(2), 165-169. http://doi: 10.1097/MRR.0b013e3282fc0f93.

Braithwaite, R. S., Col, N. F., & Wong, J. B. (2003). Estimating hip fracture morbidity, mortality and costs. *Journal of the American Geriatrics Society*, *51*(3), 364-370. http://doi.org/10.1046/j.1532-5415.2003. 51110.x.

Braun, T., Grüneberg, C., Thiel, C., & Schulz, R. J. (2018). Measuring mobility in older hospital patients with cognitive impairment using the de Morton Mobility Index. *BMC geriatrics*, *18*(1), 1-9. https://doi.org/10.1186/s12877-018-0780-9.

Braun, T., Schulz, R. J., Reinke, J., van Meeteren, N. L., de Morton, N. A., Davidson, M., ... & Grüneberg, C. (2015). Reliability and validity of the German translation of the de Morton Mobility Index (DEMMI) performed by physiotherapists in patients admitted to a sub-acute inpatient geriatric rehabilitation hospital. *BMC geriatrics*, *15*, 1-11. https://doi.org/10.1186/s12877-015-0035-y.

Brennan, T. J. (2011). Pathophysiology of postoperative pain. *Pain*, *152*(3), S33-S40. http://doi 10.1016/j.pain.2010.11.005.

Brodaty, H., Kemp, N. M., & Low, L. F. (2004). Characteristics of the GPCOG, a screening tool for cognitive impairment. *International journal of geriatric psychiatry*, *19*(9), 870-874. https://doi.org/10.1002/gps.1167.

Brodaty, H., Pond, D., Kemp, N. M., Luscombe, G., Harding, L., Berman, K., & Huppert, F. A. (2002). The GPCOG: a new screening test for dementia designed for general practice. *Journal of the American Geriatrics Society*, *50*(3), 530-534. https://doi.org/10.1046/j.1532-5415.2002.50122.x.

Brooks, D., Parsons, J., Hunter, J. P., Devlin, M., & Walker, J. (2001). The 2-minute walk test as a measure of functional improvement in persons with lower limb amputation. *Archives of physical medicine and rehabilitation*, *82*(10), 1478-1483. http://doi.org/10.1053/apmr.2001.25153.

Brown, C. J., Friedkin, R. J., & Inouye, S. K. (2004). Prevalence and outcomes of low mobility in hospitalized older patients. *Journal of the American Geriatrics Society*, *52*(8), 1263-1270. http://doi.org/10.1111/j.1532-5415.2004. 52354.x.

Buchman, A. S., Boyle, P. A., Leurgans, S. E., Barnes, L. L., & Bennett, D. A. (2011). Cognitive function is associated with the development of mobility impairments in community-dwelling elders. *The American Journal of Geriatric Psychiatry*, *19*(6), 571-580. http://doi.org/10.1097/JGP.0b013e3181ef7a2e.

Burgers, P. T., Poolman, R. W., Van Bakel, T. M., Tuinebreijer, W. E., Zielinski, S. M., Bhandari, M., ... & Horan, A. (2015). Reliability, validity, and responsiveness of the Western Ontario and McMaster Universities Osteoarthritis Index for elderly patients with a femoral neck fracture. *JBJS*, *97*(9), 751-757. http://doi: 10.2106/JBJS.N.00542.

Burns, N., & Grove, S. K. (2012). *The practice of nursing research: Appraisal, synthesis, and generation of evidence* (7th ed). Elsevier Health Sciences.

Buysse, D. J., Reynolds III, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry research*, *28*(2), 193-213. http://doi.org/10.1016/0165-1781(89)90047-4.

Byrne B. M. (2016). *Structural Equation Modelling with Amos: Basic Concepts, Applications, and Programming* (3rd ed). Routledge.

Carpintero, P., Caeiro, J. R., Carpintero, R., Morales, A., Silva, S., & Mesa, M. (2014). Complications of hip fractures: A review. *World journal of orthopedics*, *5*(4), 402-411. http://doi.10.5312/wjo.v5.i4.402.

Cary, M. P., Jr., Pan, W., Sloane, R., Bettger, J. P., Hoenig, H., Merwin, E. I., & Anderson, R. A. (2016). Self-Care and Mobility Following Postacute Rehabilitation for Older Adults With Hip Fracture: A Multilevel Analysis. *Arch Phys Med Rehabil, 97*(5), 760-771. http://doi:10.1016/j.apmr.2016.01.012.

Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public health reports*, *100*(2), 126-131.

Cassidy-Eagle, E. L., & Siebern, A. (2017). Sleep and mild cognitive impairment. *Sleep Science and Practice*, *1*(1), 1-5.https://doi.org/10.1186/s41606-017-0016-5.

Castelli, A., Daidone, S., Jacobs, R., Kasteridis, P., & Street, A. D. (2015). The determinants of costs and length of stay for hip fracture patients. *PloS one*, *10*(7), 1-14. http://doi.org/10.1371/journal.pone.0133545.

Charlson, M. E., Charlson, R. E., Peterson, J. C., Marinopoulos, S. S., Briggs, W. M., & Hollenberg, J. P. (2008). The Charlson comorbidity index is adapted to predict costs of chronic disease in primary care patients. *Journal of clinical epidemiology*, *61*(12), 1234-1240. http://doi.org/10.1016/j.jclinepi.2008.01.006.

Charlson, M. E., Pompei, P., Ales, K. L., & MacKenzie, C. R. (1987). A new method of classifying prognostic comorbidity in longitudinal studies: development and

validation. *Journal of chronic diseases*, *40*(5), 373-383. http://doi.org/10.1016/0021-9681(87)90171-8.

Cheung, A. K. L. (2014). *Probability Proportional Sampling*. In M. A.C. (Ed.), Encyclopedia of quality of life and well-being research, 171, 5069-5071. Dordrecht: Springer Netherlands.

Cheung, C.-L., Ang, S. B., Chadha, M., Chow, E. S.-L., Chung, Y.-S., Hew, F. L., . . . Wu, C.-H. (2018). An updated hip fracture projection in Asia: the Asian Federation of Osteoporosis Societies study. *Osteoporosis and Sarcopenia*, *4*(1), 16-21. http://doi.org/10.1016/j.afos.2018.03.003.

Childs, J. D., Piva, S. R., & Fritz, J. M. (2005). Responsiveness of the numeric pain rating scale in patients with low back pain. *Spine*, *30*(11), 1331-1334. http://doi: 10.1097/01.brs.0000164099.92112.29.

Cho, M.-R., Song, S.-K., & Ryu, C.-H. (2020). Sleep Disturbance Strongly Related to the Development of Postoperative Delirium in Proximal Femoral Fracture Patients Aged 60 or Older. *Hip & pelvis*, *32*(2), 93. http://doi.org/10.5371/hp.2020.32.2.93

Cho, Y. W., Lee, J. H., Son, H. K., Lee, S. H., Shin, C., & Johns, M. W. (2011). The reliability and validity of the Korean version of the Epworth sleepiness scale. *Sleep and Breathing*, *15*(3), 377-384. http://doi 10.1007/s11325-010-0343-6

Chow, S. K.-H., Qin, J.-h., Wong, R. M.-Y., Yuen, W.-F., Ngai, W.-K., Tang, N., . . . Siu, K. M. (2018). One-year mortality in displaced intracapsular hip fractures

and associated risk: a report of Chinese-based fragility fracture registry. *Journal of orthopaedic surgery and research, 13*(1), 1-6. http://doi.org/10.1186/s13018-018-0936-5.

Chung, J., Demiris, G., & Thompson, H. J. (2015). Instruments to assess mobility limitation in community-dwelling older adults: a systematic review. *Journal of aging and physical activity*, *23*(2), 298-313. http://doi.org/10.1123/japa.2013-0181.

Clark, D. J. (2015). Automaticity of walking: functional significance, mechanisms, measurement and rehabilitation strategies. *Frontiers in human neuroscience, 9(* 246), 1-13. http://doi.org/10.3389/fnhum.2015.00246

Classen, T., Zaps, D., Landgraeber, S., Li, X., & Jäger, M. (2013). Assessment and management of chronic pain in patients with stable total hip arthroplasty. *International orthopaedics*, *37*, 1-7. https://doi.org/10.1007/s00264-012-1711-6.

Cobb, S. (1976). Social support as a moderator of life stress. *Psychosomatic Medicine, 38*(5), 300–314. http://doi.org/10.1097/00006842-197609000-00003.

Coluzzi, F. (2018). Assessing and treating chronic pain in patients with end-stage renal disease. *Drugs*, *78*(14), 1459-1479. https://doi.org/10.1007/s40265-018-0980-9.

Cram, P., Yan, L., Bohm, E., Kuzyk, P., Lix, L. M., Morin, S. N., . . . Leslie, W. D. (2017). Trends in operative and nonoperative hip fracture management 1990–2014: a longitudinal analysis of Manitoba administrative data. *Journal of the American Geriatrics Society, 65*(1), 27-34. http://doi.org/10.1111/jgs.14538.

Crossley, K. M., Bennell, K. L., Cowan, S. M., & Green, S. (2004). Analysis of outcome measures for persons with patellofemoral pain: which are reliable and valid? *Archives of physical medicine and rehabilitation*, *85*(5), 815-822. http://doi.org/10.1016/S0003-9993(03)00613-0.

Csuka, M., & McCarty, D. J. (1985). Simple method for measurement of lower extremity muscle strength. *The American journal of medicine*, *78*(1), 77-81. http://doi.org/10.1016/0002-9343(85)90465-6.

Davenport, S. J., & de Morton, N. A. (2011). Clinimetric properties of the de morton mobility index in healthy, community-dwelling older adults. *Archives of Physical Medicine and Rehabilitation*, *92*(1), 51–58. http://doi.org/10.1016/j.apmr.2010. 08.023.

Davis, M. P., & Walsh, D. (2010). Mechanisms of fatigue. *The journal of supportive oncology*, *8*(4), 164-174.

Davison, S. N., Koncicki, H., & Brennan, F. (2014). Pain in chronic kidney disease: a scoping review. *Seminars in Dialysis, 27(2)*, 188-204. https://doi.org/10.1111/sdi.12196.

De Groot, V., Beckerman, H., Lankhorst, G. J., & Bouter, L. M. (2003). How to measure comorbidity: a critical review of available methods. *Journal of clinical epidemiology*, *56*(3), 221-229. http://doi.org/10.1016/S0895-4356(02)00585-1

de Morton, N. A., Brusco, N. K., Wood, L., Lawler, K., & Taylor, N. F. (2011). The de Morton Mobility Index (DEMMI) provides a valid method for measuring and monitoring the mobility of patients making the transition from hospital to the

community: an observational study. *Journal of physiotherapy*, *57*(2), 109-116. http://doi.org/10.1016/S1836-9553(11)70021-2.

de Morton, N. A., Davidson, M., & Keating, J. L. (2008). The de Morton Mobility Index (DEMMI): an essential health index for an ageing world. *Health and quality of life outcomes*, *6*(1), 1-15. http://doi.org/10.1186/1477-7525-6-63.

de Morton, N. A., Davidson, M., & Keating, J. L. (2013). The development of the de morton mobility index (DEMMI) in an older acute medical population: item reduction using the Rasch model (part 1). *Journal of Applied Measurement*, *14*(2), 159-178.

de Morton, N. A., Harding, K. E., Taylor, N. F., & Harrison, G. (2013). Validity of the de Morton Mobility Index (DEMMI) for measuring the mobility of patients with hip fracture during rehabilitation. *Disability and rehabilitation*, *35*(4), 325-333. http://doi.org/10.3109/09638288.2012.705220.

de Morton, N. A., & Lane, K. (2010). Validity and reliability of the de Morton Mobility Index in the subacute hospital setting in a geriatric evaluation and management population. *Journal of rehabilitation medicine*, *42*(10), 956-961. http://doi:10.2340/16501977-0626

Deng, Y., Zheng, Z., Cheng, S. et al. (2021). The factors associated with nosocomial infection in elderly hip fracture patients: gender, age, and comorbidity. *International Orthopaedics (SICOT) 45*, 3201–3209. http: doi.org/10.1007/s00264-021-05104-3

Department of Health, Ministry of Public Health of Thailand. (2022). *Guidelines for Implementing the Action Plan for Health Promotion for the Elderly*. Retrive

from https://eh.anamai.moph.go.th/th/kpi2-5/download?id=62803&mid=33366&mkey=m_document&lang=th&did=18543

DeVellis, R. F. (2017). *Scale development* (4th ed.). SAGE.

Deyo, R. A., Cherkin, D. C., & Ciol, M. A. (1992). Adapting a clinical comorbidity index for use with ICD-9-CM administrative databases. *Journal of clinical epidemiology*, *45*(6), 613-619. http://doi.org/10.1016/0895-4356(92)90133-8.

Dyer, S. M., Crotty, M., Fairhall, N., Magaziner, J., Beaupre, L. A., Cameron, I. D., & Sherrington, C. (2016). A critical review of the long-term disability outcomes following hip fracture. *BMC geriatrics*, *16*(1), 1-18. http://doi.org/10.1186/s12877-016-0332-0.

Eamchunprathip, S., & Phanwichatkul, T. (2021). Causal factors influencing physical functional recovery of the elderly following hip surgery. *Nursing Journal of The Ministry of Public Health*, *31*(2), 166-180. https://he02.tci-thaijo.org/index.php/tnaph/article/view/252586.

Eckhardt, A. L., DeVon, H. A., Piano, M. R., Ryan, C. J., & Zerwic, J. J. (2014). Fatigue in the presence of coronary heart disease. *Nursing research*, *63*(2), 83-93. http://doi: 10.1097/NNR.0000000000000019.

Elixhauser, A., Steiner, C., Harris, D. R., & Coffey, R. M. (1998). Comorbidity Measures for Use with Administrative Data. *Medical Care*, *36*(1), 8–27. Retrieved from http://www.jstor.org/stable/3766985.

Emmerson, B. R., Varacallo, M., & Inman, D. (2022). *Hip fracture overview*. StatPearls.

Ensari, I., & Motl, R. W. (2020). Multiple Sclerosis, Walking, and Depression: Implications for Health Psychology. *The Wiley Encyclopedia of Health Psychology*, 143-151. http://doi.org/10.1002/9781119057840.ch148.

Erkinjuntti, T., Sulkava, R., Wikström, J., & Autio, L. (1987). Short Portable Mental Status Questionnaire as a screening test for dementia and delirium among the elderly. *Journal of the American Geriatrics Society*, *35*(5), 412–416. http://doi.org/10.1111/j.1532-5415. 1987.tb04662. x.

Fayers, P., Bottomley, A. E. O. R. T. C., & EORTC Quality of Life Group. (2002). Quality of life research within the EORTC—the EORTC QLQ-C30. *European Journal of Cancer*, *38*, 125-133. https://doi.org/10.1016/S0959-8049(01)00448-8.

Fawcett, J., & DeSAnto-MADeyA, S. (2013). *Contemporary Nursing Knowledge: Analysis and evaluation of nursing models and theories* (3th ed.). FA Davis.

Feinstein, A. R. (1970). The pre-therapeutic classification of co-morbidity in chronic disease. *Journal of chronic diseases*, *23*(7), 455-468. http://doi.org/10.1016/0021-9681(70)90054-8.

Fernandez, M. A., Griffin, X. L., & Costa, M. L. (2015). Management of hip fracture. *British medical bulletin*, *115*(1). http://doi: 10.1093/bmb/ldv036.

Ferraz, M. B., Quaresma, M. R., Aquino, L. R., Atra, E., Tugwell, P., & Goldsmith, C. H. (1990). Reliability of pain scales in the assessment of literate and illiterate patients with rheumatoid arthritis. *The Journal of rheumatology*, *17*(8), 1022–1024.

Ferrucci, L., Penninx, B. W., Volpato, S., Harris, T. B., Bandeen-Roche, K., Balfour, J., ... & Md, J. M. G. (2002). Change in muscle strength explains accelerated decline of physical function in older women with high interleukin-6 serum levels. *Journal of the American Geriatrics Society*, *50*(12), 1947-1954. http://doi.org/10.1046/j.1532-5415.2002. 50605.x.

Folden, S., & Tappen, R. (2007). Factors influencing function and recovery following hip repair surgery. *Orthopaedic Nursing*, *26*(4), 234-241. http://doi: 10.1097/01.NOR.0000284652.83462.7e.

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental state": a practical method for grading the cognitive state of patients for the clinician. *Journal of psychiatric research, 12*(3), 189-198.

Foss, N., Kristensen, M. T., Palm, H., & Kehlet, H. (2009). Postoperative pain after hip fracture is procedure specific. *British journal of anaesthesia, 102*(1), 111-116. http://doi.org/10.1093/bja/aen345.

Gandhi, R., Razak, F., Davey, J. R., & Mahomed, N. N. (2010). Metabolic syndrome and the functional outcomes of hip and knee arthroplasty. *The Journal of rheumatology*, *37*(9), 1917-1922. http://doi.org/10.3899/jrheum.091242.

Gatchel, R. J., Neblett, R., Kishino, N., & Ray, C. T. (2016). Fear-avoidance beliefs and chronic pain. *Journal of Orthopaedic & Sports Physical Therapy*, *46*(2), 38-43. http://doi/10.2519/jospt.2016.0601

Gellman, M. D., & Turner, J. R. (Eds.). (2013). *Encyclopedia of behavioral medicine* (pp. 1303-1304). New York, USA: Springer.

Gencay-Can, A., & Can, S. S. (2012). Validation of the Turkish version of the fatigue severity scale in patients with fibromyalgia. *Rheumatology international*, *32*(1), 27-31. https://doi.org/10.1007/s00296-010-1558-3.

Gheorghita, A., Webster, F., Thielke, S., & Sale, J. E. M. (2018). Long-term experiences of pain after a fragility fracture. *Osteoporosis International*, *29*(5), 1093-1104. http://doi.org/10.1007/s00198-018-4399-7.

Gijsen, R., Hoeymans, N., Schellevis, F. G., Ruwaard, D., Satariano, W. A., & van den Bos, G. A. (2001). Causes and consequences of comorbidity: a review. *Journal of clinical epidemiology*, *54*(7), 661-674. http://doi.org/10.1016/S0895-4356(00)00363-2.

Glanz, K., Rimer, B. K., & Viswanath, K. (Eds.). (2008). *Health behavior and health education: theory, research, and practice*. John Wiley & Sons.

Goldman, S. E., Ancoli-Israel, S., Boudreau, R., Cauley, J. A., Hall, M., Stone, K. L., ... & Newman, A. B. (2008). Sleep problems and associated daytime fatigue in community-dwelling older individuals. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, *63*(10), 1069-1075. http://doi.org/10.1093/gerona/63.10.1069.

González-Zabaleta, J., Pita-Fernandez, S., Seoane-Pillado, T., López-Calviño, B., & Gonzalez-Zabaleta, J. L. (2016). Comorbidity as a predictor of mortality and mobility after hip fracture. *Geriatrics & Gerontology International*, *16*(5), 561-569. http://doi.org/10.1111/ggi.12510.

Gottlieb Gottlieb, B. H., & Bergen, A. E. (2010). Social support concepts and measures. *Journal of psychosomatic research*, *69*(5), 511-520. http://doi.org/10.1016/j.jpsychores.2009.10.001.

Gray, J.R., Grove, S.K. and Sutherland, S. (2017). *Burns & Grove's the Practice of Nursing Research: Appraisal, Synthesis, and Generation of Evidence* (8th ed), Elsevier, St. Louis. ISBN 978-0-323-37758-4.

Griffiths, J., Putthinoi, S., & Pongsaksri, M. (2013). The General Practitioner Assessment of Cognition; GPCOG (Thai Version): Validity and Reliability (research report). Chiang Mai University. Chiang Mai. Thailand. Productivity Commission.

Griffiths, J., Putthinoi, S., & Pongsaksri, M. (2014). The general practitioner assessment of cognition; GPCOG (Thai version): validity and reliability. Poster session presented at: Rewinding the Aging Clock. 9th Pan-Pacific Conference on Rehabilitation Cum, 21st Annual Congress of Gerontology; Nov 29-30; Jockey Club Auditorium, the Hong Kong Polytechnic University. Hong Kong, China.

Griffin, M. M., & Steinbrecher, T. D. (2013). Large-scale datasets in special education research. *International review of research in developmental disabilities*, *45*, 155-183. https://doi.org/10.1016/B978-0-12-407760-7.00004-9.

Groll, D. L., To, T., Bombardier, C., & Wright, J. G. (2005). The development of a comorbidity index with physical function as the outcome. *Journal of clinical epidemiology*, *58*(6), 595-602. http://doi.org/10.1016/j.jclinepi.2004.10.018.

Haentjens, P., Autier, P., Barette, M., Venken, K., Vanderschueren, D., Boonen, S., & Hip Fracture Study Group. (2007). Survival and functional outcome according to

hip fracture type: a one-year prospective cohort study in elderly women with an intertrochanteric or femoral neck fracture. *Bone*, *41*(6), 958-964. http://doi.org/10.1016/j.bone.2007.08.026.

Hagen, G., Magnussen, J., Tell, G., & Omsland, T. (2020). Estimating the future burden of hip fractures in Norway. A NOREPOS study. *Bone*, *131*, 1-7. http://doi.org/10.1016/j.bone.2019.115156.

Haghighi, K. S., Montazeri, A., Mehrizi, A. K., Aminian, O., Golkhandan, A. R., Saraei, M., & Sedaghat, M. (2013). The Epworth Sleepiness Scale: translation and validation study of the Iranian version. *Sleep and Breathing*, *17*(1), 419-426. http;//doi.org/10.1007/s11325-012-0646-x.

Hai, M. B. (2015). *Factors predicting quality of sleep among patients after receiving major orthopedic surgery in Hue university hospital, VietNam*. (Unpublished thesis). Burapha University.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis* (8th ed.). Cengage. ISBN: 9781473756540.

Hajjar, I., Quach, L., Yang, F., Chaves, P. H., Newman, A. B., Mukamal, K., ... & Lipsitz, L. A. (2011). Hypertension, white matter hyperintensities, and concurrent impairments in mobility, cognition, and mood: The Cardiovascular Health Study. *Circulation*, *123*(8), 858-865. https://doi.org/10.1161/CIRCULATIONAHA.110.978114.

Hall, W. H., Ramachandran, R., Narayan, S., Jani, A. B., & Vijayakumar, S. (2004). An electronic application for rapidly calculating Charlson comorbidity score. *BMC cancer*, *4*(1), 1-8. http://doi.org/10.1186/1471-2407-4-94.

Hansson, S., Rolfson, O., Åkesson, K., Nemes, S., Leonardsson, O., & Rogmark, C. (2015). Complications and patient-reported outcome after hip fracture. A consecutive annual cohort study of 664 patients. *Injury*, *46*(11), 2206-2211. http://doi.org/10.1016/j.injury.2015.07.024 .

Hao, L., Carson, J. L., Schlussel, Y., Noveck, H., & Shapses, S. A. (2020). Vitamin D deficiency is associated with reduced mobility after hip fracture surgery: a prospective study. *The American journal of clinical nutrition, 112*(3), 613-618. http://doi.org/10.1093/ajcn/nqaa029.

Harbison, J. A., Walsh, S., & Kenny, R. A. (2009). Hypertension and daytime hypotension found on ambulatory blood pressure is associated with fatigue following stroke and TIA. *QJM: An International Journal of Medicine*, *102*(2), 109-115. HTTP://doi.org/10.1093/qjmed/hcn146.

Harvey, P. D. (2019). Domains of cognition and their assessment. *Dialogues in clinical neuroscience, 21*(3), 227. http://doi: 10.31887/DCNS.2019.21.3/pharvey.

Haslam-Larmer, L., Donnelly, C., Auais, M., Woo, K., & DePaul, V. (2021). Early mobility after fragility hip fracture: a mixed method embedded case study. *BMC geriatrics, 21*(1), 1-14. http://doi.org/10.1186/s12877-021-02083-3.

Hawker, G.A., French, M.R., Waugh, E.J., Gignac, M.A.M., Cheung, C., & Murray, B.J. (2010). Th e multidimensionality of sleep quality and its relationship to fatigue in older adults with painful osteoarthritis. Osteoarthritis and Cartilage, 18, 1365-1371. http://doi:10.1016/j.joca.2010.08.002.

Hawker, G. A., Mian, S., Kendzerska, T., & French, M. (2011). Measures of adult pain: Visual analog scale for pain (vas pain), numeric rating scale for pain (nrs pain),

mcgill pain questionnaire (mpq), short-form mcgill pain questionnaire (sf-mpq), chronic pain grade scale (cpgs), short form-36 bodily pain scale (sf-36 bps), and measure of intermittent and constant osteoarthritis pain (icoap). *Arthritis care & research, 63*(S11), S240-S252. http://doi.org/10.1002/acr.20543.

Hertz, K., & Santy-Tomlinson, J. (2018). *Fragility fracture nursing: holistic care and management of the orthogeriatric patient.* Springer. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK543820/doi:10.1007/978-3-319-76681-2_6.

Hjermstad, M. J., Fayers, P. M., Haugen, D. F., Caraceni, A., Hanks, G. W., Loge, J. H., ... & European Palliative Care Research Collaborative (EPCRC. (2011). Studies comparing numerical rating scales, verbal rating scales, and visual analogue scales for assessment of pain intensity in adults: a systematic literature review. *Journal of pain and symptom management*, *41*(6), 1073-1093. http://doi.org/10.1016/j.jpainsymman.2010.08.016.

Hsu, H. J., Yen, C. H., Hsu, K. H., Wu, I. W., Lee, C. C., Hung, M. J., ... & Wu, M. S. (2014). Factors associated with chronic musculoskeletal pain in patients with chronic kidney disease. *BMC nephrology*, *15*, 1-9. https://doi.org/10.1186/1471-2369-15-6.

Hulin, C., Netemeyer, R., & Cudeck, R. (2001). Can a Reliability Coefficient Be Too High? *Journal of Consumer Psychology*, *10*(1/2), 55–58. http://www.jstor.org/stable/1480474.

Hulsbæk, S., Larsen, R. F., Rosthøj, S., & Kristensen, M. T. (2019). The Barthel Index and the Cumulated Ambulation Score are superior to the de Morton Mobility

Index for the early assessment of outcome in patients with a hip fracture admitted to an acute geriatric ward. *Disability and Rehabilitation*, *41*(11), 1351-1359. http://doi.org/10.1080/09638288.2018.1424951.

Impellizzeri, F. M., Agosti, F., De Col, A., & Sartorio, A. (2013). Psychometric properties of the Fatigue Severity Scale in obese patients. *Health and quality of life outcomes*, *11*(1), 1-7. http://doi.org/10.1186/1477-7525-11-32.

Institute of Geriatric Medicine, Department of Medical Services, Ministry of Health. (2002). *Mini-Mental State Examination.* ISBN 974-9593-33-2. (in Thai).

Jennison, T., & Yarlagadda, R. (2019). A case series of patients change in mobility following a hip fracture. *European Journal of Orthopaedic Surgery & Traumatology*, *29*(1), 87-90. http://doi.10.1007/s00590-018-2267-y.

Jansen, H., Doht, S., Frey, S. P., & Meffert, R. H. (2013). Subtrochanteric femoral fractures: influence of patient age on fracture type and mobility. *Journal of Orthopaedic Science*, *18*(3), 451-455. http://doi.org/10.1007/s00776-013-0372-7

Jirapramukpitak, T., & Tanchaiswad, W. (1997). Sleep disturbances among nurses of Songklanagarind Hospital. *Journal of the Psychiatric Association of Thailand, 42* (3), 123-132 (in Thai). Retrieved from https://dmh.go.th/abstract/pdf/100404203229.pdf.

Kanis, J. A., Harvey, N. C., Johansson, H., Odén, A., McCloskey, E. V., & Leslie, W. D. (2017). Overview of fracture prediction tools. *Journal of Clinical Densitometry*, *20*(3), 444-450. https://doi.org/10.1016/j.jocd.2017.06.013.

Kanis, J. A., Oden, A., McCloskey, E. V., Johansson, H., Wahl, D. A., Cooper, C., & IOF Working Group on Epidemiology and Quality of Life. (2012). A systematic

review of hip fracture incidence and probability of fracture worldwide. *Osteoporosis international*, *23*, 2239-2256. https://doi.org/10.1007/s00198-012-1964-3.

Karlamangla, A., Tinetti, M., Guralnik, J., Studenski, S., Wetle, T., & Reuben, D. (2007). Comorbidity in older adults: nosology of impairment, diseases, and conditions. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, *62*(3), 296-300. http://doi.org/10.1093/gerona/62.3.296.

Keith, R. A., Granger, C. V., Hamilton, B. B., Sherwin, F. S., Eisenberg, M. G., & Grzesiak, R. C. (1987). Advances in clinical rehabilitation. *The functional independence measure: A new tool in rehabilitation.* Springer-Verlag.

Kempen, G. I. J. M., & Van Eijk, L. M. (1995). The psychometric properties of the SSL12-I, a short scale for measuring social support in the elderly. *Social Indicators Research*, *35*(3), 303-312. http://doi.org/10.1007/BF01079163.

King, L. A., Priest, K. C., Nutt, J., Chen, Y., Chen, Z., Melnick, M., & Horak, F. (2014). Comorbidity and functional mobility in persons with Parkinson disease. *Archives of physical medicine and rehabilitation*, *95*(11), 2152-2157. http://doi.org/10.1016/j.apmr.2014.07.396.

Klaewklong, S., Chanruangvanich, W., Danaidutsadeekul, S., & Riansuwan, K. (2014). Relation of comorbidity, grip strength and stress to hip fracture patients' post-operative functional recovery. *Thai Journal of Nursing Council*, *29*(2), 36-48. https://he02.tci-thaijo.org/index.php/TJONC/article/view/21117.

Kleinman, L., Zodet, M. W., Hakim, Z., Aledort, J., Barker, C., Chan, K., ... & Revicki, D. (2000). Psychometric evaluation of the fatigue severity scale for use in

chronic hepatitis C. *Quality of Life Research, 9*(5), 499-508. http://doi.org/10.1023/A:1008960710415.

Kless, J. R. (2010). *Factors associated with moderate and severe postoperative pain.* (Doctoral dissertation) Case Western Reserve University. https://etd.ohiolink.edu/apexprod/rws_etd/send_file/send?accession=case1264081658&disposition=inline.

Kline, R. B. (1998). *Principles and practice of structural equation modeling*. New York: Guilford Press.

Kline, R. B. (2016). *Principles and practice of structural equation modeling*. New York: Guilford Press.

Koren-Hakim, T., Weiss, A., Hershkovitz, A., Otzrateni, I., Grosman, B., Frishman, S., ... & Beloosesky, Y. (2012). The relationship between nutritional status of hip fracture operated elderly patients and their functioning, comorbidity and outcome. *Clinical nutrition, 31*(6), 917-921. https://doi.org/10.1016/j.clnu.2012.03.010.

Kos, N., Burger, H., & Vidmar, G. (2011). Mobility and functional outcomes after femoral neck fracture surgery in elderly patients: a comparison between hemiarthroplasty and internal fixation. *Disabil Rehabil, 33*(23-24), 2264-2271. http://doi:10.3109/09638288.2011.568665.

Kristensen, M. T. (2011). Factors affecting functional prognosis of patients with hip fracture. *European Journal of Physical and Rehabilitation Medicine, 47*(2), 257-264.

Kristensen, M. T. (2013). Hip fracture related pain strongly influences functional performance of patients with an intertrochanteric fracture upon discharge from the hospital. *European Journal of Physical and Rehabilitation Medicine*, *5*(2), 135-141. http://doi.org/10.1016/j.pmrj.2012.10.006.

Kristensen, M. T., Bandholm, T., Bencke, J., Ekdahl, C., & Kehlet, H. (2009). Knee-extension strength, postural control and function are related to fracture type and thigh edema in patients with hip fracture. *Clinical Biomechanics*, *24*(2), 218-224. https://doi.org/10.1016/j.clinbiomech.2008.10.003.

Kristensen, M. T., Foss, N. B., Ekdahl, C., & Kehlet, H. (2010). Prefracture functional level evaluated by the New Mobility Score predicts in-hospital outcome after hip fracture surgery. *Acta Orthopaedica*, *81*(3), 296-302. https://doi.org/10.3109/17453674.2010.487240.

Kristensen, M. T., Öztürk, B., Röck, N. D., Ingeman, A., Palm, H., & Pedersen, A. B. (2019). Regaining pre-fracture basic mobility status after hip fracture and association with post-discharge mortality and readmission—a nationwide register study in Denmark. *Age and ageing*, *48*(2), 278-284. http://doi.org/10.1093/ageing/afy185.

Krupp, L. B., LaRocca, N. G., Muir-Nash, J., & Steinberg, A. D. (1989). The fatigue severity scale: application to patients with multiple sclerosis and systemic lupus erythematosus. *Archives of neurology*, *46*(10), 1121-1123. http://doi:10.1001/archneur.1989.00520460115022.

Krystal, A. D., & Edinger, J. D. (2008). Measuring sleep quality. *Sleep medicine*, *9*, S10-S17. http://doi10.1016/S1389-9457(08)70011-X.

Kuo, W. Y., Shyu, Y. I. L., Wang, J. S., Chen, M. C., Wu, C. C., & Huang, Y. F. (2016). The impact of sleep duration on recovery post-hip fracture among older diabetic adults in Taiwan. *Geriatric Nursing*, *37*(2), 137-144. http://doi.org/10.1016/j.gerinurse.2015.11.005.

Kuswardhani, R. T., Henrina, J., Pranata, R., Lim, M. A., Lawrensia, S., & Suastika, K. (2020). Charlson comorbidity index and a composite of poor outcomes in COVID-19 patients: A systematic review and meta-analysis. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, *14*(6), 2103-2109. http://doi.org/10.1016/j.dsx.2020.10.022.

Langford, C. P. H., Bowsher, J., Maloney, J. P., & Lillis, P. P. (1997). Social support: a conceptual analysis. *Journal of advanced nursing*, *25*(1), 95-100. http://doi.org/10.1046/j.1365-2648.1997.1997025095.x.

Langford, D., Edwards, N., Gray, S. M., Fleig, L., & Ashe, M. C. (2018). "Life goes on." Everyday tasks, coping self-efficacy, and independence: exploring older adults' recovery from hip fracture. *Qualitative health research*, *28*(8), 1255-1266. http://doi:10.1177/1049732318755675.

Lapcevic, W. A., French, D. D., & Campbell, R. R. (2010). All-cause mortality rates of hip fractures treated in the VHA: do they differ from Medicare facilities? *Journal of the American Medical Directors Association*, *11*(2), 116-119. http://doi.org/10.1016/j.jamda.2009.07.009

Lavoie, C. J., Zeidler, M. R., & Martin, J. L. (2018). Sleep and aging. *Sleep Science and Practice*, *2*, 1-8. https://doi.org/10.1186/s41606-018-0021-3.

Lee, D., Jo, J. Y., Jung, J. S., & Kim, S. J. (2014). Prognostic factors predicting early recovery of pre-fracture functional mobility in elderly patients with hip fracture. *Annals of rehabilitation medicine*, *38*(6), 827-835. http://doi.org/10.5535/arm.2014.38.6.827

Lenz, E. Gift, A., & Pugh, L. (2014). *The theory of unpleasant symptoms* (3th ed.). Philadelphia: Lippincott Williams and Wilkins.

Lenze, E. J., Munin, M. C., Dew, M. A., Rogers, J. C., Seligman, K., Mulsant, B. H., & Reynolds III, C. F. (2004). Adverse effects of depression and cognitive impairment on rehabilitation participation and recovery from hip fracture. *International journal of geriatric psychiatry*, *19*(5), 472-478. http://doi.org/10.1002/gps.1116.

Lenz, E. R., Pugh, L. C., Milligan, R. A., Gift, A., & Suppe, F. (1997). The middle-range theory of unpleasant symptoms: an update. *Advances in Nursing Science, 19*(3), 14-27. Retrieved from https://journals.lww.com/advancesinnursingscience/Fulltext/1997/03000.

Lerdal, A., Wahl, A. K., Rustoen, T., Hanestad, B. R., & Moum, T. (2005). Fatigue in the general population: a translation and test of the psychometric properties of the Norwegian version of the fatigue severity scale. *Scandinavian journal of public health*, *33*(2), 123-130. http://doi.org/10.1080/14034940410028406.

Lespasio, M. J., Piuzzi, N. S., Husni, M. E., Muschler, G. F., Guarino, A. J., & Mont, M. A. (2017). Knee osteoarthritis: a primer. *The Permanente Journal*, *21*, 16-183. https://doi.org/10.7812/TPP/16-183.

Levasseur, M., Généreux, M., Bruneau, J. F., Vanasse, A., Chabot, É., Beaulac, C., & Bédard, M. M. (2015). Importance of proximity to resources, social support, transportation and neighborhood security for mobility and social participation in older adults: results from a scoping study. *BMC public health*, *15*, 1-19. https://doi.org/10.1186/s12889-015-1824-0.

Levine, D. W., Dailey, M. E., Rockhill, B., Tipping, D., Naughton, M. J., & Shumaker, S. A. (2005). Validation of the Women's Health Initiative Insomnia Rating Scale in a multicenter controlled clinical trial. *Psychosomatic medicine*, *67*(1), 98-104. http://doi: 10.1097/01.psy.0000151743. 58067.f0.

Levine, D. W., Lewis, M. A., Bowen, D. J., Kripke, D. F., Kaplan, R. M., Naughton, M. J., & Shumaker, S. A. (2003). Reliability and validity of Women's Health Initiative Insomnia Rating Scale. *Psychological assessment*, *15*(2), 137. http://doi.org/10.1037/1040-3590.15.2.137.

Lewis, S. L., Bucher, L., Heitkemper, M. M., Harding, M. M., Kwong, J., & Roberts, D. (2016). *Medical-Surgical Nursing-E-Book: Assessment and Management of Clinical Problems, Single Volume*. Elsevier Health Sciences.

Linacre, J. M., Heinemann, A. W., Wright, B. D., Granger, C. V., & Hamilton, B. B. (1994). The structure and stability of the Functional Independence Measure. *Archives of physical medicine and rehabilitation*, *75*(2), 127-132. http://doi.org/10.1016/0003-9993(94)90384-0.

LoBiondo-Wood, G., & Haber, J. (2014). *Nursing research-e-book: methods and critical appraisal for evidence-based practice*: Elsevier Health Sciences.

Løke, D., Løvstad, M., Andelic, N., Andersson, S., Ystrom, E., & Vassend, O. (2022). The role of pain and psychological distress in fatigue: a co-twin and within-person analysis of confounding and causal relations. *Health Psychology and Behavioral Medicine*, *10*(1), 160-179. https://doi.org/10.1080/21642850.2022.2033121.

Lozano-Ondoua, A. N., Symons-Liguori, A. M., & Vanderah, T. W. (2013). Cancer-induced bone pain: mechanisms and models. *Neuroscience letters*, *557*, 52-59. https://doi.org/10.1016/j.neulet.2013.08.003.

Lund, C. A., Møller, A. M., Wetterslev, J., & Lundstrøm, L. H. (2014). Organizational factors and long-term mortality after hip fracture surgery. A cohort study of 6143 consecutive patients undergoing hip fracture surgery. *PLoS One*, *9*(6), 1-9. https://doi.org/10.1371/journal.pone.0099308

Lynn, M. R. (1986). Determination and quantification of content validity. *Nursing Research* , 35(6), 382-358.

Macri, E. M., Lewis, J. A., Khan, K. M., Ashe, M. C., & de Morton, N. A. (2012). The de Morton mobility index: normative data for a clinically useful mobility instrument. *Journal of aging research*, 1-7. http://doi.org/10.1155/2012/353252

Magee, C. A., Caputi, P., Iverson, D. C., & Huang, X. F. (2008). An investigation of the dimensionality of the Pittsburgh Sleep Quality Index in Australian adults. *Sleep and Biological Rhythms*, *6*, 222-227. https://doi.org/10.1111/j.1479-8425.2008.00371.x.

Maggi, S., Siviero, P., Wetle, T., Besdine, R., Saugo, M., Crepaldi, G. f., & Group, H. F. S. (2010). A multicenter survey on profile of care for hip fracture: predictors of

mortality and disability. *Osteoporosis international, 21*(2), 223-231. http://doi.org/10.1007/s00198-009-0936-8.

Maharlouei, N., Jafarzadeh, F., & Lankarani, K. B. (2019). Factors affecting recovery during the first 6 months after hip fracture, using the decision tree model. *Archives of osteoporosis*, *14*(1), 1-6. http://doi.org/10.1007/s11657-019-0611-4.

Mangione, K. K., Craik, R. L., Tomlinson, S. S., & Palombaro, K. M. (2005). Can elderly patients who have had a hip fracture perform moderate-to high-intensity exercise at home? *Physical therapy*, *85*(8), 727-739. https://doi.org/10.1093/ptj/85.8.727

Maninet, S., Aungsuroch, Y., & Jitpanya, C. (2021). A causal model of functional status among persons with liver cirrhosis from four public hospitals in Thailand. *Journal of Health Research*, *36*(6), 1028-1039. http://doi.org/10.1108/JHR-11-2020-0558.

Mariconda, M., Costa, G. G., Cerbasi, S., Recano, P., Orabona, G., Gambacorta, M., & Misasi, M. (2016). Factors predicting mobility and the change in activities of daily living after hip fracture: a 1-year prospective cohort study. *Journal of orthopaedic trauma*, *30*(2), 71-77. http://doi: 10.1097/BOT.0000000000000448.

Mattsson, M., Möller, B., Lundberg, I. E., Gard, G., & Boström, C. (2008). Reliability and validity of the Fatigue Severity Scale in Swedish for patients with systemic lupus erythematosus. *Scandinavian journal of rheumatology*, *37*(4), 269-277. http://doi.org/10.1080/03009740801914868.

McCaffery, M., & Pasero, C. (1999). *Pain: Clinical manual*. St Louis, MO: Mosby.

McKinnon, A., Terpening, Z., Hickie, I. B., Batchelor, J., Grunstein, R., Lewis, S. J., & Naismith, S. L. (2014). Prevalence and predictors of poor sleep quality in mild cognitive impairment. *Journal of geriatric psychiatry and neurology*, *27*(3), 204-211. http://doi.org/10.1177/0891988714527516.

Melzack, R., & Wall, P. D. (1965). Pain mechanisms: a new theory. *Science, 150*(3699), 971-979. http://doi:10.1126/science.150.3699.971.

Menezes, K. V. R. S., Auger, C., de Souza Menezes, W. R., & Guerra, R. O. (2017). Instruments to evaluate mobility capacity of older adults during hospitalization: a systematic review. *Archives of gerontology and geriatrics, 72*, 67-79. http://doi.org/10.1016/j.archger.2017.05.009.

Ministry of Public Health (2016). *Summary of patient reports 2015*. Retrieved August, 31 2021 from https://bps.moph.go.th/new_bps/sites/default/files/ill2558full.pdf

Ministry of Public Health (2017). *Summary of patient reports 2016*. Retrieved August, 31 2021 from https://bps.moph.go.th/new_bps/sites/default/files/ill_2559_full_edit.pdf

Ministry of Public Health (2018). *Summary of patient reports 2017*. Retrieved August, 31 2021 from https://bps.moph.go.th/new_bps/sites/default/files/ill_2560_full.pdf

Ministry of Public Health (2019). *Summary of patient reports 2018*. Retrieved August, 31 2021 from https://bps.moph.go.th/new_bps/sites/default/files/ill_2561_full_19Nov19.pdf

Ministry of Public Health (2020). *Summary of patient reports 2019*. Retrieved August, 31 2021 from https://bps.moph.go.th/new_bps/sites/default/files/ill_2562_full_20200921.pdf

Mollayeva, T., Thurairajah, P., Burton, K., Mollayeva, S., Shapiro, C. M., & Colantonio, A. (2016). The Pittsburgh sleep quality index as a screening tool for sleep dysfunction in clinical and non-clinical samples: A systematic review and meta-analysis. *Sleep medicine reviews*, *25*, 52-73. https://doi.org/10.1016/j.smrv.2015.01.009.

Moo, H., Kam, C. J. W., Cher, E. W. L., Peh, B. C. J., Lo, C. E., Chua, D. T. C., ... & Koh, J. S. B. (2020). The effect of the comorbidity burden on vitamin D levels in geriatric hip fracture. *BMC Musculoskeletal Disorders, 21*(1), 1-8. http://doi.org/10.1186/s12891-020-03554-1.

Moreira, N. C. V., Damasceno, R. S., Medeiros, C. A. M., De Bruin, P. F. C., Teixeira, C. A. C., Horta, W. G., & De Bruin, V. M. S. (2008). Restless leg syndrome, sleep quality and fatigue in multiple sclerosis patients. *Brazilian Journal of Medical and Biological Research, 41*, 932-937. https://doi.org/10.1590/S0100-879X2008001000017.

Morghen, S., Gentile, S., Ricci, E., Guerini, F., Bellelli, G., & Trabucchi, M. (2011). Rehabilitation of older adults with hip fracture: cognitive function and walking abilities. *Journal of the American Geriatrics Society*, *59*(8), 1497-1502. http://doi.org/10.1111/j.1532-5415.2011. 03496.x.

Morri, M., Ambrosi, E., Chiari, P., Orlandi Magli, A., Gazineo, D., D'Alessandro, F., & Forni, C. (2019). One-year mortality after hip fracture surgery and prognostic

factors: a prospective cohort study. *Scientific reports*, *9*(1), 1-7. https://doi.org/10.1038/s41598-019-55196-6.

Morris, B. A., Benetti, M., Marro, H., & Rosenthal, C. K. (2010). Clinical practice guidelines for early mobilization hours after surgery. *Orthopaedic nursing*, *29*(5), 290-316. http://doi: 10.1097/NOR.0b013e3181ef7a5d.

Morselli, L. L., Guyon, A., & Spiegel, K. (2012). Sleep and metabolic function. *Pflügers Archiv-European Journal of Physiology*, *463*(1), 139-160. http://doi.org/10.1007/s00424-011-1053-z.

Mueller-Schotte, S., Bleijenberg, N., van der Schouw, Y. T., & Schuurmans, M. J. (2016). Fatigue as a long-term risk factor for limitations in instrumental activities of daily living and/or mobility performance in older adults after 10 years. *Clinical interventions in aging*, *11*, 1579. http://doi.org/10.2147/CIA.S116741.

Münter, K. H., Clemmesen, C. G., Foss, N. B., Palm, H., & Kristensen, M. T. (2018). Fatigue and pain limit independent mobility and physiotherapy after hip fracture surgery. *Disability and Rehabilitation*, *40*(15), 1808-1816. http://doi.org/10.1080/09638288.2017.1314556.

Muthén, B. O., Muthén, L. K., & Asparouhov, T. (2016). *Regression and mediation analysis using Mplus.* Los Angeles, CA: Muthén & Muthén.

Myers, R. P., Quan, H., Hubbard, J. N., Shaheen, A. A. M., & Kaplan, G. G. (2009). Predicting in-hospital mortality in patients with cirrhosis: results differ across risk adjustment methods. *Hepatology*, *49*(2), 568-577. http://doi.org/10.1002/hep.22676.

Naismith, S. L., Hickie, I. B., Terpening, Z., Rajaratnam, S. W., Hodges, J. R., Bolitho, S., ... & Lewis, S. J. (2014). Circadian misalignment and sleep disruption in mild cognitive impairment. *Journal of Alzheimer's Disease*, *38*(4), 857-866. http://doi:10.3233/JAD-131217.

National Health Commission Office. (2015). *System for establishing a area health for the Thai people*. Retrieved November, 12 2021. From https://www.nationalhealth.or.th/sites/default/files/upload_files/60_01_15_8475.pdf (in Thai).

Nelesen, R., Dar, Y., Thomas, K., & Dimsdale, J. E. (2008). The relationship between fatigue and cardiac functioning. *Archives of internal medicine*, *168*(9), 943-949. http://doi 10.1001/archinte.168.9.943

Nelson, K. L., Davis, J. E., & Corbett, C. F. (2022). Sleep quality: An evolutionary concept analysis. In *Nursing Forum*, 57(1), 144-151) http://doi.org/10.1111/nuf.12659.

Newfield, S. A., Hinz, M. D., & Scott-Tilley, D. (2007). *Cox's Clinical Application of Nursing Diagnosis: Adult, Child, Women's, Mental Health, Gerontic, and Home Health Consideration*. FA Davis.

New, P. W., Scroggie, G. D., & Williams, C. M. (2017). The validity, reliability, responsiveness and minimal clinically important difference of the de Morton mobility index in rehabilitation. *Disability and rehabilitation*, *39*(10), 1039-1043. https://doi.org/10.1080/09638288.2016.1179800.

Ngamkham, S., Holden, J. E., & Wilkie, D. J. (2011). Differences in pain location, intensity, and quality by pain pattern in outpatients with cancer. *Cancer nursing*, *34*(3), 228–237. http://doi.org/10.1097/NCC.0b013e3181faab63.

Nicassio, P. M., Ormseth, S. R., Custodio, M. K., Irwin, M. R., Olmstead, R., & Weisman, M. H. (2012). A multidimensional model of fatigue in patients with rheumatoid arthritis. *The Journal of rheumatology*, *39*(9), 1807-1813. http:// doi.org/10.3899/jrheum.111068

Nicassio, P. M., Ormseth, S. R., Custodio, M. K., Olmstead, R., Weisman, M. H., & Irwin, M. R. (2014). Confirmatory factor analysis of the Pittsburgh Sleep Quality Index in rheumatoid arthritis patients. *Behavioral sleep medicine*, *12*(1), 1-12. http://doi.org/10.1080/15402002.2012.720315.

Nielson, W. R. (2001). The concept of pain. *The Clinical journal of pain*, *17*(4), S5-S7

Nikkel, L. E., Fox, E. J., Black, K. P., Davis, C., Andersen, L., & Hollenbeak, C. S. (2012). Impact of comorbidities on hospitalization costs following hip fracture. *The Journal of Bone & Joint Surgery*, *94*(1), 9-17. http://doi: 10.2106/JBJS.J.01077.

Ninlerd, C., Dungkong, S., Phuangphay, G., Amornsupak, C., & Narkbunnam, R. (2020). Effect of home-based rehabilitation exercise program for elderly patients with femoral neck fracture after bipolar hemiarthroplasty. *Siriraj Medical Journal*, *72*(4), 307-314. http://doi.org/10.33192/Smj.2020.42.

Noohi, F., Kinnaird, C., De Dios, Y., Kofman, I., Wood, S. J., Bloomberg, J. J., ... & Seidler, R. D. (2019). Deactivation of somatosensory and visual cortices during

vestibular stimulation is associated with older age and poorer balance. *PLoS one*, *14*(9), e0221954. https://doi.org/10.1371/journal.pone.0221954

Nuotio, M., & Luukkaala, T. (2016). Factors associated with changes in mobility and living arrangements in a comprehensive geriatric outpatient assessment after hip fracture. *Disability and rehabilitation*, *38*(12), 1125-1133. http://doi.org/10.3109/09638288.2015.1074728.

Nuotio, M., Tuominen, P., & Luukkaala, T. (2016). Association of nutritional status as measured by the Mini-Nutritional Assessment Short Form with changes in mobility, institutionalization and death after hip fracture. *European Journal of Clinical Nutrition*, *70*(3), 393-398. http://doi.org/10.1038/ejcn.2015.174.

Ohayon, M., Wickwire, E. M., Hirshkowitz, M., Albert, S. M., Avidan, A., Daly, F. J., ... & Vitiello, M. V. (2017). National Sleep Foundation's sleep quality recommendations: first report. *Sleep health*, *3*(1), 6-19. http://doi: 10.1016/j.sleh.2016.11.006.

Ong, J. C., Gill, J. R., & Parker, M. J. (2019). Mobility after intertrochanteric hip fracture fixation with either a sliding hip screw or a cephalomedullary nail: Sub group analysis of a randomised trial of 1000 patients. *Injury*, *50*(10), 1709-1714. http://doi.org/10.1016/j.injury.2019.06.015.

Parker, M. J., & Palmer, C. R. (1993). A new mobility score for predicting mortality after hip fracture. *The Journal of bone and joint surgery. British volume*, *75*(5), 797-798. http://doi.org/10.1302/0301-620X.75B5.8376443.

Pasero, C., & McCaffery, M. (2011). *Pain assessment and pharmacologic management*, St. Louis, Mosby.

Pedro, I. C. D. S., Rocha, S. M. M., & Nascimento, L. C. (2008). Social support and social network in family nursing: reviewing concepts. *Revista latino-americana de enfermagem*, *16*, 324-327. http://doi.org/10.1590/S0104-11692008000200024.

Pfeiffer, E. (1975). A short portable mental status questionnaire for the assessment of organic brain deficit in elderly patients. *Journal of the American Geriatrics Society*, *23*(10), 433-441. http://doi.org/10.1111/j.1532-5415. 1975.tb00927. x.

Piper, B. F., Lindsey, A. M., & Dodd, M. J. (1987). Fatigue mechanisms in cancer patients: developing nursing theory. In *Oncology nursing forum*, 14(6), 17-23.

Piper, B. F., Lindsey, A. M., Dodd, M. J., Ferketich, S., Paul, S. M., & Weller, S. (1989). The development of an instrument to measure the subjective dimension of fatigue. *Management of pain, fatigue and nausea* (pp. 199-208). Macmillan Education UK.

Pitzul, K. B., Munce, S. E., Perrier, L., Beaupre, L., Morin, S. N., McGlasson, R., & Jaglal, S. B. (2017). Scoping review of potential quality indicators for hip fracture patient care. *BMJ open*, *7*(3), 1-10. http://doi.org/10.1136/bmjopen-2016-014769.

Polit, D. F., & Beck, C. T. (2017). *Nursing research: Generating and assessing evidence for nursing practice* (10th ed): Wolters Kluwer Health.

Pope, J. E. (2020). Management of fatigue in rheumatoid arthritis. *Rhumatic & Musculoskeletal Disease open*, *6*(1), 1-9. http://doi:10.1136/ rmdopen-2019-001084.

Portegijs, E., Edgren, J., Salpakoski, A., Kallinen, M., Rantanen, T., Alen, M., . . . Sipilä, S. (2012). Balance confidence was associated with mobility and balance performance in older people with fall-related hip fracture: a cross-sectional study. *Archives of physical medicine and rehabilitation*, 93(12), 2340-2346. http://doi.org/10.1016/j.apmr.2012.05.022.

Pozzi, F., Madara, K., & Zeni Jr, J. A. (2017). A six-week supervised exercise and educational intervention after total hip arthroplasty: a case series. *International journal of sports physical therapy, 12(2),* 259–272.

Promchat, L., Chanruangvanich, W., Utriyaprasit, K., & Riansuwan, K. (2015). Influence of sleep quality, comorbidity and hemoglobin level on hip fracture patients' initial ambulatory ability after hemiarthroplasty. *Thai Journal of Nursing Council 30*(2), 75-85. (in Thai). Retrieved from https://he02.tci-thaijo.org/index.php/TJONC/article/view/35461.

Punjabi, N. M., & Beamer, B. A. (2007). C-reactive protein is associated with sleep disordered breathing independent of adiposity. *Sleep*, *30*(1), 29-34. http://doi.org/10.1093/sleep/30.1.29.

Quach, S., Hennessy, D. A., Faris, P., Fong, A., Quan, H., & Doig, C. (2009). A comparison between the APACHE II and Charlson Index Score for predicting hospital mortality in critically ill patients. *BMC health services research*, *9*(1), 1-8. http://doi.org/10.1186/1472-6963-9-129.

Quan, H., Li, B., Couris, C. M., Fushimi, K., Graham, P., Hider, P., . . . Sundararajan, V. (2011). Updating and validating the Charlson comorbidity index and score for risk adjustment in hospital discharge abstracts using data from 6 countries.

American journal of epidemiology, *173*(6), 676-682. https://doi.org/10.1093/aje/kwq433.

Radosavljevic, N., Nikolic, D., Lazovic, M., Petronic, I., Milicevic, V., Radosavljevic, Z., ... & Jeremic, A. (2013). Estimation of functional recovery in patients after hip fracture by Berg Balance Scale regarding the sex, age and comorbidity of participants. *Geriatrics & gerontology international*, *13*(2), 365-371. http://doi.org/10.1111/j.1447-0594.2012. 00908.x.

Radovanovic, D., Seifert, B., Urban, P., Eberli, F. R., Rickli, H., Bertel, O., ... & AMIS Plus Investigators. (2014). Validity of Charlson Comorbidity Index in patients hospitalised with acute coronary syndrome. Insights from the nationwide AMIS Plus registry 2002–2012. *Heart*, *100*(4), 288-294. http://doi.org/10.1136/heartjnl-2013-304588.

Ramírez-García, E., García de la Torre, G. S., Rodríguez Reyes, E. J., Moreno-Tamayo, K., Espinel-Bermudez, M. C., & Sánchez-García, S. (2021). Factors Associated with Recovered Functionality After Hip Fracture in Non-Institutionalized Older Adults: A Case-Control Study Nested in a Cohort. *Clinical Interventions in Aging*, *16,* 1515-1525. http://doi: 10.2147/CIA.S320341.

Rantakokko, M., Mänty, M., & Rantanen, T. (2013). Mobility declines in old age. *Exercise and sport sciences reviews*, *41*(1), 19-25. http:// doi: 10.1097/JES.0b013e3182556f1e.

Rasmussen, B., & Uhrenfeldt, L. (2016). Establishing well-being after hip fracture: a systematic review and meta-synthesis. *Disability and Rehabilitation*, *38*(26), 2515-2529. https://doi.org/10.3109/09638288.2016.1138552.

Ream, E., & Richardson, A. (1996). Fatigue: a concept analysis. *International journal of nursing studies*, *33*(5), 519-529. http://doi.org/10.1016/0020-7489(96)00004-1.

Reider, L., Hawkes, W., Hebel, J. R., D'Adamo, C., Magaziner, J., Miller, R., ... & Alley, D. E. (2013). The association between body mass index, weight loss and physical function in the year following a hip fracture. *The journal of nutrition, health & aging*, *17*, 91-95. https://doi.org/10.1007/s12603-012-0073-5.

Rener-Sitar, K., John, M. T., Bandyopadhyay, D., Howell, M. J., & Schiffman, E. L. (2014). Exploration of dimensionality and psychometric properties of the Pittsburgh Sleep Quality Index in cases with temporomandibular disorders. *Health and quality of life outcomes*, *12*(1), 1-9. http://doi.org/10.1186/1477-7525-12-10.

Reppas-Rindlisbacher, C., Ahuja, M., Wong, E., Gormley, J., Siddhpuria, S., Lee, J., ... & Patterson, C. (2021). Researching the effects of sleep on step count during the postoperative period. *Journal of the American Geriatrics Society*, *69*(10), 2990-2992. http://doi.org/10.1111/jgs.17305.

Riegel, B., Hanlon, A. L., Zhang, X., Fleck, D., Sayers, S. L., Goldberg, L. R., & Weintraub, W. S. (2013). What is the best measure of daytime sleepiness in adults with heart failure? *Journal of the American Association of Nurse Practitioners*, *25*(5), 272-279. http://doi.org/10.1111/j.1745-7599.2012. 00784.x.

Ritchie, C. (2007). Health care quality and multimorbidity: the jury is still out. *Medical care*, *45*(6), 477-479. http://doi: 10.1097/MLR.0b013e318074d3c1

Roberts, K. C., Brox, W. T., Jevsevar, D. S., & Sevarino, K. (2015). Management of hip fractures in the elderly. *JAAOS-Journal of the American Academy of Orthopaedic Surgeons*, *23*(2), 131-137.

Rodriguez, C. S. (2001). Pain measurement in the elderly: a review. *Pain Management Nursing*, *2*(2), 38-46. http://doi.org/10.1053/jpmn.2001.23746.

Roffman, C. E., Buchanan, J., & Allison, G. T. (2014). Predictors of non-use of prostheses by people with lower limb amputation after discharge from rehabilitation: development and validation of clinical prediction rules. *Journal of physiotherapy*, *60*(4), 224-231. http://doi.org/10.1016/j.jphys.2014.09.003.

Rogal, S. S., Winger, D., Bielefeldt, K., & Szigethy, E. (2013). Pain and opioid use in chronic liver disease. *Digestive diseases and sciences*, *58*(10), 2976-2985. http://doi 10.1007/s10620-013-2638-5.

Rogmark, C., Kristensen, M. T., Viberg, B., Rönnquist, S. S., Overgaard, S., & Palm, H. (2018). Hip fractures in the non-elderly—Who, why and whither?. *Injury*, *49*(8), 1445-1450. http://doi.org/10.1016/j.injury.2018.06.028.

Roobsoong, A., Permyao, J., & Chantiratikul, S. (2020). Clinical outcomes of peritrochanteric hip fracture in the intermediate postoperative care project between the regional and district hospitals in Chiang Rai province: preliminary comparative results. Journal of Health Systems Research 2020;14(1):88-100. (in Thai).

Rosendahl-Riise, H., Dierkes, J., Ådnanes, S., Skodvin, V. A., Strand, E., & Ranhoff, A. H. (2020). Weight changes and mobility in the early phase after hip fracture in

community-dwelling older persons. *Eur Geriatr Med, 11*(4), 545-553. http://doi:10.1007/s41999-020-00342-x.

Rossi, D., Galant, L. H., & Marroni, C. A. (2017). Psychometric property of fatigue severity scale and correlation with depression and quality of life in cirrhotics. *Arquivos de gastroenterologia, 54*, 344-348. http://doi.org/10.1590/S0004-2803.201700000-85.

Rowe, P. C., Marden, C. L., Flaherty, M. A., Jasion, S. E., Cranston, E. M., Johns, A. S., ... & Violand, R. L. (2014). Impaired range of motion of limbs and spine in chronic fatigue syndrome. *The Journal of pediatrics, 165*(2), 360-366. http://doi.org/10.1016/j.jpeds.2014.04.051.

Salpakoski, A., Portegijs, E., Kallinen, M., Sihvonen, S., Kiviranta, I., Alen, M., . . . Sipilä, S. (2011). Physical inactivity and pain in older men and women with hip fracture history. *Gerontology, 57*(1), 19-27. http://doi.org/10.1159/000315490.

Salter, K., Jutai, J., Foley, N., & Teasell, R. (2010). Clinical Outcome Variables Scale: A retrospective validation study in patients after stroke. *Journal of rehabilitation medicine, 42*(7), 609-613. http://doi: 10.2340/16501977-0567.

Sarzi-Puttini, P., Salaffi, F., Di Franco, M., Bazzichi, L., Cassisi, G., Casale, R., ... & Atzeni, F. (2014). Pain in rheumatoid arthritis: a critical review. *Reumatismo, 66*(1), 18-27. http://doi.org/10.4081/reumatismo.2014.760.

Sawasdee, A., Preechawoong, S., & Jitpanya, C. (2017). Relationships between Pain, Sleep Quality, Depressive Symptoms, and Fatigue in Post Stroke Patients. *Kuakarun Journal of Nursing*, 24(2), 7-22. http://doi.org/10.14457/CU.the.2014.826.

Sebastião, E., Sandroff, B. M., Learmonth, Y. C., & Motl, R. W. (2016). Validity of the timed up and go test as a measure of functional mobility in persons with multiple sclerosis. *Archives of physical medicine and rehabilitation*, *97*(7), 1072-1077. http://doi.org/10.1016/j.apmr.2015.12.031.

Seitz, D. P., Adunuri, N., Gill, S. S., & Rochon, P. A. (2011). Prevalence of dementia and cognitive impairment among older adults with hip fractures. *Journal of the American Medical Directors Association*, *12*(8), 556-564.http:// https://doi.org/10.1016/j.jamda.2010.12.001.

Sharav, Y., & Benoliel, R. (2008). The diagnostic process. *Orofacial Pain and Headache. Edinburgh: Mosby Elsevier*.

Shyu, Y. I. L., Chen, M. C., Wu, C. C., & Cheng, H. S. (2010). Family caregivers' needs predict functional recovery of older care recipients after hip fracture. *Journal of advanced nursing*, *66*(11), 2450-2459. http://doi.org/10.1111/j.1365-2648.2010.05418.x.

Sigurdsson, G., Aspelund, T., Chang, M., Jonsdottir, B., Sigurdsson, S., Eiriksdottir, G., Gudmundsson, A., Harris, T. B., Gudnason, V., & Lang, T. F. (2006). Increasing sex difference in bone strength in old age: The Age, Gene/Environment Susceptibility-Reykjavik study (AGES-REYKJAVIK). *Bone*, *39*(3), 644–651. https://doi.org/10.1016/j.bone.2006.03.020.

Silpakit, O., Silpakit, C., & Pukdeenaul, P. (2007). A comparison study of cognitive impairment screening tools: CDT, IQCODE vs MMSE. *Siriraj Medical Journal*, *59*, 361-363.

Sirindhorn National Medical Rehabilitation Institute. (2022). *Guideline for intermediate care in hip fracture (fragility fracture).* Department of Medical Survice, Ministry of Public Health. Thailand. Retrived from https://rbpho.moph.go.th/upload-file/doc/files/10012023-100315-9734.pdf.

Sitasuwan, T., Bussaratid, S., Ruttanaumpawan, P., & Chotinaiwattarakul, W. (2014). Reliability and validity of the Thai version of the Pittsburgh Sleep Quality Index. *J Med Assoc Thai*, *97*(3), S57-S67.

Smith, G. H., Tsang, J., Molyneux, S. G., & White, T. O. (2011). The hidden blood loss after hip fracture. *Injury*, *42*(2), 133-135. https://doi.org/10.1016/j.injury.2010.02.015.

Snyder-Halpern, R., & Verran, J. A. (1987). Instrumentation to describe subjective sleep characteristics in healthy subjects. *Research in Nursing & Health*, *10*(3), 155-163. http://doi.org/10.1002/nur.4770100307.

Somers, T. J., Wren, A. A., & Shelby, R. A. (2012). The context of pain in arthritis: self-efficacy for managing pain and other symptoms. *Current pain and headache reports*, *16*(6), 502-508. http://doi.org/10.1007/s11916-012-0298-3.

Sperber, A. D., Devellis, R. F., & Boehlecke, B. (1994). Cross-cultural translation: Methodology and validation. *Journal of cross-cultural psychology*, *25*(4), 501-524. http://doi.org/10.1177/0022022194254006.

Starfield, B. (2006). Threads and yarns: weaving the tapestry of comorbidity. *The Annals of Family Medicine*, *4*(2), 101-103. http://doi.org/10.1370/afm.524.

Steihaug, O. M., Gjesdal, C. G., Bogen, B., Kristoffersen, M. H., Lien, G., Hufthammer, K. O., & Ranhoff, A. H. (2018). Does sarcopenia predict change in mobility

after hip fracture? a multicenter observational study with one-year follow-up. *BMC geriatrics*, *18*(1), 1-10. http://doi.org/10.1186/s12877-018-0755-x.

Stenholm, S., Kronholm, E., Sainio, P., Borodulin, K., Era, P., Fogelholm, M., ... & Koskinen, S. (2010). Sleep-related factors and mobility in older men and women. *Journals of Gerontology Series A: Biomedical Sciences and Medical Sciences*, *65*(6), 649-657. http://doi.org/10.1093/gerona/glq017.

Steven H. S., Christopher M. B. & Matthew D. S. (2018). *Key Techniques in Orthopaedic Surgery* (2nd ed). Thieme.

Stott-Eveneshen, S., Sims-Gould, J., McAllister, M. M., Fleig, L., Hanson, H. M., Cook, W. L., & Ashe, M. C. (2017). Reflections on hip fracture recovery from older adults enrolled in a clinical trial. *Gerontology and Geriatric Medicine*, *3*, 1-8. https://doi.org/10.1177/2333721417697663.

Studenski, S., Perera, S., Wallace, D., Chandler, J. M., Duncan, P. W., Rooney, E., ... & Guralnik, J. M. (2003). Physical performance measures in the clinical setting. *Journal of the American Geriatrics Society*, *51*(3), 314-322. http://doi.org/10.1046/j.1532-5415.2003. 51104.x.

Sucharitpongpan, W., Daraphongsataporn, N., Saloa, S., Philawuth, N., Chonyuen, P., Sriruanthong, K., & Waiwattana, K. (2019). Epidemiology of fragility hip fractures in Nan, Thailand. *Osteoporosis and Sarcopenia*, *5*(1), 19-22. http://doi.org/10.1016/j.afos.2019.03.003.

Suwanno, J., Petsirasan, R., Saisuk, W., & Chanpradit, A. (2009). Age and heart failure self-care: a comparison of self-care maintenance between eldery and

adults. *Songklanagarind Medical Journal*, *27*(4), 335-346. Retrieved from http://smj.medicine.psu.ac.th/index.php/smj/article/viewFile/264/266.

Tabachnick, B. G., and Fidell, L. S. (2007). *Using multiple statistics* (5th ed). Boston: Pearson International Education.

Talbot, K., Madden, V. J., Jones, S. L., & Moseley, G. L. (2019). The sensory and affective components of pain: are they differentially modifiable dimensions or inseparable aspects of a unitary experience? A systematic review. *British journal of anaesthesia*, *123*(2), e263-e272. http://doi.org/10.1016/j.bja.2019.03.033.

Tam, T. L., Tsang, K. K., & Lee, K. B. (2020). Development of a prognostic model to predict post-operative mobility of patients with fragility hip fractures: a retrospective cohort study. *International Journal of Orthopaedic and Trauma Nursing*, *38*, 1-6. http://doi.org/10.1016/j.ijotn.2020.100770

Tan, H., Wutthilert, C., & O'Connor, M. (2011). Spirituality and quality of life in older people with chronic illness in Thailand. *Progress in Palliative Care*, *19*(4), 177-184. http://doi.org/10.1179/1743291X11Y.0000000013.

Taylor, N. F., Barelli, C., & Harding, K. E. (2010). Community ambulation before and after hip fracture: a qualitative analysis. *Disability and rehabilitation*, *32*(15), 1281-1290. http://doi.org/10.3109/09638280903483869.

Taylor, S.E. (2011). "Social support: A Review". In M.S. Friedman (ed.). *The Handbook of Health Psychology*. New York, NY: Oxford University Press.

Thai Orthopaedic Nurses' society. (2018). *Clinical Nursing Practice Guidelines for Patients with Hip Fracture Undergoing Hip Arthroplasty*. Bangkok: N.P. Press.

The International Association for the Study of Pain. (2020). Retrieved from https://www.iasp-pain.org/terminology?navItemNumber¼576#Pain.

The Royal College of orthopedic surgeons of Thailand. (2017). *A memorandum of cooperation between the Royal College of orthopedic surgeons of Thailand and the Ministry of public health Thailand by organizing "Capture the fracture" training*. Retrieved from https://spd.moph.go.th/new_bps/sites/default/files/12.rcost.pdf (in Thai).

Tomfohr, L. M., Schweizer, C. A., Dimsdale, J. E., & Loredo, J. S. (2013). Psychometric characteristics of the Pittsburgh Sleep Quality Index in English speaking non-Hispanic whites and English and Spanish speaking Hispanics of Mexican descent. *Journal of Clinical Sleep Medicine*, *9*(1), 61-66. http://doi.org/10.5664/jcsm.2342

Trendall, J. (2000). Concept analysis: chronic fatigue. *Journal of advanced nursing*, *32*(5), 1126-1131. http://doi.org/10.1046/j.1365-2648.2000.01583.x

Trongsakul, S. (2015). Correlation between cognitive impairment and depressive mood of Thai elderly with type 2 diabetes in a primary care setting. *Malaysian family physician: the official journal of the Academy of Family Physicians of Malaysia*, *10*(1), 11-18

Tsuboi, M., Hasegawa, Y., Suzuki, S., Wingstrand, H., & Thorngren, K. G. (2007). Mortality and mobility after hip fracture in Japan: a ten-year follow-up. *The Journal of bone and joint surgery. British volume*, *89*(4), 461-466. http://doi.org/10.1302/0301-620X.89B4.18552.

Turan, Y., Duruöz, M. T., Bal, S., Guvenc, A., Cerrahoglu, L., & Gurgan, A. (2007). Assessment of fatigue in patients with ankylosing spondylitis. *Rheumatology international, 27*(9), 847-852. http://doi.org/10.1007/s00296-007-0313-x.

Unnanuntana, A., Jarusriwanna, A., & Nepal, S. (2018). Validity and responsiveness of Barthel index for measuring functional recovery after hemiarthroplasty for femoral neck fracture. *Archives of Orthopaedic and Trauma Surgery, 138*(12), 1671-1677. http://doi.org/10.1007/s00402-018-3020-z.

Valderas, J. M., & Alonso, J. (2008). Patient reported outcome measures: a model-based classification system for research and clinical practice. *Quality of Life Research, 17*(9), 1125-1135. http://doi.org/10.1007/s11136-008-9396-4.

Valderas, J. M., Starfield, B., Sibbald, B., Salisbury, C., & Roland, M. (2009). Defining comorbidity: implications for understanding health and health services. *The Annals of Family Medicine, 7*(4), 357-363. http://doi.org/10.1370/afm.983.

Valko, P. O., Bassetti, C. L., Bloch, K. E., Held, U., & Baumann, C. R. (2008). Validation of the fatigue severity scale in a Swiss cohort. *Sleep, 31*(11), 1601-1607. http://doi.org/10.1093/sleep/31.11.1601.

Van Cauter, E. (2011). Sleep disturbances and insulin resistance. *Diabetic Medicine, 28*(12), 1455-1462. http://doi: 10.1111/j.1464-5491.2011.03459.x.

Van Den Akker-Scheek, I., Stevens, M., Spriensma, A., & Van Horn, J. R. (2004). Groningen Orthopaedic social support scale: validity and reliability. *Journal of advanced nursing, 47*(1), 57-63. http://doi.org/10.1111/j.1365-648.2004.03065x

Vergara, I., Vrotsou, K., Orive, M., Gonzalez, N., Garcia, S., & Quintana, J. M. (2014). Factors related to functional prognosis in elderly patients after accidental hip

fractures: a prospective cohort study. *BMC geriatrics*, *14*, 1-9. https://doi.org/10.1186/1471-2318-14-124.

Vochteloo, A. J., Moerman, S., Tuinebreijer, W. E., Maier, A. B., de Vries, M. R., Bloem, R. M., . . . Pilot, P. (2013). More than half of hip fracture patients do not regain mobility in the first postoperative year. *Geriatrics & gerontology international, 13*(2), 334-341. http://doi.org/10.1111/j.1447-0594.2012.00904.x.

Walsh, D. A., & McWilliams, D. F. (2012). Pain in rheumatoid arthritis. *Current pain and headache reports*, *16*(6), 509-517. http://doi 10.1007/s11916-012-0303-x.

Whitehead, L. (2009). The measurement of fatigue in chronic illness: a systematic review of unidimensional and multidimensional fatigue measures. *Journal of pain and symptom management*, *37*(1), 107-128. http://doi.org/10.1016/j.jpainsymman.2007.08.019.

Wilckens, K. A., Erickson, K. I., & Wheeler, M. E. (2018). Physical activity and cognition: a mediating role of efficient sleep. *Behavioral sleep medicine, 16*(6), 569-586. http://doi.org/10.1080/15402002.2016.1253013.

Wongpakaran, T., Wongpakaran, N., & Ruktrakul, R. (2011). Reliability and validity of the multidimensional scale of perceived social support (MSPSS). *Clinical practice and epidemiology in mental health: CP & EMH, 7*, 161-166. http://doi: 10.2174/1745017901107010161.

Wongtriratanachai, P., Luevitoonvechkij, S., Songpatanasilp, T., Sribunditkul, S., Leerapun, T., Phadungkiat, S., & Rojanasthien, S. (2013). Increasing incidence of hip fracture in Chiang Mai, Thailand. *Journal of clinical densitometry*, *16*(3), 347-352. http://doi.org/10.1016/j.jocd.2012.07.002.

Woodward, L. M., Clemson, L., Moseley, A. M., Lord, S. R., Cameron, I. D., & Sherrington, C. (2014). Most functional outcomes are similar for men and women after hip fracture: a secondary analysis of the enhancing mobility after hip fracture trial. *BMC geriatrics*, *14*(1), 1-7. http://doi.org/10.1186/1471-2318-14-140.

World Health Organization. (2001). *International Classification of Functioning, Disability and Health*. Geneva, Switzerland.

Yogev-Seligmann, G., Hausdorff, J. M., & Giladi, N. (2008). The role of executive function and attention in gait. *Movement disorders: official journal of the Movement Disorder Society*, *23*(3), 329-342. http://doi.org/10.1002/mds.21720.

Yuksel, E., Unver, B., Kalkan, S., & Karatosun, V. (2021). Reliability and minimal detectable change of the 2-minute walk test and Timed Up and Go test in patients with total hip arthroplasty. *HIP International*, *31*(1), 43-49. http://doi.org/10.1177/1120700019888614.

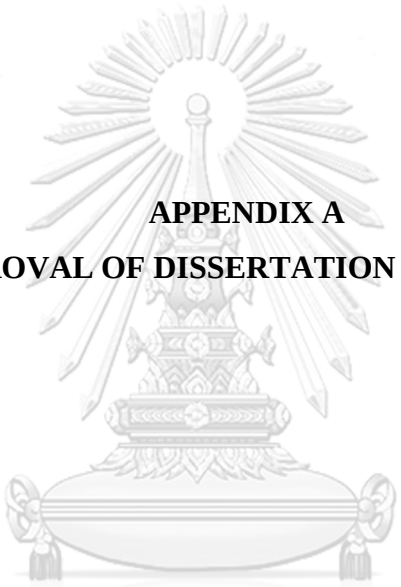
Zaninotto, P., Batty, G. D., Allerhand, M., & Deary, I. J. (2018). Cognitive function trajectories and their determinants in older people: 8 years of follow-up in the English Longitudinal Study of Ageing. *J Epidemiol Community Health*, *72*(8), 685-694. http://dx.doi.org/10.1136/jech-2017-210116.

Zaslavsky, O., Zisberg, A., & Shadmi, E. (2015). Impact of functional change before and during hospitalization on functional recovery 1 month following hospitalization. *Journals of Gerontology Series A: Biomedical Sciences and Medical Sciences*, *70*(3), 381-386. http://doi.org/10.1093/gerona/glu168.

Zimet, G. D., Powell, S. S., Farley, G. K., Werkman, S., & Berkoff, K. A. (1990). Psychometric characteristics of the multidimensional scale of perceived social support. *Journal of personality assessment*, *55*(3-4), 610-617. http://doi.org/10.1080/00223891.1990.9674095.

APPENDICES

APPENDIX A
APPROVAL OF DISSERTATION PROPOSAL



ประกาศ
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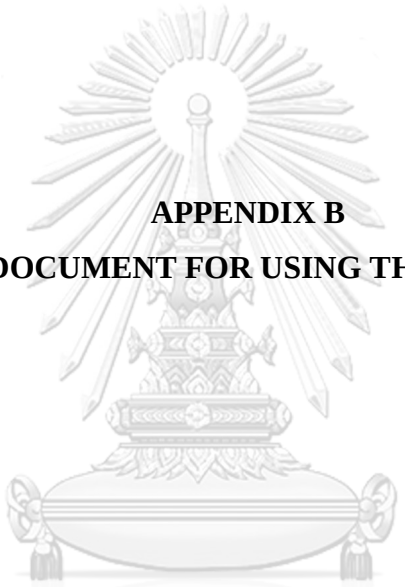
ชื่อหัวข้อดุษฎีนิพนธ์	การวิเคราะห์โมเดลเชิงเส้นทางของการเคลื่อนไหวของผู้ป่วยที่กระดูกสะโพกหักภายหลังได้รับการผ่าตัด
(Title of Thesis)	*A PATH ANALYSIS MODEL OF MOBILITY AMONG PATIENTS WITH HIP FRACTURE UNDERGOING SURGERY*
ครั้งที่อนุมัติ *(Announcement No.)*	1/2564
ระดับ *(Level)*	ปริญญาเอก *Doctoral degree*

จากมติคณะกรรมการบริหารคณะพยาบาลศาสตร์ ครั้งที่ 5/2565 วันที่ 8 มีนาคม 2565
(Approved by the Board of the Faculty of Nursing. No. 5/2022 Date March 8, 2022)

ประกาศ ณ วันที่ 10 มีนาคม พ.ศ. 2565
(Announced on March 10, 2022)

(ศาสตราจารย์ ดร. รัตน์ศิริ ทาโต)
(Ratsiri Thato)
คณบดีคณะพยาบาลศาสตร์
Professor and Dean

APPENDIX B
PERMISSION DOCUMENT FOR USING THE MEASUREMENTS



The de Morton Mobility Index

มหาวิทยาลัย
นวมินทราธิราช

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>

Asking for permission to use the DEMMI

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th> Wed, Feb 2, 2022 at 12:33 PM
To: jenny.keating@med.monash.edu.au

Dear professor
My name is Chanipa Yoryuenyong, a doctoral student at the Faculty of Nursing, Chulalongkorn University, Thailand. I have developed my dissertation and would like to use the de Morton Mobility Index (DEMMI) to collect the data. And I would like to translate it into the Thai language. So I sincerely look forward to your permission.
Best Regards
Miss Chanipa Yoryuenyong
Doctoral student

Chanipa Yoryuenyong, B.S.N, M.N.S (Adult nursing)
Nursing Instructor
Administration and Fundamental of Nursing Department
Kuakarun Faculty of Nursing Navamindradhiraj University
131/5 Kao road Vajira Dusit Bangkok Thailand 10300
Mobile: 0944651419
Tel:022416500 ต่อ 8212

มหาวิทยาลัย
นวมินทราธิราช

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>

Asking for permission to use the DEMMI

Jenny Keating <jenny.keating@monash.edu> Wed, Feb 2, 2022 at 1:50 PM
To: v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>
Cc: Megan Davidson <megandavidson883@gmail.com>

Dear Chanipa
Yes you can use the DEMMI as you like..it is a freely available published document ...I wish you all the best with your research
Jenny
[Quoted text hidden]

Charlson Comorbidity Index

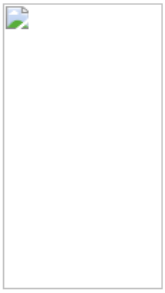
มหาวิทยาลัย นวมินทราธิราช

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>

Ask for permission to use the CCI

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th> Wed, Jan 5, 2022 at 11:03 AM
To: mecharl@med.cornell.edu

Dear professor
My name is Chanipa Yoryuenyong, a doctoral student at the Faculty of Nursing, Chulalongkorn University, Thailand. I will develop my dissertation and use the Charlson Comorbidity Index (CCI) to collect the data. So I sincerely look forward to your permission.
Best Regards
Chanipa Yoryuenyong



Chanipa Yoryuenyong, B.S.N, M.N.S (Adult nursing)
Nursing Instructor
Administration and Fundamental of Nursing Department
Kuakarun Faculty of Nursing Navamindradhiraj University
131/5 Kao road Vajira Dusit Bangkok Thailand 10300
Mobile: 0944651419
Tel:022416500 ต่อ 8212

มหาวิทยาลัย นวมินทราธิราช

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>

Ask for permission to use the CCI

Robin D Andrews <rra2004@med.cornell.edu> Sat, May 14, 2022 at 10:02 PM
To: "chanipa@nmu.ac.th" <chanipa@nmu.ac.th>

Dear Chanipa Yoryuenyong,

Attached is the Charlson Comorbidity Index (CCI) for your one-time use for this research study only. It is not to be used for any commercial purpose.

Warmest Regards,

Robin

[Quoted text hidden]

2 attachments

CCI Article.pdf
535K

Charlson Comorbidity Index.pdf
70K

Charlson Comorbidity Index

มหาวิทยาลัย
นวมินทราธิราช

v_ชนิภา ยอยีนยง <chanipa@nmu.ac.th>

May I ask something

Robin D Andrews <rra2004@med.cornell.edu> Fri, May 20, 2022 at 6:41 PM
To: v_ชนิภา ยอยีนยง <chanipa@nmu.ac.th>

Good Morning Chanipa,

I am Dr. Charlson's Administrative Assistant. She forwarded your email and has given you permission to use the CCI for your study. Please let me know if you have additional questions or concerns.

Warmest Regards,

Robin

[Quoted text hidden]

Charlson Comorbidity Index (Thai Version)

มหาวิทยาลัย
นวมินทราธิราช

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>

ขออนุญาตใช้เครื่องมือวิจัย

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th> Thu, Jan 20, 2022 at 3:40 PM
To: jomsuwanno@gmail.com, sjom@wu.ac.th

เรียน รองศาสตราจารย์ ดร. จอม สุวรรณโณ
สวัสดีค่ะอาจารย์ ดิฉัน นางสาวชนิภา ยอยืนยง นักศึกษาปริญญาเอก คณะพยาบาลศาสตร์
จุฬาลงกรณ์มหาวิทยาลัย. ขณะนี้กำลังเขียน proposal และจะขออนุญาตใช้เครื่องมือ
the Charlson Comorbidity Index (ICC) (Thai version) ในการรวบรวมข้อมูล. ดังนั้นจึงเขียน e-mail มาเพื่อขออนุญาตจากอาจารย์ค่ะ.
ขอบพระคุณค่ะ
ปล.หนูได้ mail มาเรียนอาจารย์แล้วเมื่อสัปดาห์ก่อนค่ะ
ชนิภา ยอยืนยง

Chanipa Yoryuenyong, B.S.N, M.N.S (Adult nursing)
Nursing Instructor
Administration and Fundamental of Nursing Department
Kuakarun Faculty of Nursing Navamindradhiraj University
131/5 Kao road Vajira Dusit Bangkok Thailand 10300
Mobile: 0944651419
Tel:022416500 ต่อ 8212

มหาวิทยาลัย
นวมินทราธิราช

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>

ขออนุญาตใช้เครื่องมือวิจัย

Jom Suwanno <jomsuwanno@gmail.com> Thu, Jan 20, 2022 at 8:37 PM
To: v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>

น้องดูจากต้นฉบับบทความที่พี่อ้างอิงครับ เป็นการใช้ CCI ที่เชื่อมกับระบบบันทึกแฟ้มข้อมูล ICD พี่คิดว่าน้องอ้างถึงจากต้นฉบับนั้นเลยก็ได้นะครับ เพราะเป็นการอ้างแนวคิด ไม่น่าจะต้องขออนุญาตแต่อย่างใด

เพราะว่า ICD เป็นระบบการจำแนกที่ใช้กันอยู่ทั่วไปแล้ว

จอม

ในวันที่ พฤ. 20 ม.ค. 2022 15:40 น. v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th> เขียนว่า:
[Quoted text hidden]

General Practitioner Assessment of Cognition

มหาวิทยาลัย
นวมินทราธิราช

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>

Ask for permission to use the GPCOG

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th> Tue, Jan 4, 2022 at 3:48 PM
To: h.brodaty@unsw.edu.au

Dear professor
My name is Chanipa Yoryuenyong, a doctoral student at the Faculty of Nursing, Chulalongkorn University, Thailand. I will develop my dissertation and use the General Practitioner Assessment of Cognition (GPCOG) (Thai version) to collect the data. So I sincerely look forward to your permission.
Best Regards
Chanipa Yoryuenyong

Chanipa Yoryuenyong, B.S.N, M.N.S (Adult nursing)
Nursing Instructor
Administration and Fundamental of Nursing Department
Kuakarun Faculty of Nursing Navamindradhiraj University
131/5 Kao road Vajira Dusit Bangkok Thailand 10300
Mobile: 0944651419
Tel:022416500 ต่อ 8212

มหาวิทยาลัย
นวมินทราธิราช

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>

Ask for permission to use the GPCOG

Henry Brodaty <h.brodaty@unsw.edu.au> Tue, Jan 4, 2022 at 5:02 PM
To: v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>

Chanipa
Good luck with your PhD
You are welcome to use the GPCOG. Pls cite references to GPCOG and acknowledge.
I would be interested to see your paper when finished

Henry Brodaty

On 4 Jan 2022, at 7:49 pm, v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th> wrote:

[Quoted text hidden]

General Practitioner Assessment of Cognition (Thai version)

คณะพยาบาลศาสตร์
จุฬาลงกรณ์มหาวิทยาลัย
เลขรับที่: 0972
วันที่: 26 พฤษภาคม 2565 เวลา: 08:30

ที่ อว ๘๘๘๘/๘๘๐๘

คณะเทคนิคการแพทย์ มหาวิทยาลัยเชียงใหม่
๑๑๐ ถนนอินทวโรรส อำเภอเมืองเชียงใหม่
จังหวัดเชียงใหม่ ๕๐๒๐๐

๑๗ พฤษภาคม ๒๕๖๕

เรื่อง ยินดีอนุญาตให้ใช้เครื่องมือในการทำวิทยานิพนธ์

เรียน **คณบดีคณะพยาบาลศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย**

อ้างถึง หนังสือที่ อว ๒๔.๑๑/๐๐๔๒๐ ลงวันที่ ๒๓ มีนาคม ๒๕๖๕

ตามหนังสือที่อ้างถึง นางสาวชนิภา ยอยืนยง นิสิตชั้นปริญญาดุษฎีบัณฑิต คณะพยาบาลศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย กำลังดำเนินการพัฒนาวิทยานิพนธ์ เรื่อง "การวิเคราะห์โมเดลเชิงเส้นทางของการเคลื่อนไหวของผู้ป่วยกระดูกสะโพกหักภายหลังได้รับการผ่าตัด" โดยมี รองศาสตราจารย์ ดร.ชนกพร จิตบัญญา เป็นอาจารย์ที่ปรึกษาวิทยานิพนธ์หลัก และรองศาสตราจารย์ ร.อ.หญิง ดร.ศิริพันธุ์ สาสัตย์ เป็นอาจารย์ที่ปรึกษาวิทยานิพนธ์ร่วม และขออนุญาตใช้เครื่องมือการวิจัย คือ แบบประเมินความรู้ความเข้าใจจีพีซีด็อก (ฉบับภาษาไทย) จากรายงานการวิจัย เรื่อง แบบประเมินความรู้ความเข้าใจจีพีซีด็อก (ฉบับภาษาไทย) ความเที่ยงตรงและความเชื่อมั่น ของ ผู้ช่วยศาสตราจารย์ ดร.จิรนันท์ กริพพิทย์ บุคลากรในสังกัด ความละเอียดแจ้งแล้ว นั้น

ในการนี้ คณะเทคนิคการแพทย์ มหาวิทยาลัยเชียงใหม่ พิจารณาแล้วไม่ขัดข้อง ยินดีอนุญาตให้ **นางสาวชนิภา ยอยืนยง** ใช้เครื่องมือการวิจัยดังกล่าวข้างต้นได้

จึงเรียนมาเพื่อโปรดทราบ

ขอแสดงความนับถือ

(ศาสตราจารย์ ดร.สาคร พรประเสริฐ)
คณบดีคณะเทคนิคการแพทย์
มหาวิทยาลัยเชียงใหม่

เรียน รองคณบดี
เพื่อทราบ และดำเนินการให้นิสิตดำเนินการต่อไป
26 พฤษภาคม 2565 เวลา 10:04
26 พฤษภาคม 2565 เวลา 12:01

รับทราบ และแจ้งนิสิตทราบเพื่อดำเนินการต่อไป
27 พฤษภาคม 2565 เวลา 09:23

งานบริหารทั่วไป
โทรศัพท์ ๐-๕๓๙๔-๘๖๐๔
อีเมล: Thanakorn.kam@cmu.ac.th
CMU e-Document: 2FB2DD-3E0-224

วิสัยทัศน์: คณะเทคนิคการแพทย์ มหาวิทยาลัยเชียงใหม่ ชั้นนำสร้างสุขชนเข้มแข็ง มีความเป็นสากลด้านวิชาชีพและการใช้ในระดับสากล

Groningen Orthopedic Social Support Scale

มหาวิทยาลัย
นวมินทราธิราช

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>

Ask permission to translate GOSSS in Thai

tum <chanipa@nmu.ac.th> Mon, Jan 3, 2022 at 11:01 AM
To: "i.scheek@orth.azg.nl" <i.scheek@orth.azg.nl>

Dear Sir Dr. Inge van den Akker-Scheek

My name is Chanipa Yoryuenyong, a doctoral student at the Faculty of Nursing, Chulalongkorn University, Thailand. I have developed my dissertation and need to use the Groningen Orthopaedic Social Support Scale (GO-SSS) to collect the data. And I would like to translate it into the Thai language. So I sincerely look forward to your permission.
Best Regards
Miss Chanipa Yoryuenyong

Sent from Mail for Windows

มหาวิทยาลัย
นวมินทราธิราช

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>

Ask permission to translate GOSSS in Thai

Scheek, I <i.scheek@umcg.nl> Mon, Jan 10, 2022 at 4:29 PM
To: tum <chanipa@nmu.ac.th>

Dear Chanipa

You have my permission, good luck with your research!

Kind regards

Inge van den Akker-Scheek

Kind regards,
Inge van den Akker-Scheek

I. van den Akker-Scheek | Associate Professor
Human Movement Scientist | Epidemiologist
University Medical Center Groningen | Department of Orthopedics
Hanzeplein 1 | PO Box 30001 | 9700 RB Groningen | The Netherlands
Phone: +31 50 361 05 49 (not available on Friday)

https://www.rug.nl/staff/i.van.den.akker-scheek/research

[Quoted text hidden]

Numeric rating scale

มหาวิทยาลัย
นวมินทราธิราช

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>

Asking for permission to use the NRS

tum <chanipa@nmu.ac.th> Thu, Feb 17, 2022 at 12:24 PM
To: "cpasero@aol.com" <cpasero@aol.com>

Dear professor

My name is Chanipa Yoryuenyong, a doctoral student at the Faculty of Nursing, Chulalongkorn University, Thailand. I have developed my dissertation and would like to use The Numeric Rating Scale (NRS) to collect the data. So I sincerely look forward to your permission.
Best Regards
Miss Chanipa Yoryuenyong
Doctoral student

Sent from Mail for Windows

มหาวิทยาลัย
นวมินทราธิราช

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>

Asking for permission to use the NRS

Chris Pasero <cpasero@aol.com> Fri, Feb 18, 2022 at 9:48 AM
Reply-To: Chris Pasero <cpasero@aol.com>
To: "chanipa@nmu.ac.th" <chanipa@nmu.ac.th>

Dear Chanipa,

The NRS is in the public domain, which means you do not need to request permission from anyone to use it. See attached highlighted statement in legend of NRS on page 56 in chapter from our book. You are free to use the NRS for your dissertation.

Let me know if there are any questions.

Best regards,

Chris Pasero, MS, RN-BC, FAAN
Retired
[Quoted text hidden]

Ch03.pdf
7669K

Fatigue Severity Scale

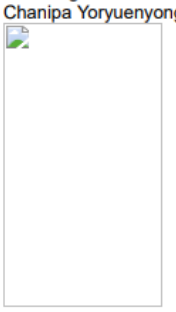
มหาวิทยาลัย
นวมินทราธิราช

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>

Ask for permission to use the FSS

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th> Wed, Jan 5, 2022 at 11:30 AM
To: lauren.krupp@nyulangone.org

Dear professor
My name is Chanipa Yoryuenyong, a doctoral student at the Faculty of Nursing, Chulalongkorn University, Thailand. I will develop my dissertation and use the Fatigue Severity Scale (FSS) to collect the data. So I sincerely look forward to your permission.
Best Regards
Chanipa Yoryuenyong



Chanipa Yoryuenyong, B.S.N, M.N.S (Adult nursing)
Nursing Instructor
Administration and Fundamental of Nursing Department
Kuakarun Faculty of Nursing Navamindradhiraj University
131/5 Kao road Vajira Dusit Bangkok Thailand 10300
Mobile: 0944651419
Tel:022416500 ต่อ 8212

มหาวิทยาลัย
นวมินทราธิราช

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>

Ask for permission to use the FSS

Krupp, Lauren <Lauren.Krupp@nyulangone.org> Fri, Jan 7, 2022 at 12:31 AM
To: v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>

Best of luck with your research and you may use the scale for your project.

From: v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>
Sent: Tuesday, January 4, 2022 11:30:33 PM
To: Krupp, Lauren
Subject: Ask for permission to use the FSS

[EXTERNAL]

[Quoted text hidden]

Fatigue Severity Scale (Thai Version)

คณะพยาบาลศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
คำร้องขออนุญาตใช้เครื่องมือการวิจัย (ภายในคณะฯ)

เลขที่รับ 0478/CON-CU-THESIS11
วันที่ 29 มีนาคม 2565
เวลา 07.25 น.
ผู้รับ ศิริไรยา

เรื่อง ขอหนังสือรออนุญาตใช้เครื่องมือการวิจัย
เรียน รองคณบดี

ข้าพเจ้า นางสาวชนิกา ยอยืนยง รหัสนิสิต 6278302936

ไพรศัพท์มือถือ	0	9	4	4	6	5	1	4	1	9	ประกาศหัวข้อฯ ฉบับที่	0	1	/	2	5	6	4	หน้าที่		

E-MAIL: chanipa@nmu.ac.th

มีความประสงค์ที่จะขออนุญาตใช้เครื่องมือการวิจัย

1. ชื่อเครื่องมือ แบบประเมินความเหนื่อยล้า (ฉบับภาษาไทย)
2. ชื่อวิทยานิพนธ์ ปัจจัยคัดสรรที่สัมพันธ์กับความเหนื่อยล้าในผู้ป่วยโรคหลอดเลือดสมอง
3. ชื่อเจ้าของเครื่องมือ นางสาวอรพร สวัสดี
4. อาจารย์ที่ปรึกษาฯ (เจ้าของเครื่องมือ) ผศ.ดร.สุนิตา ปรีชาวงษ์ และ รศ.ดร.ชนกพร จิตปัญญา
5. ปีของวิทยานิพนธ์ พ.ศ.2554

เรียน รองคณบดี
เพื่อทราบและพิจารณาอนุญาตในการของใช้เครื่องมือวิจัย ของนางสาวอรพร สวัสดี ซึ่งมี ผศ.ดร.สุนิตา ปรีชาวงษ์ เป็นอาจารย์ที่ปรึกษา และอาจารย์ที่ปรึกษาได้ให้ความเห็นของอาจารย์ที่ปรึกษาแล้ว

ลงนาม ผู้ยื่นคำร้อง
(นางสาวชนิกา ยอยืนยง)
16 / มีนาคม / 2565

ความเห็นอาจารย์ที่ปรึกษาวิทยานิพนธ์
29 มีนาคม 2565 เวลา 09:46
.....สมควรดำเนินการตามที่นิสิตร้องขอ
.....
.....
.....
ลงนาม
(รองศาสตราจารย์ ดร.ชนกพร จิตปัญญา)
16 / มีนาคม / 2565

ความเห็นอาจารย์ที่ปรึกษาของนิสิตเจ้าของเครื่องมือ
.....เห็นสมควรอนุญาตให้นิสิตใช้เครื่องมือดังกล่าว
.....
.....
.....
ลงนาม .....
(ผู้ช่วยศาสตราจารย์ ดร.สุนิตา ปรีชาวงษ์)
16 / มีนาคม / 2565

29 มีนาคม 2565 เวลา 10:02

อนุญาต
ลงนาม .....
(.....)
รองคณบดี
...../...../.....

Pittsburgh Sleep Quality Index

มหาวิทยาลัย นวมินทราธิราช

v_ชนิภา ยอยีนยง <chanipa@nmu.ac.th>

Ask for permission to use the PSQI

v_ชนิภา ยอยีนยง <chanipa@nmu.ac.th> Wed, Jan 5, 2022 at 12:04 PM
To: buyssedj@upmc.edu

Dear professor
My name is Chanipa Yoryuenyong, a doctoral student at the Faculty of Nursing, Chulalongkorn University, Thailand. I will develop my dissertation and use the Pittsburgh Sleep Quality Index (PSQI) to collect the data. So I sincerely look forward to your permission.
Best Regards
Chanipa Yoryuenyong

Chanipa Yoryuenyong, B.S.N, M.N.S (Adult nursing)
Nursing Instructor
Administration and Fundamental of Nursing Department
Kuakarun Faculty of Nursing Navamindradhiraj University
131/5 Kao road Vajira Dusit Bangkok Thailand 10300
Mobile: 0944651419
Tel:022416500 ต่อ 8212

มหาวิทยาลัย นวมินทราธิราช

ว_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>

Ask for permission to use the PSQI

Gasiorowski, Mary <GasiorowskiMJ@upmc.edu> Fri, Jan 7, 2022 at 12:13 AM
To: "chanipa@nmu.ac.th" <chanipa@nmu.ac.th>

Sent on behalf of Dr. Buysse

Dear Chanipa Yoryuenyong,

You have my permission to use the PSQI for your research study. You can find the instrument, scoring instructions, the original article, links to available translations, and other useful information at www.sleep.pitt.edu under the Measures/Instruments tab. Please ensure that the PSQI is accurately reproduced in any on-line version (including copyright information). We request that you do cite the 1989 paper in any publications that result.

Note that Question 10 is not used in scoring the PSQI. This question is for informational purposes only, and may be omitted during data collection per requirements of the particular study.

Good luck with your research.

Sincerely,

Daniel J. Buysse, M.D.

Professor of Psychiatry and Clinical and Translational Science

University of Pittsburgh School of Medicine

E-1123 WPIC

3811 O'Hara St.

Pittsburgh, PA 15213

T: (412) 246-6413

F: (412) 246-5300

buyssedj@upmc.edu

Pittsburgh Sleep Quality Index (Thai Version)

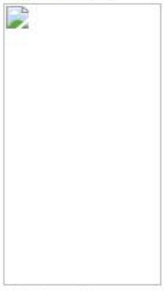
มหาวิทยาลัย
นวมินทราธิราช

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>

ขออนุญาตใช้เครื่องมือวิจัย

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th> Wed, Jan 5, 2022 at 12:09 PM
To: tawanchaij@gmail.com

เรียน รศ.นพ.ดะวันชัย จิรประมุขพิทักษ์
สวัสดีค่ะอาจารย์ ดิฉัน นางสาวชนิภา ยอยืนยง นักศึกษาปริญญาเอก คณะพยาบาลศาสตร์
จุฬาลงกรณ์มหาวิทยาลัย. ขณะนี้กำลังเขียน proposal และจะขออนุญาตใช้เครื่องมือ
the Pittsburgh Sleep Quality Index (PSQI) (Thai version) ในการรวบรวมข้อมูล ดังนั้นจึงเขียน e-mail มาเพื่อขออนุญาตจากอาจารย์ค่ะ.
ขอบพระคุณค่ะ
ชนิภา ยอยืนยง



Chanipa Yoryuenyong, B.S.N, M.N.S (Adult nursing)
Nursing Instructor
Administration and Fundamental of Nursing Department
Kuakarun Faculty of Nursing Navamindradhiraj University
131/5 Kao road Vajira Dusit Bangkok Thailand 10300
Mobile: 0944651419
Tel:022416500 ต่อ 8212

มหาวิทยาลัย
นวมินทราธิราช

v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>

ขออนุญาตใช้เครื่องมือวิจัย

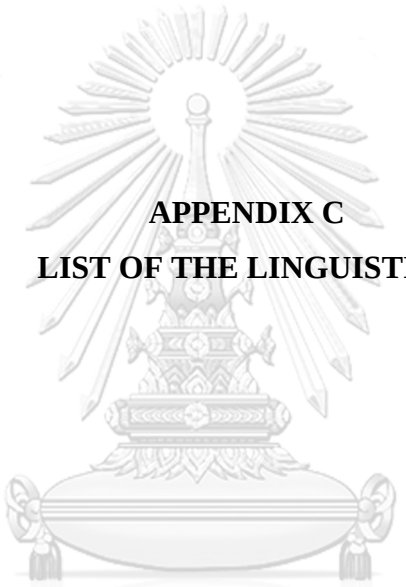
Tawan Jira <tawanchaij@gmail.com> Wed, Jan 5, 2022 at 8:24 PM
To: v_ชนิภา ยอยืนยง <chanipa@nmu.ac.th>

ใช้ได้เลยโดยไม่ต้องขออนุญาตครับ

ขอบคุณครับ

ดะวันชัย
[Quoted text hidden]

APPENDIX C
LIST OF THE LINGUISTICS



LIST OF THE LINGUISTICS

1. Dr. Surachai Maninet

   Lecturer at Faculty of Nursing, Ubon Ratchathani University.

2. Pol. Lt. Col. Dr. Anoma Rojanaphong.

   Lecturer at Faculty of Social Sciences, Royal Police Cadet Academy.

3. Assoc. Prof. Dr. Maneewan Pewnim

   Translator at the translation unit, Faculty of Arts, Chulalongkorn University.

4. Ms. Mayura phitaksuksanti

   Translator at the translation unit, Faculty of Arts, Chulalongkorn University.

APPENDIX D
MEASUREMENTS

APPENDIX D1

แบบสอบถามข้อมูลส่วนบุคคลและข้อมลสุขภาพ

คำชี้แจง: โปรดเติมคำในช่องว่าง หรือทำเครื่องหมายถูก √ ลงหน้าข้อความที่ตรงกับ ความเป็นจริงของท่านมากที่สุด

ข้อมูลส่วนบุคคล **วันที่.....เลขที่ผู้มีส่วนร่วมในการวิจัย.....**

1. อายุ.....ปี
2. เพศ ☐ ชาย ☐ หญิง
3. น้ำหนักตัว.....กก. ส่วนสูง..... ซม.
4. ศาสนา ☐ พุทธ ☐ อิสลาม ☐ คริสต์ ☐ ฮินดู ☐ อื่น ๆ โปรดระบุ.....
5. ระดับการศึกษา ☐ ไม่ได้เรียนหนังสือ ☐ ประถมศึกษา ☐ มัธยมศึกษาตอนต้น ☐ มัธยมศึกษาตอนปลาย ☐ อาชีวศึกษา/ประกาศนียบัตร ☐ ปริญญาตรี ☐ สูงกว่าปริญญาตรี
6. สถานภาพสมรส ☐ โสด ☐ คู่ ☐ แยกกันอยู่ ☐ หย่า ☐ หม้าย ☐ อื่น ๆ โปรดระบุ.....
7. อาชีพ ☐ ไม่ได้ประกอบอาชีพ/ว่างงาน ☐ ลูกจ้าง / รับจ้างทั่วไป ☐ แม่บ้าน ☐ เกษตรกร ☐ เจ้าของธุรกิจส่วนตัว ☐ ข้าราชการ/รัฐวิสาหกิจ ☐ พนักงานบริษัทเอกชน ☐ อื่น ๆ โปรดระบุ.....
8. จำนวนสมาชิกในครอบครัว.....คน
9. รายได้ต่อเดือน ☐ 15,000 บาท ☐ 15,001 – 25, 000 บาท ☐ 25, 001 – 35,000 บาท ☐ 35,001 – 45,000 บาท ☐ ≥ 45,001 บาท

10. สิทธิในการรักษา
- ☐ ชำระเงินเอง
- ☐ บัตรประกันสุขภาพถ้วนหน้า (บัตรทอง 30 บาทรักษาทุกโรค)
- ☐ ประกันสังคม
- ☐ เบิกจากต้นสังกัด/ สิทธิข้าราชการ / พนักงานรัฐวิสาหกิจ
- ☐ ประกันชีวิต / ประกันสุขภาพ
- ☐ อื่น ๆ โปรดระบุ.....

11. การสูบบุหรี่
- ☐ ไม่สูบบุหรี่
- ☐ เคยสูบแต่ปัจจุบันเลิกสูบแล้ว
- ☐ ปัจจุบันยังสูบบุหรี่อยู่

12. การดื่มเครื่องดื่มที่มีแอลกอฮอล์ เช่น สุรา เบียร์
- ☐ ไม่ดื่มเครื่องดื่มที่มีแอลกอฮอล์
- ☐ ดื่มเครื่องดื่มที่มีแอลกอฮอล์เมื่อสังสรรค์
- ☐ ปัจจุบันยังดื่มเครื่องดื่มที่มีแอลกอฮอล์

13. การอยู่อาศัย
- ☐ อาศัยอยู่คนเดียว
- ☐ อาศัยอยู่กับคู่สมรสเท่านั้น
- ☐ อาศัยอยู่กับลูก ๆ
- ☐ อาศัยอยู่กับเพื่อน
- ☐ อาศัยอยู่กับคู่สมรสและลูก ๆ
- ☐ ยอยู่กับผู้ดูแล
- ☐ อื่น ๆ โปรดระบุ.....

ข้อมูลสุขภาพ

14. มีประวัติครอบครัวกระดูกสะโพกหัก
- ☐ ไม่มี
- ☐ มี
  - ☐ าติสายตรง (บิดา มารดา พี่ น้อง)
  - ☐ าติสายรอง (ปู่ ย่า ตา ยาย อา น้า ป้า ลุง หลาน ลูกพี่ลูกน้อง)

15. สาเหตุของการเกิดกระดูกหัก
- ☐ ลื่นล้ม
- ☐ สะดุดล้ม
- ☐ ขาอ่อนแรง
- ☐ อื่น ๆ.....

16. ชนิดของกระดูกหัก
- ☐ ส่วนคอ (Neck of femur)
- ☐ ส่วนโทรเชนเทอริก (Trochanter)
  - ☐ ส่วนต้นขา (Intertrochanteric)
  - ☐ ส่วนซับโทรเชนเทอริก (Subtertrochanteric)

17. ชนิดของการผ่าตัด
- ☐ การผ่าตัดเปลี่ยนหัวกระดูกต้นขาและเบ้า ข้อสะโพก (Total hip arthroplasty)
- ☐ การเปลี่ยนข้อสะโพกเทียมเพียงด้านเดียว (Hemi hip arthroplasty)
- ☐ การยึดกระดูกโดยการผ่าตัดใส่เครื่องยึดที่เป็นโลหะ (Internal fixation)

วันที่ผ่าตัด.....

18. การเคลื่อนไหวก่อนผ่าตัด
- ☐ สามารถเดินได้ในบ้าน
- ☐ สามารถเดินได้นอกบ้าน
- ☐ สามารถทำกิจกรรมนอกบ้าน เช่น ซื้อของได้

19. ชนิดของอุปกรณ์ช่วยเดินก่อนผ่าตัด
- ☐ ไม่ต้องใช้อุปกรณ์ช่วยเดิน
- ☐ อุปกรณ์ช่วยเดินสี่ขา (walker)
- ☐ ไม้เท้า (cane)
- ☐ ไม้ค้ำยัน (crutches)
- ☐ อื่น ๆ .....

20. ชนิดของอุปกรณ์ช่วยเดินหลังผ่าตัด
- ☐ ไม่ต้องใช้อุปกรณ์ช่วยเดิน
- ☐ อุปกรณ์ช่วยเดินสี่ขา (walker)
- ☐ ไม้เท้า (cane)
- ☐ ไม้ค้ำยัน (crutches)
- ☐ อื่น ๆ .....

21. ปริมาณเลือดที่เสียระหว่างผ่าตัด.....มิลลิลิตร
22. จำนวนวันนอนโรงพยาบาล.....วัน

APPENDIX D2

แบบสอบถามโรคร่วม

คำชี้แจง : แบบสอบถามต่อไปนี้จัดทำขึ้นเพื่อสอบถามโรคร่วมของท่าน ขอให้ท่านใส่เครื่องหมาย √ ในช่องที่ตรงกับโรคของท่าน ท่านสามารถตอบได้มากกว่า 1 ข้อ

โรคร่วม	ใช่	ไม่ใช่	คะแนน
โรคกล้ามเนื้อหัวใจตาย (Myocardial infarction)			1
โรคหัวใจล้มเหลว (Congestive heart failure)			1
โรคหลอดเลือดส่วนปลาย (Peripheral vascular disease)			1
โรค.....			1
โรค.....			1
โรค.....			1
โรค.....			1
โรค.....			1
โรค.....			1
โรค.....			1
โรค.....			2
โรค.....			2
โรค.....			2
โรค.....			2
โรคตับชนิดปานกลางหรือชนิดรุนแรง (Moderate or severe liver disease)			3
โรคมะเร็งชนิดก้อนระยะแพร่กระจาย (Metastatic solid tumor)			6
โรคภูมิคุ้มกันบกพร่อง (AIDS)			6
คะแนนรวม			

APPENDIX D3

แบบประเมินความรู้ความเข้าใจ

คำชี้แจง: แบบประเมินนี้จัดทำขึ้นเพื่อประเมินความรู้ความเข้าใจ ผู้ประเมินทำเครื่องหมาย √ ในช่องด้านขวามือ ที่ได้จากการประเมิน (ทุกข้อคำถามควรถามเพียงครั้งเดียวยกเว้นแต่มีการระบุไว้)

ขั้นตอนที่ 1 ทดสอบผู้ป่วย

ชื่อและที่อยู่สำหรับการระลึกได้

1. "ฉันกำลังจะบอกชื่อและที่อยู่ให้กับคุณ หลังจากที่พูดไปแล้วฉันต้องการให้คุณพูดซ้ำตามที่ฉันพูด ตอนนี้ให้จำชื่อและที่อยู่นี้ไว้ก่อนเพราะว่าฉันกำลังจะขอให้คุณบอกฉันอีกครั้งในอีกไม่กี่นาทีนี้: นายจันทร์ ดวงดี, บ้านเลขที่ 42 ถนนรอบเมือง, เชียงใหม่" (ให้ผู้ป่วยพูดตามถ้าหากไม่ถูกต้องผู้ทดสอบสามารถบอกซ้ำได้มากที่สุด 4 ครั้ง)

	ถูกต้อง	ไม่ถูกต้อง
การรับรู้เวลา		
2.	☐	☐
การวาดนาฬิกา (ใช้กระดาษที่พิมพ์เป็นรูปวงกลม)		
3.	☐	☐
4.	☐	☐
ข้อมูล		
5.	☐	☐
การระลึกได้ ชื่อและที่อยู่ที่ฉันขอให้คุณจำไว้คืออะไร		
จันทร์	☐	☐
ดวงดี	☐	☐
42	☐	☐
ถนนรอบเมือง	☐	☐
เชียงใหม่	☐	☐
รวมคะแนน	☐	

"ถูกต้อง" ได้ 1 คะแนน "ไม่ถูกต้อง" ได้ 0 คะแนน

ขั้นตอนที่ 2 สัมภาษณ์ผู้ให้ข้อมูล

ผู้ให้ข้อมูลมีความสัมพันธ์กับผู้ป่วยโดยเป็น.....ของผู้ป่วย

(คำถามทั้งหมดให้ถามโดยเปรียบเทียบกับเมื่อตอนที่ผู้ป่วยยังปกติดี หรือในช่วง 5-10 ปีที่ผ่านมา

	ใช่	ไม่ใช่	ไม่ทราบ	ไม่สามารถประเมินได้
1. ผู้ป่วยมีปัญหาเกี่ยวการจำในสิ่งต่าง ๆ ที่เพิ่งเกิดขึ้นในช่วง เร็ว ๆ นี้มากกว่าที่ผู้ป่วยเคยเป็นหรือไม่	☐	☐	☐	
2. ผู้ป่วยลืมเรื่องที่คุยกันหลังจากที่ผ่านไป 2-3 วันหรือไม่	☐	☐	☐	
3.	☐	☐	☐	
4.	☐	☐	☐	☐
5.	☐	☐	☐	☐
6. ผู้ป่วยมีความจำเป็นที่จะได้รับความช่วยเหลือในการเดินทางด้วยยานพาหนะมากขึ้นหรือไม่	☐	☐	☐	☐

รวมคะแนน ☐

APPENDIX D4

แบบสอบถามการสนับสนุนทางสังคม

คำชี้แจง แบบสอบถามชุดนี้จัดทำขึ้นเพื่อใช้ในการประเมินการสนับสนุนทางสังคมของท่าน ขอให้ท่านใส่เครื่องหมาย √ ในข้อที่ตรงกับความเป็นจริงมากที่สุด

1 หมายถึง ไม่เคยเลย / แทบจะไม่เคย
2 หมายถึง นาน ๆ ครั้ง
3 หมายถึง เป็นประจำ
4 หมายถึง สม่ำเสมอ

ข้อคำถาม	1 ไม่เคยเลย	2 นาน ๆ ครั้ง	3 เป็นประจำ	4 สม่ำเสมอ
1. ครอบครัวและเพื่อนๆ ของฉันเข้าใจฉัน				
2. ครอบครัวและเพื่อนๆ ของฉันช่วยฉันออกกำลังกาย				
3. ครอบครัวและเพื่อนๆ ของฉันจัดเตรียมอาหารให้ฉัน				
4.				
5.				
6.				
7.				
8.				
9.				
10. ฉันสามารถแบ่งปันความสุขและความเสียใจกับ ครอบครัวและเพื่อนๆ ของฉัน				
11. ครอบครัวและเพื่อนๆ ของฉันช่วยฉันทำงานบ้าน				
12. ครอบครัวและเพื่อนๆ ของฉัน เตรียมพร้อมที่จะช่วยฉันในการตัดสินใจ				
คะแนนรวม				

APPENDIX D5

แบบสอบถามอาการเหนื่อยล้า

คำชี้แจง แบบสอบถามชุดนี้จัดทำขึ้นเพื่อใช้ในการประเมินความรุนแรงของอาการเหนื่อยล้าของท่าน ขอให้ท่านใส่เครื่องหมายวงกลม ◯ ที่หมายเลข 1-7 เพียง 1 หมายเลขของแต่ละข้อ ตามความรู้สึกที่แท้จริงของท่านมากที่สุด **ในระยะเวลา 1 สัปดาห์ที่ผ่านมา**

ในระยะ 1 สัปดาห์ที่ผ่านมา ฉันพบว่า	**ไม่เห็นด้วยอย่างยิ่ง** ◄——► **เห็นด้วยอย่างยิ่ง**						
1. แรงจูงใจในการเคลื่อนไหวของฉันลดลงเมื่อฉันมีอาการเหนื่อยล้า	1	2	3	4	5	6	7
2. การออกกำลังกายทำให้ฉันรู้สึกเหนื่อยล้า	1	2	3	4	5	6	7
3. ฉันรู้สึกเหนื่อยล้าได้ง่าย	1	2	3	4	5	6	7
4.	1	2	3	4	5	6	7
5.	1	2	3	4	5	6	7
6.	1	2	3	4	5	6	7
7.	1	2	3	4	5	6	7
8. อาการเหนื่อยล้าเป็นหนึ่งในอาการสำคัญที่ทำให้ฉันทำสิ่งต่าง ๆ ได้ลดลง	1	2	3	4	5	6	7
9. อาการเหนื่อยล้ามีผลกระทบต่อการทำงาน การใช้ชีวิตในครอบครัว หรือการใช้ชีวิตในสังคมของฉัน	1	2	3	4	5	6	7
คะแนนรวม							

APPENDIX D6

แบบสอบถามคุณภาพการนอนหลับ

คำชี้แจง แบบสอบถามชุดนี้จัดทำขึ้นเพื่อใช้ในการประเมินคุณภาพการนอนหลับของท่าน ขอให้ท่านใส่คำตอบและเครื่องหมาย √ ในข้อที่ตรงกับการนอนหลับส่วนใหญ่ของท่านใน**ระยะ 1 เดือนที่ผ่านมา**ให้ตรงกับความเป็นจริงมากที่สุด

1. ในช่วง 1 เดือนที่ผ่านมาส่วนใหญ่ท่านมักจะเข้านอนเวลาประมาณกี่โมง.....น.
2. ในช่วง 1 เดือนที่ผ่านมาท่านต้องใช้เวลานานกี่นาที ตั้งแต่เข้านอนจนหลับไป.....นาที
3. .....
4. .....

5. ในช่วง 1 เดือนที่ผ่านมาท่านมีปัญหาเกี่ยวกับการนอนเนื่องจากสาเหตุเหล่านี้บ่อยเพียงใด	ไม่เลย (0)	< 1 ครั้ง/สัปดาห์ (1)	1-2 ครั้ง/สัปดาห์ (2)	≥ 3 ครั้ง/สัปดาห์ (3)
5.1 นอนไม่หลับหลังจากเข้านอนไปแล้วนานกว่า 30 นาที				
5.2				
5.3				
5.4				
5.5				
5.6				
5.7				
5.8				
5.9				
5.10				
6.				
7.				
8.				
9.				
คำถามประกอบเพิ่มเติม 10.				
10.1				
10.2				
10.3				
10.4 ท่านมี อาการกระสับกระส่ายอื่น ๆ ขณะนอนหลับหรือไม่ อาการอื่น ๆ (โปรดระบุ) เช่น เป็นตะคริว				

APPENDIX D7

แบบสอบถามอาการปวด

คำชี้แจง แบบสอบถามชุดนี้จัดทำขึ้นเพื่อใช้ในการประเมินอาการปวดของท่าน ขอให้ท่านใส่เครื่องหมาย √ ในช่องที่ตรงกับความเป็นจริงมากที่สุด

1. ความปวดที่เกิดขึ้นมีความรุนแรงเป็นคะแนนเท่าไร โปรดใส่เครื่องหมาย X (กากบาท)

   โดย 0 หมายถึงไม่ปวดเลย และ 10 หมายถึง ปวดมากที่สุด

ไม่ปวดเลย ปวดมากที่สุด

2. ถ้ามีอาการปวด อาการปวดเกิดขึ้นบ่อยแค่ไหน

☐ 1 ครั้ง/สัปดาห์ ☐ 2 ครั้ง/สัปดาห์ ☐ > 3ครั้ง/สัปดาห์

APPENDIX D8

แบบประเมินการเคลื่อนไหว

คำชี้แจง แบบสอบถามชุดนี้จัดทำขึ้นเพื่อใช้ในการประเมินการเคลื่อนไหวของท่าน ขอให้ท่านปฏิบัติตาม โดยผู้ประเมินใส่เครื่องหมาย √ ในช้อที่ตรงกับความเป็นจริงมากที่สุด

ข้อ	วิธีปฏิบัติ	0	1	2
1. ท่าสะพาน	.....	☐ ทำไม่ได้	☐ ทำได้	
2.	.....	☐ ทำไม่ได้	☐ ทำได้	
3.	.....	☐ ทำไม่ได้	☐ ต้องมีการช่วยเหลือเล็กน้อย ☐ ต้องให้การช่วยเหลือมาก	☐ ทำได้ด้วยตนเอง
4. นั่งทรงตัวบนเก้าอี้	.....	☐ ทำไม่ได้	☐ ทำได้ 10 วินาที	
5.	.....	☐ ทำไม่ได้	☐ ต้องมีการช่วยเหลือเล็กน้อย ☐ ต้องให้การช่วยเหลือมาก	☐ ทำได้ด้วยตนเอง
6.	.....	☐ ทำไม่ได้	☐ ทำได้	
7. ยืนทรงตัว	.....	☐ ทำไม่ได้	☐ ทำได้ 10 วินาที	
8.	.....	☐ ทำไม่ได้	☐ ทำได้ 10 วินาที	
9.	.....	☐ ทำไม่ได้	☐ ทำได้ 10 วินาที	
10.	.....	☐ ทำไม่ได้	☐ ทำได้ 10 วินาที	
11.ระยะทางเดิน โดยใช้/หรือไม่ใช้อุปกรณ์ช่วยเดิน	.....	☐ ทำไม่ได้ ☐ ทำได้ 5 เมตร	☐ ทำได้ 10 เมตร ☐ ทำได้ 20 เมตร	☐ ทำได้ 50 เมตร
12.	.....	☐ ทำไม่ได้	☐ เดินได้ด้วยตนเองโดยใช้อุปกรณ์ช่วยเดิน	☐ เดินได้ด้วยตนเองโดยไม่ต้องใช้อุปกรณ์ช่วยเดิน
13.เดินถอยหลัง 4 ก้าว	.....	☐ ทำไม่ได้	☐ ทำได้	
14.	.....	☐ ทำไม่ได้	☐ ทำได้	
15.	.....	☐ ทำไม่ได้	☐ ทำได้	
รวมคะแนนดิบ		/19		
รวมคะแนน DEMMI		/100		

APPENDIX E
LIST OF THE EXPERTS

LIST OF THE EXPERTS

1. Assoc. Prof. Satit Thiengwittayaporn, M.D.

   Department of Orthopaedics, Faculty of Medicine Vajira Hospital, Navamindradhiraj University.

2. Assoc. Prof. Dr. Pongsri Srimorakot

   Lecturer at Department of Medical and Surgical Nursing, Faculty of Nursing, Bangkokthonburi University.

3. Assoc. Prof. Dr. Suparb Aree-Ue

   Division of Adult and Gerontological Nursing,

   Ramathibodi School of Nursing, Faculty of Medicine Ramathibodi Hospital. Mahidol University.

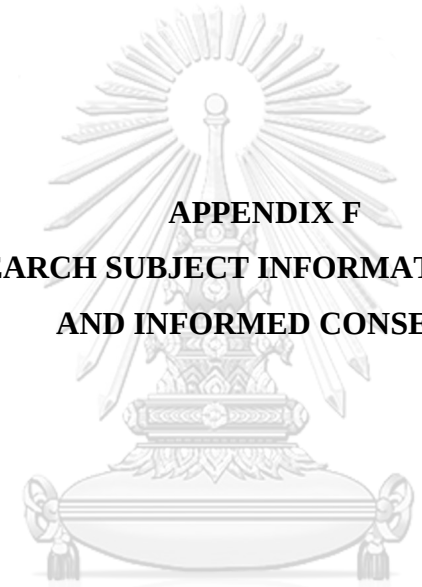
4. Dr. Sunee Suwanpasu

   Advanced Practitioner Nurse (APN), Nursing Resercher at Nursing Department, King Chulalongkorn Memorial Hospital.

5. Mrs. Parichad Jansoontraporn

   Advanced Practitioner Nurse (APN), Nursing Department, Faculty of Medicine Vajira Hospital, Navamindradhiraj University.

APPENDIX F
RESEARCH SUBJECT INFORMATION SHEET AND INFORMED CONSENT



เอกสารชี้แจงขอมูลสำหรับผูมีสวนรวมในโครงการวิจัย

(Research Subject Information sheet)

ชื่อโครงการวิจัย การวิเคราะห์โมเดลเชิงเส้นทางของการเคลื่อนไหวของผู้ป่วยกระดูกสะโพกหักภายหลังได้รับการผ่าตัด

ชื่อผู้วิจัย นางสาวชนิภา ยอยืนยง ตำแหน่ง นิสิตคณะพยาบาลศาสตร์จุฬาลงกรณ์มหาวิทยาลัย

สถานที่ติดต่อผู้วิจัย (ที่ทำงาน) คณะพยาบาลศาสตร์จุฬาลงกรณ์มหาวิทยาลัย อาคารบรมราชชนนีศรีศตพรรษ ชั้น 11 ถนน พระรามที่ 1 แขวงวังใหม่ เขตปทุมวัน กรุงเทพมหานคร 10330

(ที่บ้าน) 90/17 หมู่บ้านชวนชื่นพาร์คกาญจนา-บางใหญ่ ถนนกาญจนาภิเษก ซอยกันตนา ตำบลบางใหญ่ อำเภอบางใหญ่ จังหวัดนนทบุรี 11140

โทรศัพท์มือถือ 094-4651419 E-mail : chanipa@nmu.ac.th

ขอเรียนเชิญเข้าร่วมการวิจัย ก่อนตัดสินใจเข้าร่วมในการวิจัย โปรดทำความเข้าใจว่างานวิจัยนี้เกี่ยวข้องกับอะไรและทำเพราะเหตุใด กรุณาใช้เวลาในการอ่านข้อมูลต่อไปนี้อย่างรอบคอบ หากมีข้อความใดที่อ่านแล้วไม่เข้าใจหรือไม่ชัดเจน โปรดสอบถามเพิ่มเติมกับผู้วิจัยได้ตลอดเวลา ผู้วิจัยจะอธิบายจนกว่าท่านจะเข้าใจอย่างชัดเจน

1. ความเป็นมา เหตุผลและวัตถุประสงค์ของโครงการวิจัย

อุบัติการณ์ของผู้ป่วยกระดูกสะโพกหักมีจำนวนเพิ่มขึ้น ผู้ป่วยกระดูกสะโพกหักประมาณ 80-90% ต้องรับเข้าในโรงพยาบาลเพื่อรักษาโดยการผ่าตัด การรักษามีวัตถุประสงค์เพื่อให้ผู้ป่วยกลับมาใช้ชีวิตได้ตามปกติ หรือใกล้เคียงปกติมากที่สุด อย่างไรก็ตามพบว่าผู้ป่วยกระดูกสะโพกหักที่ได้รับการผ่าตัดมีปัญหาการเคลื่อนไหวลดลงและผู้ป่วยบางรายไม่สามารถกลับไปเคลื่อนไหวได้เหมือนเดิมก่อนกระดูกหัก จากการศึกษาพบว่ามีหลายปัจจัยที่มีความสัมพันธ์กับการเคลื่อนไหวของผู้ป่วย ได้แก่ โรคร่วม การทำหน้าที่ด้านการรู้คิด การสนับสนุนทางสังคม อาการปวด อาการเหนื่อยล้า และคุณภาพการนอนหลับ ในประเทศไทย การศึกษาเกี่ยวกับการเคลื่อนไหวของผู้ป่วยกระดูกสะโพกหักที่ได้รับการผ่าตัดมีน้อยมาก การศึกษาส่วนใหญ่มุ่งเน้นไปที่ภาวะแทรกซ้อน พฤติกรรมการดูแลตนเอง และกิจกรรมการใช้ชีวิตประจำวันของผู้ป่วย ดังนั้น การศึกษานี้จะทำให้เห็นความเชื่อมโยงระหว่างปัจจัยต่าง ๆ ต่อการเคลื่อนไหวให้มีความชัดเจนขึ้น

วัตถุประสงค์ของโครงการวิจัย งานวิจัยนี้มีวัตถุประสงค์หลัก เพื่อศึกษาความสัมพันธ์ทั้งทางตรงและทางอ้อมของโรคร่วม การทำหน้าที่ด้านการรู้คิด การสนับสนุนทางสังคม อาการปวด อาการเหนื่อยล้า คุณภาพการนอนหลับ ต่อการเคลื่อนไหวของผู้ป่วยกระดูกสะโพกหักภายหลังได้รับการผ่าตัด

2. ท่านจะได้รับเอกสารนี้ 1 ชุด เพื่ออ่านและปรึกษาหารือกับญาติพี่น้อง เพื่อน หรือแพทย์ที่ท่านรู้จัก ให้ช่วยตัดสินใจว่าควรจะเข้าร่วมโครงการวิจัยนี้หรือไม่ การเข้าร่วมในโครงการวิจัยครั้งนี้จะต้องเป็น**ความสมัครใจ**ของท่าน ไม่มีการบังคับหรือชักจูง ถึงแม้ท่านจะไม่เข้าร่วมในโครงการวิจัย

โปรดอย่าลงลายมือชื่อของท่านในเอกสารนี้จนกว่าท่านจะแน่ใจว่ามีความประสงค์จะเข้าร่วมในโครงการวิจัยนี้ คำว่า “ท่าน” ในเอกสารนี้ หมายถึงผู้เข้าร่วมโครงการวิจัยในฐานะเป็นอาสาสมัครในโครงการวิจัยนี้ หากท่านเป็น**ผู้แทนโดยชอบธรรมตามกฎหมาย**ของผู้ที่จะเข้าร่วมในโครงการวิจัยและลงนามแทนในเอกสารนี้ โปรดเข้าใจว่า “ท่าน” ในเอกสารนี้หมายถึงผู้เข้าร่วมในโครงการวิจัยเท่านั้น

3. รายละเอียดของผู้เข้าร่วมการวิจัยและคุณสมบัติ โครงการวิจัยนี้ทำการศึกษากับผู้ป่วยกระดูกสะโพกหักหลังได้รับการผ่าตัดจำนวน 316 คนจาก 4 โรงพยาบาล โดยเป็นผู้ป่วยจาก โรงพยาบาลศิริราช จังหวัดกรุงเทพมหานคร จำนวน 141 ราย โรงพยาบาลวชิรพยาบาล จังหวัดกรุงเทพมหานคร จำนวน 119 คน (รวมการทดสอบเครื่องมือ) โรงพยาบาลสิงห์บุรี จังหวัดสิงห์บุรี จำนวน 12 คน โรงพยาบาลกระทุ่มแบน จังหวัดสมุทรสาคร จำนวน 44 คน ผู้ที่สามารถมีส่วนร่วมในการวิจัยและเข้าร่วมโครงการได้ต้องเป็นผู้ป่วยกระดูกสะโพกหักหลังได้รับการผ่าตัด ที่มีอายุ 50 ปีขึ้นไป ที่มาตรวจ ณ ห้องตรวจผู้ป่วยนอกออร์โธปิดิกส์ ห้องตรวจกายภาพบำบัด ท่านสามารถสื่อสารภาษาไทยได้ ท่านไม่สามารถเข้าร่วมโครงการได้หากท่านมีภาวะคุกคามถึงชีวิต เช่น กล้ามเนื้อหัวใจตาย มีประวัติเป็นโรคที่ส่งผลต่อความสามารถในการรู้คิดบกพร่อง

4. การคัดกรองผู้มีส่วนนร่วมในการวิจัย การศึกษานี้ไม่มีการคัดกรองผู้มีส่วนร่วมในการวิจัย หาก ท่านไม่ยินดีเข้าร่วมโครงการวิจัย ท่านจะไม่ถูกขอให้ตอบแบบสอบถามใด ๆ ผู้วิจัยจะเปิดโอกาสให้ท่านสอบถามถึงปัญหาสุขภาพของท่านโดย ผู้วิจัยจะให้คำแนะนำเกี่ยวกับการดูแลปัญหาสุขภาพเหล่านั้นตามความเหมาะสม หากสภาวะของท่านสมควรได้รับคำแนะนำหรือช่วยเหลือต่อไป ผู้วิจัยจะประสานพยาบาลประจำหน่วยเพื่อให้คำแนะนำและให้การช่วยเหลือท่าน

5. ในการเข้าร่วมงานวิจัย หากท่านตัดสินใจที่จะเข้าร่วมโครงการ สิ่งที่จะขอให้ท่านปฏิบัติต่อไปคือการตอบแบบสอบถามครั้งเดียว จำนวน 7 ชุด ประกอบด้วย แบบสอบถามข้อมูลส่วนบุคคล แบบสอบถามโรคร่วม แบบประเมินสภาวะการรู้คิด แบบสอบถามการสนับสนุนทางสังคม แบบสอบถามอาการเหนื่อยล้าแบบสอบถามอาการปวด แบบสอบถามการนอนหลับ จำนวนประมาณ 70 ข้อ ใช้เวลาประมาณ 30 นาทีและทดสอบการเคลื่อนไหวของท่าน โดยแบบประเมินการเคลื่อนไหว

ในห้องที่จัดเตรียมไว้ซึ่งมีเตียงนอนผู้ป่วย เก้าอี้ที่มีพนักพิง โถงทางเดินยาวประมาณ 10-15 เมตร ซึ่งการประเมินการเคลื่อนไหวจะเริ่มต้นด้วยการเคลื่อนไหวบนเตียง ได้แก่ การทำท่าสะพาน การพลิกตะแคงตัว การนอนและลุกนั่ง การเคลื่อนไหวบนเก้าอี้ ได้แก่ การนั่งบนเก้าอี้ การนั่งและยืนจากเก้าอี้ การยืน ได้แก่ การยืนทรงตัว การยืนเท้าชิด การยืนบนปลายเท้า การเดิน ได้แก่ การเดินโดยใช้และ/หรือไม่ใช้เครื่องช่วยเดิน และการทรงตัว ได้แก่ การก้มหยิบของ การเดินถอยหลัง และการกระโดด โดยใช้เวลาประมาณ 15 นาที ซึ่งการสัมภาษณ์และการประเมินการเคลื่อนไหวครั้งนี้ใช้เวลารวมทั้งสิ้นประมาณ 30 – 45 นาที ซึ่งผู้วิจัยเป็นผู้สัมภาษณ์และประเมินการเคลื่อนไหวด้วยตนเอง

6. เนื่องจากในแบบสอบถามข้อมูลส่วนบุคคล มีข้อมูลบางส่วน ได้แก่ ชนิดของกระดูกหัก ชนิดของการผ่าตัด ปริมาณการเสียเลือดระหว่างผ่าตัด และจำนวนวันนอนโรงพยาบาลที่ผู้วิจัยต้องใช้ข้อมูลจากเวชระเบียนแฟ้มประวัติของท่าน โดยผู้วิจัยจะทำหนังสือขออนุญาตใช้ข้อมูลจากเวชระเบียนแฟ้มประวัติจากจุฬาลงกรณ์มหาวิทยาลัย ถึงผู้อำนวยการโรงพยาบาล และขออนุญาตท่านเพื่อเข้าถึงข้อมูลดังกล่าวก่อนเก็บรวมรวมข้อมูล

7. ความเสี่ยง/อันตราย และความไม่สะดวกต่าง ๆ ที่อาจเกิดขึ้นจากการเข้าร่วมการวิจัย เนื่องจากโครงการวิจัยนี้ส่วนใหญ่เป็นการตอบแบบสอบถาม จึงมีความเสี่ยงเพียงเล็กน้อย เช่น เสียเวลา นอกจากนี้ความเสี่ยงจากการประเมินการเคลื่อนไหว เช่น อาการหน้ามืด คล้ายเป็นลม ทั้งนี้ผู้วิจัยซึ่งเป็นผู้เก็บข้อมูลด้วยตนเองได้ให้ความระมัดระวังเป็นพิเศษ โดยการอยู่ใกล้ชิดผู้ป่วยตลอดเวลา และมีการประเมินความเสี่ยงโดยวัดสัญญาณชีพก่อนให้ท่านทำการประเมินการเคลื่อนไหว อย่างไรก็ตามท่านมีสิทธิที่จะปฏิเสธการตอบแบบสอบถาม รวมทั้งการประเมินการเคลื่อนไหวและสามารถถอนตัวจากการศึกษาได้หากมีความรู้สึกไม่สุขสบายใจในการที่จะตอบแบบสอบถามและประเมินการเคลื่อนไหวได้ตลอดเวลาที่ท่านต้องการ และหากท่านรู้สึกมีอาการผิดปกติในการตอบแบบสอบถามและประเมินการเคลื่อนไหว ผู้วิจัยจะหยุดการเก็บรวบรวมข้อมูลและประสานพยาบาลประจำหน่วยเพื่อช่วยเหลือท่านทันที

8. ประโยชน์ในการเข้าร่วมการวิจัย เนื่องจากโครงการวิจัยนี้เป็นการศึกษาความสัมพันธ์ท่านจะได้รับการประเมินการเคลื่อนไหวจากการเข้าร่วมการวิจัย นอกจากนี้ประโยชน์จากการศึกษานี้ คือ ผลการศึกษานี้จะช่วยให้บุคลากรด้านสุขภาพ เห็นภาพรวมของการเคลื่อนไหวในผู้ป่วยกระดูกสะโพกหักหลังได้รับการผ่าตัด ช่วยให้บุคลากรด้านสุขภาพประเมิน ติดตาม และระบุผู้ป่วยที่มีความเสี่ยงต่อการเสื่อมถอยในการเคลื่อนไหวได้ตั้งแต่ระยะเริ่มแรก และเพื่อนำข้อค้นพบไปสร้างโปรแกรมที่เฉพาะเจาะจงต่อการเคลื่อนไหวของผู้ป่วยกระดูกสะโพกหักหลังได้รับการผ่าตัด

9. **ข้อมูลที่เกี่ยวข้องกับผู้มีส่วนร่วมในการวิจัยจะเก็บเป็นความลับ** โครงการวิจัยนี้จะไม่มีการเปิดเผยชื่อ – นามสกุลของท่าน ต่อสาธารณะเป็นรายบุคคล ผู้วิจัยจะใช้รหัสแทนชื่อ ข้อมูลที่ได้จากการตอบแบบสอบถาม การประเมินการเคลื่อนไหว และบันทึกทางการแพทย์ จะถูกเก็บไว้เป็นความลับ ผู้วิจัยจะตีพิมพ์ รายงานผลการศึกษา และนำเสนอเป็นภาพรวม

10. เมื่อเสร็จสิ้นการวิจัยแล้วข้อมูลที่เกี่ยวข้องกับตัวท่านจะถูกทำลาย โดยผู้วิจัยจะทำลายกระดาษที่เป็นแบบสอบถามและแบบประเมินโดยใช้เครื่องทำลายเอกสาร และทำลายข้อมูลไฟล์อิเลกทรอนิกส์ที่บันทึกไว้ในคอมพิวเตอร์ทั้งหมดด้วยตนเอง

11. โครงการวิจัยนี้ไม่มีค่าใช้จ่ายที่ท่านต้องรับผิดชอบ และไม่มีค่าตอบแทนให้ท่านที่เข้าร่วมการวิจัย ทั้งนี้ผู้เข้าร่วมในการวิจัยจะได้รับปากกาที่มีสัญลักษณ์จุฬาลงกรณ์มหาวิทยาลัยเพื่อเป็นการขอบคุณสำหรับการเข้าร่วมการวิจัย นอกจากนี้ผู้วิจัยจะมีการให้ข้อมูลความรู้ที่เป็นประโยชน์ต่อผู้ป่วย เช่น ประโยชน์ของการเคลื่อนไหว เพื่อช่วยให้ร่างกายมีความคล่องตัว กล้ามเนื้อแข็งแรงขึ้น ป้องกันการหกล้ม ป้องกันการติดเตียงและการติดเชื้อทางเดินหายใจ เป็นต้น

12. การเข้าร่วมการวิจัยเป็นโดยสมัครใจ ท่านสามารถปฏิเสธที่จะเข้าร่วมหรือถอนตัวจากการวิจัยได้ทุกขณะ โดยไม่ต้องให้เหตุผล ไม่ว่าท่านจะเข้าร่วมการวิจัยครั้งนี้หรือไม่ท่านยังคงได้รับการพยาบาลตามปกติ การปฏิเสธที่จะเข้าร่วมหรือถอนตัวจากการวิจัยจะไม่มีผลใด ๆ ต่อการรักษาหรือการพยาบาลที่ท่านได้รับอยู่

13. **หากท่านมีข้อสงสัยที่จะสอบถามเกี่ยวกับการวิจัย** ท่านสามารถติดต่อ นางสาวชนิภา ยอยืนยง 094-4651419 หรือตามที่อยู่ที่ได้ให้ไว้ข้างต้นได้ตลอด 24 ชั่วโมง

14. **หากได้รับการปฏิบัติไม่ตรงตามข้อมูลดังกล่าว**สามารถร้องเรียนได้ที่ คณะกรรมการพิจารณาจริยธรรมการวิจัยในคน กลุ่มสหสถาบัน ชุดที่ 1 จุฬาลงกรณ์มหาวิทยาลัย 254 อาคารจามจุรี 1 ชั้น 2 ถนนพญาไท เขตปทุมวัน กรุงเทพฯ 10330 โทรศัพท์ 0-2218-3202, 0-2218-3049 E-mail: eccu@chula.ac.th

หนังสือแสดงเจตนายินยอมเข้าร่วมการวิจัย (Informed Consent)

ข้าพเจ้า (นาย, นาง, นางสาว).....
ได้รับทราบโครงการวิจัยเรื่อง “การวิเคราะห์โมเดลเชิงเส้นทางของการเคลื่อนไหวของผู้ป่วยกระดูกสะโพกหักภายหลังได้รับการผ่าตัด” วันที่ลงนาม ...../...../.....

ก่อนที่จะลงนามในใบยินยอมให้ทำการวิจัยนี้ ข้าพเจ้าได้รับการอธิบายจากผู้วิจัยชื่อนางสาว ชนิภา ยอยืนยง นิสิต ปริญญาเอก คณะพยาบาลศาสตร์จุฬาลงกรณ์มหาวิทยาลัย สถานที่ติดต่อคณะพยาบาลศาสตร์จุฬาลงกรณ์มหาวิทยาลัย โทรศัพท์ติดต่อ 094-4651419 ถึงวัตถุประสงค์ของการวิจัย วิธีการวิจัย ความเสี่ยง อันตราย หรืออาการที่อาจเกิดขึ้น จากการวิจัย รวมทั้งประโยชน์ที่คาดว่าจะเกิดขึ้นจากการวิจัยเรื่อง “การวิเคราะห์โมเดลเชิงเส้นทางของการเคลื่อนไหวของผู้ป่วยกระดูกสะโพกหักภายหลังได้รับการผ่าตัด” และมีความเข้าใจดีแล้ว

ผู้วิจัยรับรองว่าจะตอบคำถามที่ข้าพเจ้าสงสัยด้วยความเต็มใจและไม่ปิดบัง จนข้าพเจ้าพอใจ

ข้าพเจ้าเข้าร่วมในโครงการวิจัยนี้ด้วยความสมัครใจ โดยปราศจากการบังคับหรือชักจูง

ข้าพเจ้ามีสิทธิที่จะบอกเลิกการเข้าร่วมในโครงการวิจัยเมื่อใดก็ได้และการบอกเลิกนี้จะไม่มีผลต่อการรักษา พยาบาลที่ข้าพเจ้าจะพึงได้รับในปัจจุบันและในอนาคต

ผู้วิจัยรับรองว่าจะเก็บข้อมูลเกี่ยวกับตัวข้าพเจ้าเป็นความลับ และจะเปิดเผยเฉพาะในรูปของสรุปผลการวิจัยโดย ไม่มีการระบุชื่อนามสกุลของข้าพเจ้า การเปิดเผยข้อมูลเกี่ยวกับตัวข้าพเจ้าต่อหน่วยงานต่าง ๆ ที่เกี่ยวข้อง จะกระทำด้วยเหตุผลทางวิชาการเท่านั้น

ผู้วิจัยรับรองว่าหากเกิดอันตรายใด ๆ จากการวิจัย ข้าพเจ้าจะได้รับการรักษาพยาบาลและได้รับค่าชดเชย ตามที่ระบุในเอกสารชี้แจงข้อมูลแก่ผู้เข้าร่วมโครงการวิจัย

ข้าพเจ้าจะได้รับเอกสารชี้แจงและหนังสือยินยอมที่มีข้อความเดียวกันกับที่นักวิจัยเก็บไว้เป็นส่วนตัวข้าพเจ้าเอง 1 ชุด

ข้าพเจ้าได้อ่านข้อความข้างต้นแล้ว มีความเข้าใจดีทุกประการ และลงนามในใบยินยอมด้วยความเต็มใจ

ลงชื่อ.....	ลงชื่อ.....
(.....)	(.....)
ผู้เข้าร่วมการวิจัย	ผู้ดำเนินโครงการวิจัย
โทรศัพท์.....	โทรศัพท์.....
ลงชื่อ.....	ลงชื่อ.....
(.....)	(.....)
พยาน	พยาน
โทรศัพท์.....	โทรศัพท์.....

APPENDIX G
APPROVAL OF ETHICAL REVIEW COMMITTEE

APPROVAL OF THE COMMITTEE BOARDS

1. The Research Ethics Review Committee for Research Involving Human Research Participants, Group 1, Chulalongkorn University.
2. The Institutional Review Board of the Faculty of Medicine Vajira Hospital.
3. The Human Research Ethics Committee of Krathumbaen Hospital.
4. The Human Research Ethics Committee of Singburi Hospital.
5. The Institutional Review Board, Royal Thai Army Medical Department.

The Research Ethics Review Committee for Reseach Involving Human Research Participants, Group I, Chulalongkorn University

Chamchuri 1 Building, 2nd Floor, 254 Phayathai Road, Pathumwan, Bangkok 10330 Thailand

Telephone: 02-218-3202, 02-218-3049 Email: eccu@chula.ac.th

COA No. 137/65

Certificate of Approval

Study Title No. 650069 : A PATH ANALYSIS MODEL OF MOBILITY AMONG PATIENTS WITH HIP FRACTURE UNDERGOING SURGERY

Principal Investigator : Ms. Chanipa Yoryuenyong

Place of Proposed Study/Institution : Faculty of Nursing, Chulalongkorn University

The Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University, Thailand, has approved constituted in accordance with Belmont Report 1979, Declaration of Helsinki 2013, Council for International Organizations of Medical Sciences (CIOM) 2016, Standards of Research Ethics Committee (SREC) 2017, and National Policy and guidelines for Human Research 2015.

Signature Prida Tasanapradit

(Associate Prof. Prida Tasanapradit)

Chairman

Signature Raveenan Mingpakanee

(Assistant Prof. Dr. Raveenan Mingpakanee)

Secretary

Date of Approval : 29 June 2022

Approval Expire date : 28 June 2023

The approval documents including:

1. Participant Information Sheet and Consent Form
2. Research proposal
3. Researcher
4. Research instruments/tools

Conditions

The approved investigator must comply with the following conditions:

1. It's unethical to collect data of research participants before the project has been approved by the committee.

2. The research/project activities must end on the approval expired date. To renew the approval, it can be applied one month prior to the expired date with submission of progress report.

3. Strictly conduct the research/project activities as written in the proposal.

4. Using only the documents that bearing the RECCU's seal of approval: research tools, information sheet, consent form, invitation letter for research participation (if applicable).

5. Report to the RECCU for any serious adverse events within 5 working days.

6. Report to the RECCU for any amendment of the research project prior to conduct the research activities.

7. Report to the RECCU for termination of the research project within 2 weeks with reasons.

8. Final report (AF 01-15) and abstract is required for a one year (or less) research/project and report within 30 days after the completion of the research/project.

9. Research project with several phases; approval will be approved phase by phase, progress report and relevant documents for the next phase must be submitted for review.

10. The committee reserves the right to site visit to follow up how the research project being conducted.

11. For external research proposal the dean or head of department oversees how the research being conducted

Study Title No. 650069
Date of Approval 29 Jun 2022
Approval Expire date 28 Jun 2023

681 SAMSEN ROAD, DUSIT, BANGKOK 10300
Tel. 0-2244-3843

COA 140/2565

INSTITUTIONAL REVIEW BOARD
FACULTY OF MEDICINE VAJIRA HOSPITAL
CERTIFICATE OF APPROVAL

The Institutional Review Board of the Faculty of Medicine Vajira Hospital, is in full compliance with the International guidelines for human research protection as Declaration of Helsinki, The Belmont Report, CIOMS Guideline and International Conference on Harmonization in Good Clinical Practice (ICH-GCP)

PROTOCOL TITLE	A Path Analysis Model of Mobility Among Patients With Hip Fracture Undergoing Surgery การวิเคราะห์โมเดลเชิงเส้นทางของการเคลื่อนไหวของผู้ป่วยกระดูกสะโพกหักภายหลังได้รับการผ่าตัด
STUDY CODE	092/65 E
PRINCIPAL INVESTIGATOR	Chanipa Yoryuenyong Assoc. Prof. Chanokporn Jitpanya
AFFILIATION	Faculty of Nursing Chulalongkorn University

APPROVAL DOCUMENTS

1. Research protocol **version 2 date 30 June 2022**
2. Inform consent documents **version 2 date 30 June 2022**
3. Case record form **version 2 date 30 June 2022**
4. Investigator's CV and ICH-GCP training certificate and declaration of conflict of interest
   - 4.1 Investigator's
     1) Chanipa Yoryuenyong
     2) Assoc. Prof. Chanokporn Jitpanya

Signature.....
(Professor Siriwan Tangjitgamol, MD)
Chairman
Vajira Institutional Review Board

Date of Approval 29/06/2022
Approval Expire Date 28/06/2023
Approval is granted subject to the following conditions: (see back of this Certificate)

Page | 1/1

สำนักงานคณะกรรมการพิจารณาจริยธรรมการวิจัย (ศึกวชศาสตร์พื้นฐ ชั้น 5)
คณะแพทยศาสตร์วชิรพยาบาล มหาวิทยาลัยนวมินทราธิราช
681 ถนนสามเสน แขวงวชิรพยาบาล เขตดุสิต กรุงเทพ ฯ 10300
โทรศัพท์ 0-2244-3843

No. 009/65

เอกสารรับรองจริยธรรมการวิจัยในมนุษย์

โดยคณะกรรมการพิจารณาจริยธรรมการวิจัยในมนุษย์ โรงพยาบาลกระทุ่มแบน

ชื่อโครงการวิจัย	การวิเคราะห์โมเดลเชิงเส้นของการเคลื่อนไหวของผู้ป่วยกระดูกสะโพกหักภายหลังได้รับการผ่าตัด
ชื่อผู้วิจัย	นางสาวชนิภา ยอยืนยง อาจารย์พยาบาล
หน่วยงาน	คณะพยาบาลศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

ขอรับรองว่าโครงการวิจัยดังกล่าวได้ผ่านการพิจารณาเห็นชอบจากคณะกรรมการพิจารณาจริยธรรมการวิจัยในมนุษย์ โรงพยาบาลกระทุ่มแบนแล้ว

(พญ.สุกัญญา วิริยโกศล)
ประธานคณะกรรมการจริยธรรมการวิจัยในมนุษย์

วันที่รับรอง วันที่ 18 เดือน ก.ค. พ.ศ. 2565
วันที่เอกสารรับรองหมดอายุ เมื่อสิ้นสุดการดำเนินการวิจัย

เอกสารรับรองโครงการ
คณะกรรมการจริยธรรมการวิจัยในมนุษย์ โรงพยาบาลสิงห์บุรี

หมายเลข ๑๐/๒๐๒๒

ชื่อโครงการภาษาไทย : การวิเคราะห์โมเดลเชิงเส้นทางของการเคลื่อนไหวของผู้ป่วยกระดูกสะโพกหักภายหลังได้รับการผ่าตัด
รหัสโครงการ : EC ๑๐/๒๐๒๒ ลงวันที่ ๒๒/๐๙/๒๐๒๒
หัวหน้าโครงการวิจัย : นางสาวชนิภา ยอยืนยง นิสิตชั้นปริญญาดุษฎีบัณฑิต คณะพยาบาลศาสตร์ จุฬาฯ
สถานที่ทำวิจัย : โรงพยาบาลสิงห์บุรี
เอกสารที่รับรอง

๑. แบบเสนอโครงการวิจัยเพื่อขอรับการพิจารณาจากคณะกรรมการจริยธรรมการวิจัยในมนุษย์
๒. โครงร่างการวิจัย
๓. แบบสอบถาม
๔. ประวัติผู้วิจัย

วันที่รับรอง : ๒๒ กันยายน ๒๕๖๕
วันหมดอายุ : ๒๒ กันยายน ๒๕๖๖

คณะกรรมการจริยธรรมการวิจัยในมนุษย์ โรงพยาบาลสิงห์บุรี ได้ดำเนินการพิจารณาเห็นควรให้การรับรองโครงการวิจัยในมนุษย์ เรื่องการวิเคราะห์โมเดลเชิงเส้นทางของการเคลื่อนไหวของผู้ป่วยกระดูกสะโพกหักภายหลังได้รับการผ่าตัด

ลงนาม.....
(แพทย์หญิงสุมาลี นาถวงษ์)
ประธานคณะกรรมการจริยธรรมการวิจัยในมนุษย์โรงพยาบาลสิงห์บุรี
วันที่.....เดือน ๒๒ ก.ย. ๒๕๖๕ พ.ศ.....

อนุมัติ
ลงนาม.....
(นายพงษ์เรินทร์ ชาติรังสรรค์)
ผู้อำนวยการโรงพยาบาลสิงห์บุรี
วันที่.....เดือน ๒๒ ก.ย. ๒๕๖๕ พ.ศ.....

RL 01_2563

The Institutional Review Board, Royal Thai Army Medical Department

317/5Rajavithi Road, Rajathevee, Bangkok 10400, Thailand

No. IRBRTA 1644 **/2022** **Code: Q031q/65_Exp**

Title of Project: A PATH ANALYSIS MODEL OF MOBILITY AMONG PATIENTS WITH HIP FRACTURE UNDERGOING SURGERY

Protocol No.: -

Principal Investigator: Miss Chanipa Yoryuenyong

Name of Department: Faculty of Nursing Chulalongkorn University

Study Site: Phramongkutklao Hospital

Approval documents	Reference (e.g. version and date)
Research protocol	(1) Submission Form for Ethical Review; Version 1 dated 12 Sep 2022 (2) Research Proposal; Version 2 dated 28 Nov 2022
Questionnaire	(3) Questionnaire; Version 2 dated 28 Nov 2022
Informed Document	(4) Information Sheet and Informed consent; Version 2 dated 28 Nov 2022
Curriculum Vitae (CVs)	(5) Miss Chanipa Yoryuenyong; Version 1 dated 22 Sep 2022 (6) Assoc.Prof.Dr.Chanokporn Jitpanya; Version 1 dated 22 Sep 2022 (7) Col. Augchara Sookmak; Version 1 dated 22 Sep 2022

The aforementioned documents have been reviewed and approved by the Institutional Review Board, Royal Thai Army Medical Department incompliance with international guidelines such as Declaration of Helsinki, the Belmont Report, CIOMS Guidelines and the International Conference on Harmonization of Technical Requirements for Registration of Pharmaceuticals for Human Use - Good Clinical Practice (ICH - GCP)

Date of Approval: 13 December 2022

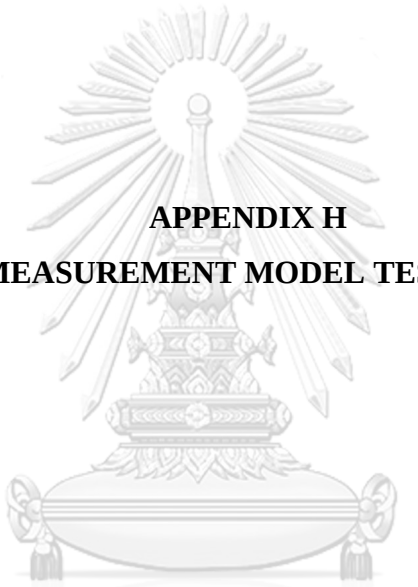
Date of Expiration: 12 December 2023

Frequency of progress report submission: 1 Year

Colonel Suthee Panichkul, M.D.
Chairperson,
Institutional Review Board,
Royal Thai Army Medical Department

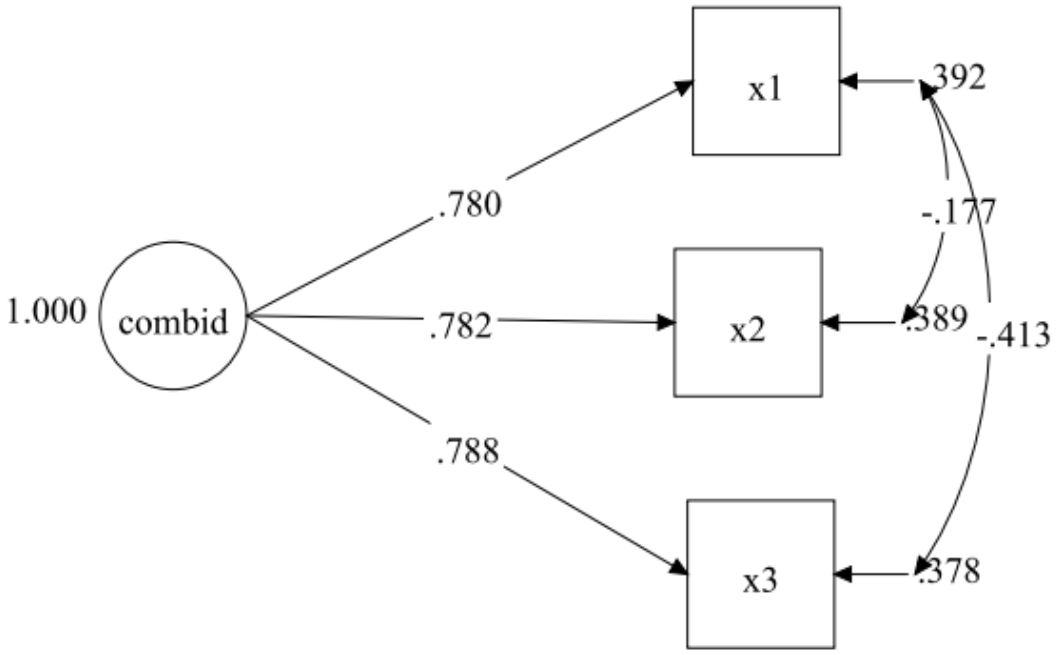
สำนักงานคณะอนุกรรมการพิจารณาโครงการวิจัย พบ.

APPENDIX H
MEASUREMENT MODEL TESTING



APPENDIX H1

Charlson's Comorbidity Index (CCI) measurement model



Chi-Square (df = 1) = 1.275, p = 0.2588., $\chi 2$ /df = 1.275, CFI = .999, TLI = .996, RMSEA = .033, SRMR = .014, p < .01.

Fit indices of the Charlson Comorbidity Index (CCI)

Syntax used for analysis confirmatory factor analysis of the CCI

```
INPUT INSTRUCTIONS
     TITLE: CFA COMBID MODEL
     DATA:
          FILE
     IS"C:\finalPathmobility\01datacfacombid.txt";
          TYPE IS CORRELATION;
          NOBSERVATION ARE 100;
     VARIABLE:
          NAMES ARE X1 X2 X3;
          USEVARIABLES ARE X1 X2 X3;
     MODEL:
          COMBID BY X1 X2 X3;
                    X1@0.39;
                    X2@0.38;
                    X3@0.37;
                    X3 WITH X1;
                    X2 WITH X1;
     OUTPUT: SAMPSTAT MODINDICES (0) STANDARDIZED;
```

Printout of final model testing of the CCI

MODEL FIT INFORMATION

Number of Free Parameters	5

Chi-Square Test of Model Fit

Value	1.275
Degrees of Freedom	1
P-Value	0.2588

RMSEA (Root Mean Square Error Of Approximation)

Estimate	0.033

CFI/TLI

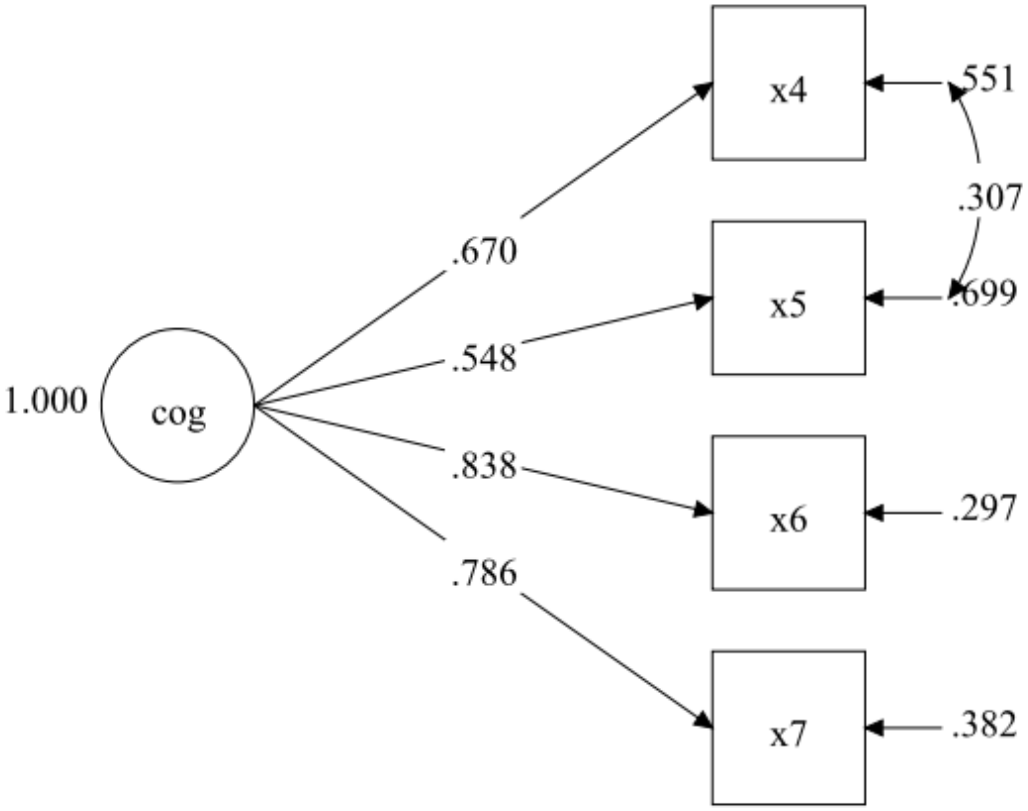
CFI	0.999
TLI	0.996

SRMR (Standardized Root Mean Square Residual)

Value	0.014

APPENDIX H2

The General Practitioner Assessment of Cognition (GPCOG) measurement model



Chi-Square (df = 1) = 1.547, p = .2136, χ^2/df = 1.547, CFI = .999, TLI = .991, RMSEA = .046, SRMR = .010). p < .01

Fit indices of the cognitive function questionnaire

Syntax used for analysis confirmatory factor analysis of the GPCOG

```
INPUT INSTRUCTIONS
     TITLE: CFA COG MODEL
     DATA:
     FILE IS "C:\finalPathmobility\02datacfacog.txt";
          TYPE IS CORRELATION;
          NOBSERVATION ARE 100;
     VARIABLE:
          NAMES ARE X4 X5 X6 X7;
          USEVARIABLES ARE X4 X5 X6 X7;
     ANALYSIS:
          TYPE IS GENERAL;
          ESTIMATOR IS ML;
          ITERATIONS = 1000;
          CONVERGENCE = 0.00005;
     MODEL:
          COG BY X4 X5 X6 X7;
          X5 WITH X4;

     OUTPUT:  SAMPSTAT MODINDICES (0) STANDARDIZED;
```

Printout of final model testing of the GPCOG

MODEL FIT INFORMATION

Number of Free Parameters	9

Chi-Square Test of Model Fit

Value	1.547
Degrees of Freedom	1
P-Value	0.2136

RMSEA (Root Mean Square Error Of Approximation)

Estimate	0.046

CFI/TLI

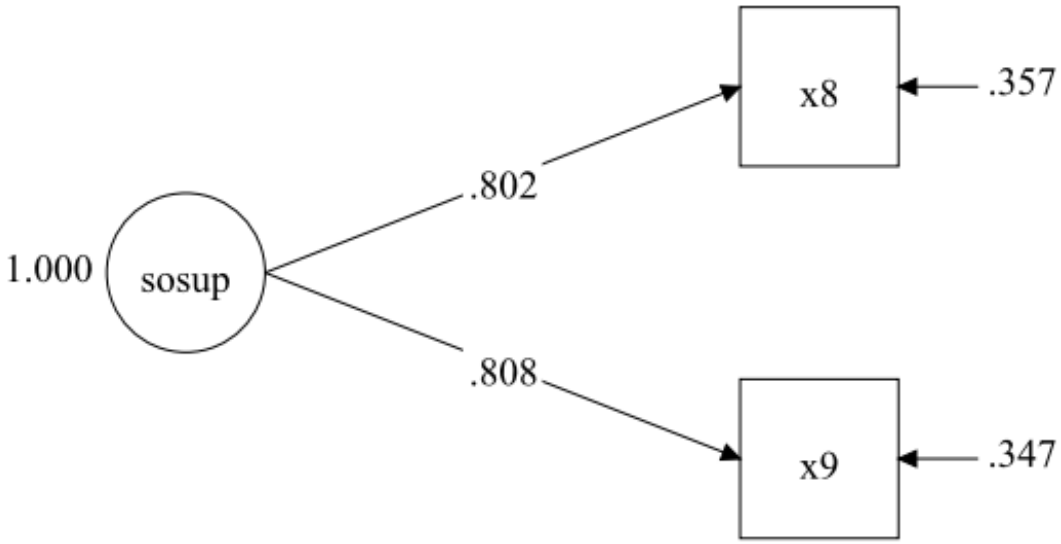
CFI	0.999
TLI	0.991

SRMR (Standardized Root Mean Square Residual)

Value	0.010

APPENDIX H3

Groningen Orthopedic Social Support Scale (GOSSS) measurement model



Chi-Square (df=1) = 1.023; p = 0.3117; χ^2 /df = 1.023; CFI = 1.000; TLI = 1.000; RMSEA = 0.009; and SRMR = 0.016, p < .01 .

Fit indices of the social support questionnaire

Syntax used for analysis confirmatory factor analysis of the GOSSS

```
INPUT INSTRUCTIONS
     TITLE: CFA SOSUP MODEL
     DATA:
          FILE IS
     "C:\finalPathmobility\03datacfasosup.txt";
          TYPE IS CORRELATION;
          NOBSERVATION ARE 100;
     VARIABLE:
          NAMES ARE X8 X9;
          USEVARIABLES ARE X8 X9;
     MODEL:
          SOSUP BY X8 X9;
          X8@0.35;
          X9@0.34;
     OUTPUT: SAMPSTAT MODINDICES (0) STANDARDIZED;
```

Printout of final model testing of the GOSSS

MODEL FIT INFORMATION

Number of Free Parameters	2

Chi-Square Test of Model Fit

Value	1.023
Degrees of Freedom	1
P-Value	0.3117

RMSEA (Root Mean Square Error Of Approximation)

Estimate	0.009

CFI/TLI

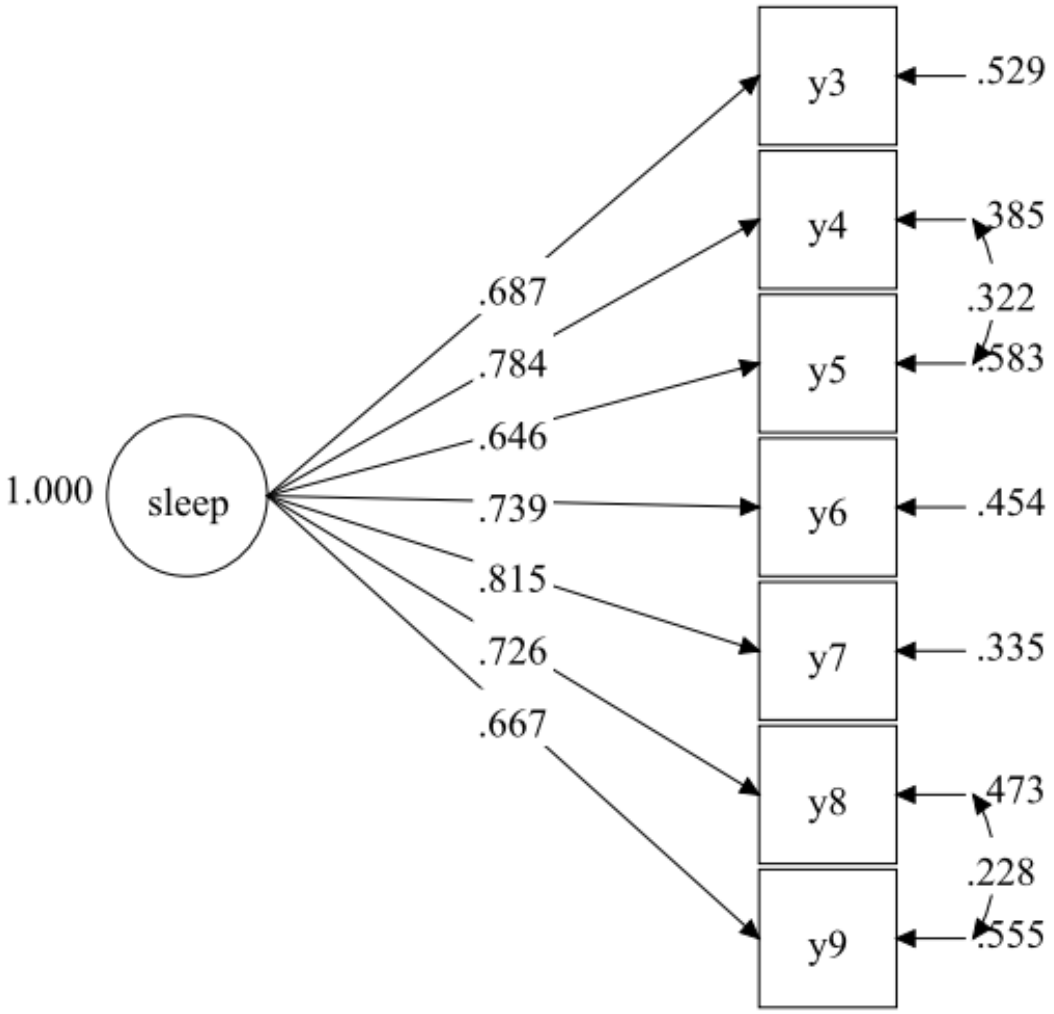
CFI	1.000
TLI	1.000

SRMR (Standardized Root Mean Square Residual)

Value	0.016

APPENDIX H4

The Pittsburgh Sleep Quality Index (PSQI) measurement model



Chi-Square (df = 12) = 17.517, p = .1311; χ^2 /df = 1.459, CFI = .994, TLI = .989, RMSEA = .042, SRMR = .025, p < .01.

Fit indices of the social support questionnaire

Syntax used for analysis confirmatory factor analysis of the PSQI

```
INPUT INSTRUCTION

     TITLE: CFA SLEEP MODEL
     DATA:
          FILE IS
     "C:\finalPathmobility\05datacfasleep.txt";
          TYPE IS CORRELATION;
          NOBSERVATION ARE 100;
     VARIABLE:
          NAMES ARE Y3 Y4 Y5 Y6 Y7 Y8 Y9;
          USEVARIABLES ARE Y3 Y4 Y5 Y6 Y7 Y8 Y9;
     ANALYSIS:
          TYPE IS GENERAL;
          ESTIMATOR IS ML;
          ITERATIONS = 1000;
          CONVERGENCE = 0.00005;
     MODEL:
     SLEEP BY Y3 Y4 Y5 Y6 Y7 Y8 Y9;
     Y5 WITH Y4;
     Y9 WITH Y8;
     OUTPUT: SAMPSTAT MODINDICES (0) STANDARDIZED;
```

Printout of final model testing of the PSQI

MODEL FIT INFORMATION

Number of Free Parameters	16

Chi-Square Test of Model Fit

Value	17.517
Degrees of Freedom	12
P-Value	0.1311

RMSEA (Root Mean Square Error Of Approximation)

Estimate	0.042

CFI/TLI

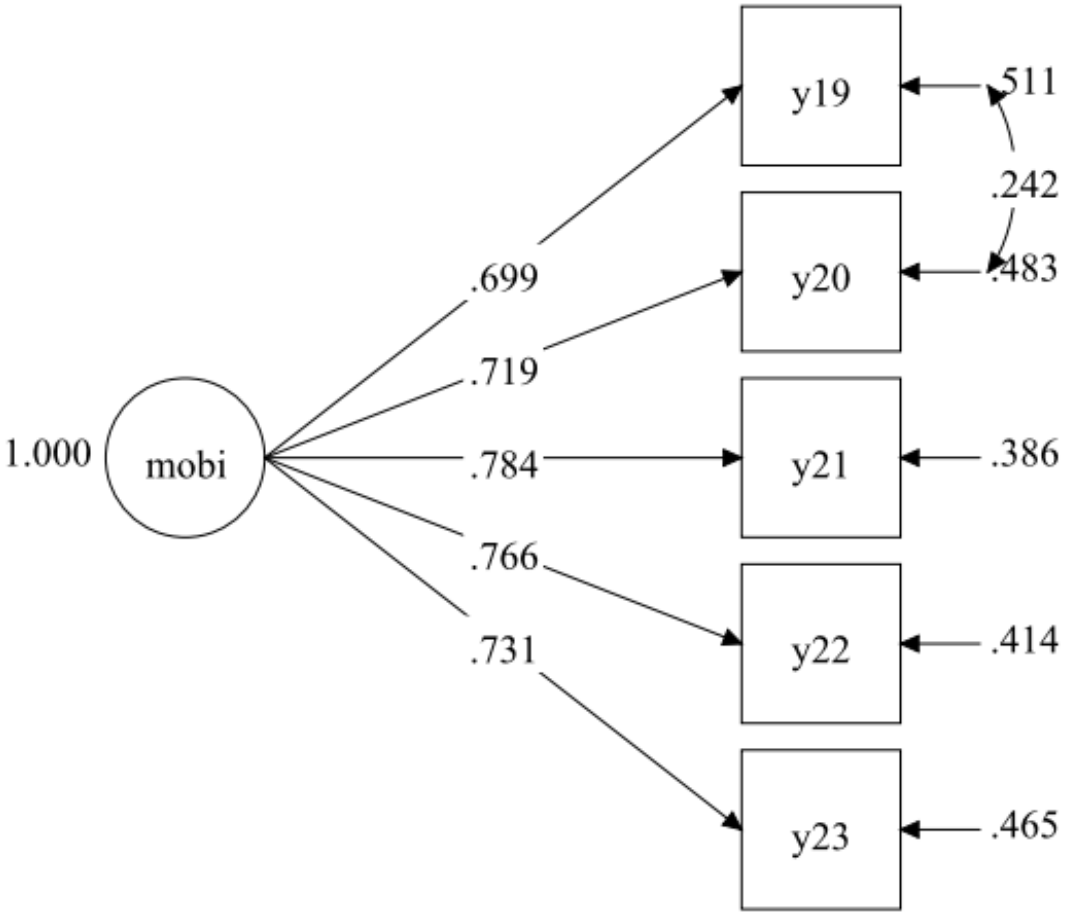
CFI	0.994
TLI	0.989

SRMR (Standardized Root Mean Square Residual)

Value	0.025

APPENDIX H5

de Morton Mobility Index (DEMMI) measurement model



Chi-Square (df = 4) = 5.101, p = 0.277, χ^2 /df = 1.275, CFI = .998, TLI = .995, RMSEA = .033, SRMR = .016, p < .01

Fit indices of the DEMMI

Syntax used for analysis confirmatory factor analysis of the DEMMI

```
INPUT INSTRUCTIONS
          TITLE: CFA MOBI MODEL
     DATA:
          FILE IS
     "C:\finalPathmobility\07datacfamobi.txt";
          TYPE IS CORRELATION;
          NOBSERVATION ARE 100;
     VARIABLE:
          NAMES ARE Y19 Y20 Y21 Y22 Y23;
          USEVARIABLES ARE Y19 Y20 Y21 Y22 Y23;
     ANALYSIS:
          TYPE IS GENERAL;
          ESTIMATOR IS ML;
          ITERATIONS = 1000;
          CONVERGENCE = 0.00005;
     MODEL:
          MOBI BY Y19 Y20 Y21 Y22 Y23;
          Y20 WITH Y19;
     OUTPUT:  SAMPSTAT MODINDICES (0) STANDARDIZED;
```

Printout of final model testing of the DEMMI

MODEL FIT INFORMATION

Number of Free Parameters	11

Chi-Square Test of Model Fit

Value	5.101
Degrees of Freedom	4
P-Value	0.2771

RMSEA (Root Mean Square Error Of Approximation)

Estimate	0.033

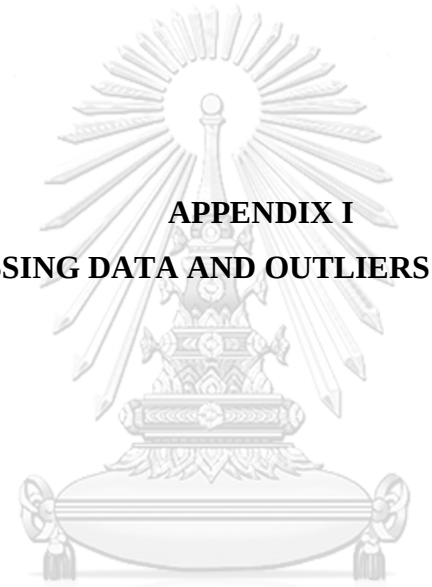
CFI/TLI

CFI	0.998
TLI	0.995

SRMR (Standardized Root Mean Square Residual)

Value	0.016

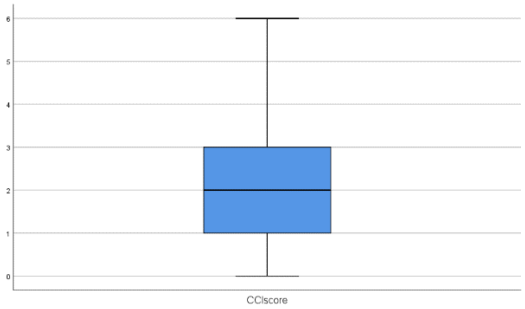
APPENDIX I
MISSING DATA AND OUTLIERS TESTING



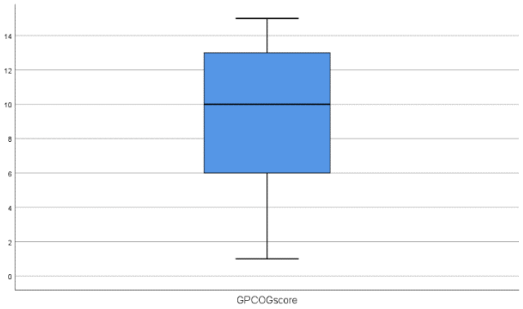
APPENDIX I1: Univariate outlier testing

A box plots

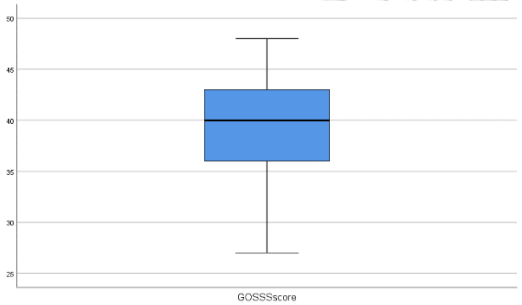
Comorbidity



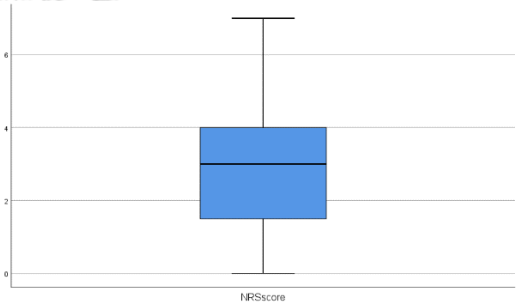
Cognitive function



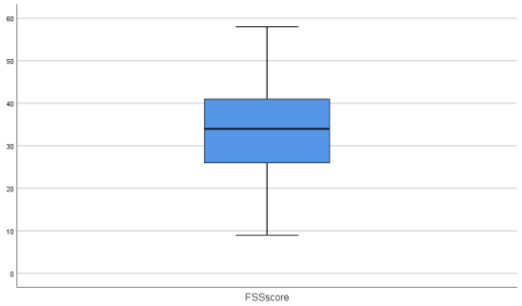
Social support



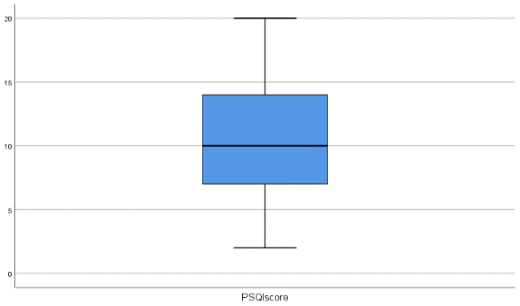
Pain



Fatigue



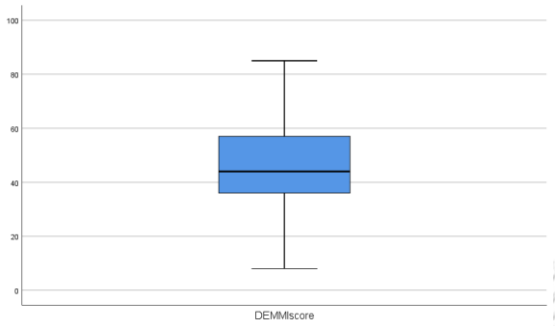
Sleep



APPENDIX I1: Univariate outlier testing

A box plots

Mobility



APPENDIX I2: Multivariate outlier testing

Mahalanobis distance

Multivariate outliers were present wherever the probability values were less than .001. No case had a value of multivariate outlier.

	MAH_1	Probability_MAH_1	var
1	21.14271	.00356	
2	20.32721	.00490	
3	19.20699	.00756	
4	18.79643	.00885	
5	17.58727	.01398	
6	17.43692	.01479	
7	16.45249	.02129	
8	16.33139	.02226	
9	15.91876	.02587	
10	15.64777	.02854	
11	15.27803	.03260	
12	15.26963	.03269	
13	15.21247	.03337	
14	15.19196	.03362	
15	15.02324	.03570	
16	14.90050	.03730	
17	14.66392	.04056	
18	14.43655	.04394	
19	14.21250	.04753	
20	14.05511	.05021	
21	13.80872	.05469	
22	13.68887	.05700	

	MAH_1	Probability_MAH_1	var
23	13.47249	.06140	
24	13.37748	.06343	
25	13.37603	.06346	
26	13.34184	.06420	
27	13.28327	.06550	
28	13.16764	.06813	
29	13.12581	.06910	
30	13.06686	.07050	
31	12.93471	.07372	
32	12.86012	.07559	
33	12.47071	.08610	
34	12.47041	.08611	
35	12.16577	.09524	
36	12.01819	.09996	
37	11.61911	.11380	
38	11.56676	.11574	
39	11.53985	.11674	
40	11.48199	.11893	
41	11.32991	.12486	
42	11.31164	.12559	
43	11.25592	.12784	
44	11.22187	.12923	

	MAH_1	Probability_MAH_1	var
45	11.19722	.13024	
46	11.08803	.13482	
47	11.00546	.13838	
48	10.99412	.13888	
49	10.97034	.13992	
50	10.68572	.15293	
51	10.60780	.15666	
52	10.32673	.17080	
53	10.29316	.17256	
54	10.25661	.17449	
55	10.19417	.17783	
56	9.91768	.19329	
57	9.88667	.19509	
58	9.85040	.19721	
59	9.84932	.19727	
60	9.81725	.19917	
61	9.77798	.20151	
62	9.73132	.20432	
63	9.66774	.20820	
64	9.66693	.20825	
65	9.64846	.20939	
66	9.63608	.21015	

	MAH_1	Probability_MAH_1	var
67	9.62475	.21085	
68	9.58187	.21353	
69	9.57947	.21368	
70	9.38475	.22620	
71	9.31840	.23060	
72	9.30843	.23126	
73	9.24595	.23548	
74	9.17361	.24043	
75	9.15169	.24195	
76	9.14187	.24263	
77	9.14161	.24265	
78	9.05444	.24877	
79	9.00072	.25260	
80	8.99976	.25267	
81	8.98164	.25398	
82	8.96489	.25519	
83	8.95337	.25602	
84	8.95049	.25623	
85	8.93730	.25719	
86	8.91962	.25848	
87	8.89889	.26000	
88	8.89654	.26017	

Mahalanobis distance

	MAH_1	Probability_MAH_1	var
89	8.84772	.26378	
90	8.80357	.26707	
91	8.75520	.27071	
92	8.62490	.28072	
93	8.61809	.28125	
94	8.56126	.28571	
95	8.54308	.28715	
96	8.53459	.28782	
97	8.52251	.28878	
98	8.51132	.28967	
99	8.50533	.29015	
100	8.49099	.29129	
101	8.43300	.29596	
102	8.38689	.29972	
103	8.32707	.30464	
104	8.28937	.30777	
105	8.28185	.30840	
106	8.27573	.30891	
107	8.27219	.30921	
108	8.26778	.30957	
109	8.23958	.31194	
110	8.18740	.31636	

	MAH_1	Probability_MAH_1	var
111	8.14143	.32029	
112	8.11937	.32219	
113	8.10925	.32306	
114	8.09893	.32395	
115	8.08571	.32510	
116	8.03058	.32991	
117	8.00058	.33254	
118	7.94993	.33703	
119	7.92718	.33906	
120	7.90276	.34125	
121	7.84416	.34654	
122	7.75916	.35431	
123	7.67995	.36166	
124	7.58874	.37025	
125	7.54238	.37467	
126	7.54122	.37478	
127	7.52706	.37614	
128	7.51928	.37688	
129	7.47787	.38087	
130	7.41988	.38651	
131	7.38302	.39012	
132	7.35728	.39265	

	MAH_1	Probability_MAH_1	var
133	7.34156	.39420	
134	7.25680	.40264	
135	7.24619	.40370	
136	7.24224	.40410	
137	7.20362	.40799	
138	7.19453	.40891	
139	7.19394	.40897	
140	7.18561	.40981	
141	7.18218	.41016	
142	7.17345	.41105	
143	7.16474	.41193	
144	7.15650	.41277	
145	7.12996	.41547	
146	7.12375	.41611	
147	6.98165	.43079	
148	6.94373	.43476	
149	6.86426	.44315	
150	6.86136	.44346	
151	6.83309	.44646	
152	6.81934	.44793	
153	6.74980	.45539	
154	6.70251	.46050	

	MAH_1	Probability_MAH_1	var
155	6.68995	.46186	
156	6.67391	.46360	
157	6.61664	.46985	
158	6.61469	.47007	
159	6.53705	.47862	
160	6.47573	.48542	
161	6.43921	.48950	
162	6.40068	.49382	
163	6.31824	.50312	
164	6.30797	.50428	
165	6.24987	.51089	
166	6.22724	.51348	
167	6.22638	.51358	
168	6.21397	.51500	
169	6.19399	.51729	
170	6.17535	.51943	
171	6.12081	.52572	
172	6.11793	.52605	
173	6.08121	.53030	
174	6.07366	.53118	
175	6.07147	.53143	
176	6.06803	.53183	

Mahalanobis distance

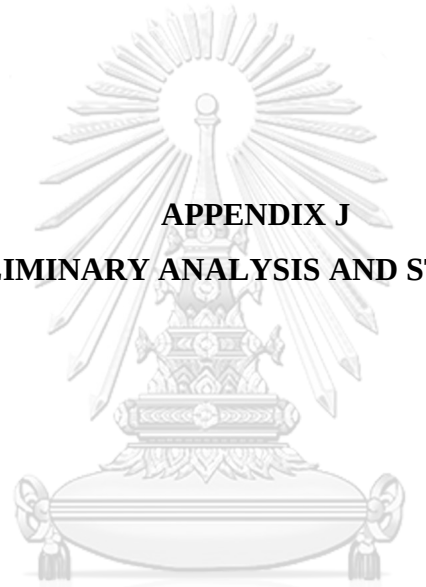
	MAH_1	Probability_MAH_1	var
177	5.99871	.53990	
178	5.99113	.54079	
179	5.90634	.55073	
180	5.90445	.55095	
181	5.89782	.55173	
182	5.73464	.57105	
183	5.72302	.57244	
184	5.71865	.57296	
185	5.71729	.57312	
186	5.70454	.57464	
187	5.68916	.57648	
188	5.68083	.57747	
189	5.67140	.57860	
190	5.66851	.57894	
191	5.65170	.58095	
192	5.54364	.59393	
193	5.44609	.60569	
194	5.34591	.61783	
195	5.34555	.61787	
196	5.27660	.62625	
197	5.25082	.62938	
198	5.19517	.63616	

	MAH_1	Probability_MAH_1	var
199	5.18313	.63763	
200	5.15178	.64145	
201	5.08396	.64972	
202	4.96825	.66384	
203	4.95182	.66584	
204	4.95000	.66606	
205	4.89325	.67299	
206	4.86902	.67594	
207	4.86805	.67606	
208	4.86783	.67609	
209	4.81040	.68309	
210	4.80405	.68386	
211	4.80105	.68423	
212	4.78481	.68621	
213	4.71558	.69463	
214	4.69778	.69679	
215	4.67157	.69997	
216	4.63650	.70422	
217	4.63023	.70498	
218	4.61955	.70628	
219	4.59920	.70874	
220	4.57995	.71107	

	MAH_1	Probability_MAH_1	var
223	4.51447	.71897	
224	4.45557	.72606	
225	4.36729	.73663	
226	4.33369	.74064	
227	4.32589	.74157	
228	4.32411	.74178	
229	4.28161	.74683	
230	4.23366	.75251	
231	4.22455	.75358	
232	4.16533	.76055	
233	4.14897	.76247	
234	4.10356	.76778	
235	4.06355	.77243	
236	4.04301	.77481	
237	4.02234	.77720	
238	3.76405	.80652	
239	3.73778	.80944	
240	3.47260	.83812	
241	3.45126	.84036	
242	3.37806	.84797	
243	3.30806	.85512	
244	3.26769	.85918	

	MAH_1	Probability_MAH_1	var
245	3.24353	.86160	
246	3.20797	.86512	
247	3.06512	.87891	
248	3.05650	.87973	
249	2.91393	.89285	
250	2.71284	.91024	
251	2.66213	.91440	
252	2.61334	.91832	
253	2.56794	.92189	
254	2.35451	.93765	
255	2.26636	.94364	
256	2.18794	.94871	
257	2.09218	.95456	
258	1.74037	.97281	
259	1.62963	.97748	
260	1.40759	.98534	
261			

APPENDIX J
PRELIMINARY ANALYSIS AND STATISTICS



In the period of preliminary analysis, before the path analysis was performed, assumptions of path analysis testing were conducted to ensure no violation of the underlying assumption. The assumption for path analysis has two parts first is a logical assumption, and the second is a statistical assumption.

Logical assumption for path analysis

The logical assumptions for path analysis were as follows (Shanthi, 2019; p 408**)**

Assumption 1: All relations are linear. The causal assumptions (what causes what) are shown in the path diagram.

A linear relationship is a straight-line relationship between two variables (Tabachnick & Fidell, 2013). A linear relationship is one where increasing or decreasing one variable n times will cause a corresponding increase or decrease of n times in the other variable. Linearity is essential and can be expressed in a graphical format where the variable and the constant are connected via a straight line or in a mathematical format where the independent variable is multiplied by the slope coefficient and added by a constant, which determines the dependent variable.

Assumption 2: The causal flow is one-way. Logic, theory, and assumptions determine the direction of arrows. If the researcher is using cross-section data, then the researcher needs ‘logical’ (i.e., an argument) and theoretical (i.e., some larger body of assumptions and knowledge which specifies relationships between variables) basis for choosing which variables are independent (i.e., purely causal), which are mediating (i.e., are both causes and effects of other variables), and which are dependent (purely outcomes). However, it is often difficult to meet the assumptions in social scientific research, recursively or unidirectional causal flow. The path model has to assume that

each variable is an exact manifestation of the theoretical concepts underlying them and reasonably (Shanthi, 2019).

The conceptual framework of the current study was based on the TOUS theory and literature review. From the conceptual framework proposed, path analysis's direct and indirect effects are as follows:

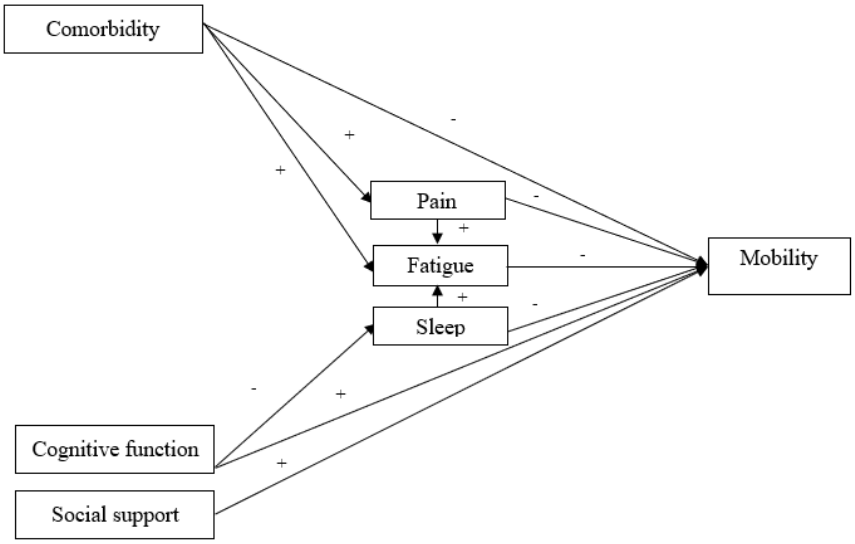


Diagram 1 The hypothesized model (all potential relationships)

Assumption 3: The variables are measured on interval scales or better. Variables of the current study are measured on interval scale or ratio scale.

Assumption 4: The variables are measured without error (perfect reliability).

The most common or frequent measurement error occurs due to measurement attenuation. Essentially, attenuated measurement occurs when a measure's reliability is less than perfect. A perfect reliability would be a value of 1.00, indicating that no matter how much something is measured (assuming no change), the same value becomes indicated (Allen, 2017). Since all tests have some error, reliability coefficients never reach 1.0. Generally, if the reliability of a standardized test is 0.6-0.7 indicates an

acceptable level of reliability, and above .80, it is said to have very good reliability (Hulin et al., 2001).

Table 1: Reliability of the measurements

Measurements	30 cases	260 cases
Charlson's Comorbidity Index	Inter-rater = 0.96 (0.948-0.988)	-
The General Practitioner Assessment of Cognition	Kuder-Richardson (KR 20) = 0.86	Kuder-Richardson (KR 20) = 0.88
The Groningen Orthopedic Social Support Scale	Cronbach's alpha = 0.85	Cronbach's alpha = 0.87
The Numeric Rating Scale	Test-retest = 0.89	-
Pain frequency	Test-retest = 0.90	
The Fatigue Severity Scale	Cronbach's alpha = 0.82	Cronbach's alpha = 0.88
The Pittsburgh Sleep Quality Index	Cronbach's alpha = 0.82	Cronbach's alpha = 0.84
The de Morton Mobility Index	Inter-rater = 0.96 (0.911-0.980)	-

Statistical assumptions for path analysis

In the period of preliminary analysis, assumptions of path analysis testing were conducted to ensure no violation of the underlying assumption. According to Hair, Black, Babin, and Anderson (2019, p 93). In this study the multivariate analysis assumptions included normality, and multicollinearity testing. This section presents the assessment of statistic assumptions before path analysis.

Normality testing

In the current study, skewness and kurtosis values were used to test the normal distribution of the data. Regarding Hair (2019, p 96) stated that the skewness and

kurtosis values were above ± 2.58 (.01 significance level) and ±1.96 (.05 significance level), indicating non-normal distributions. Moreover, Acceptable values of skewness fall between -3 and +3, and kurtosis is appropriate from a range of -10 to +10 when utilizing SEM (Griffin & Steinbrecher, 2013, p 176). In this study, the skewness and kurtosis of mobility were analyzed. The skewness value of mobility was found in the positive zone as .51. The kurtosis value of mobility was also found in the positive zone as .09.

For other studied variables, the score distribution for the comorbidity was close to normal. The skewness value of this variable was .71. The kurtosis value was -.14. The score distribution for the cognitive function was close to normal since the skewness value of this variable was .16. The kurtosis value was -1.21. The score distribution for the social support was close to normal since the skewness value of this variable was -.30. The kurtosis value was -.27. The score distribution for the pain was close to normal since the skewness value of this variable was .12. The kurtosis value was -.78. The score distribution for the fatigue was close to normal since the skewness value of this variable was -.16. The kurtosis value was -.53. Finally, the score distribution for the sleep was close to normal since the skewness value of this variable was .14. The kurtosis value was -1.01.

These values indicate that data does not remarkably depart from a normal distribution. There is efficient evidence about the reasonable satisfaction of the normality assumption. The summary of path analysis assumption testing is shown in Table 1.

Table 2: Descriptive statistics for the major studied variables (N = 260)

Variables	Min	Max	$\bar{x}$	SD	CV	Sk	Ku
Mobility	8.00	85.00	47.51	15.63	244.24	0.51	0.09
Comorbidity	0.00	6.00	2.15	1.67	2.78	0.71	-0.14
Cognitive function	1.00	9.00	5.17	2.37	5.62	0.16	-1.21
Social support	27.00	48.00	39.22	4.80	22.99	-0.30	-0.27
Pain	0.00	7.00	2.74	1.87	3.49	0.12	-0.78
Fatigue	9.00	58.00	33.39	10.68	114.07	-0.16	-0.53
Sleep	2.00	20.00	10.12	4.41	19.44	0.14	-1.01

Abbreviations: Min = Minimum, Max = Maximum, SD = Standard deviation, CV = Coefficient of variation, Sk = Skewness, Ku = Kurtosis

Multicollinearity testing

Multicollinearity is defined as the interrelatedness of the independent variables. It is believed that the high correlations among variables would evaluate statistical results problematic.

Convergent validity and discriminant validity involve the evaluation of measures against each other. Variables presumed to measure the same construct show convergent validity if their intercorrelations are appreciable in magnitude. Discriminant validity is supported if the intercorrelations among a set of variables presumed to measure different constructs are not too high (Kline et al., 2016).

Convergent validity is assessed by estimating the mean of the extracted variance (AVE), which indicates the amount of variance shared by the items that make up the constructs. The AVE values of all constructs are above the minimum acceptable value

of 0.50. In addition, standardized loading estimates should be .5 or higher, and ideally, .7 or higher, as recommended by Hair et al. (2019).

The discriminant validity of the measurement model, in turn, is used to assess how distinct a latent construct is from other constructs. In order to fulfill the discriminant validity condition, the square root of the AVE values of each construct must be superior to the other correlations (Hair et al., 2019). In this study shows that all constructs are statistically different from the others, as they have a square root of AVE higher than the correlation of variables. The correlation of variables ranged from -.148 to .603 among the seven major variables.

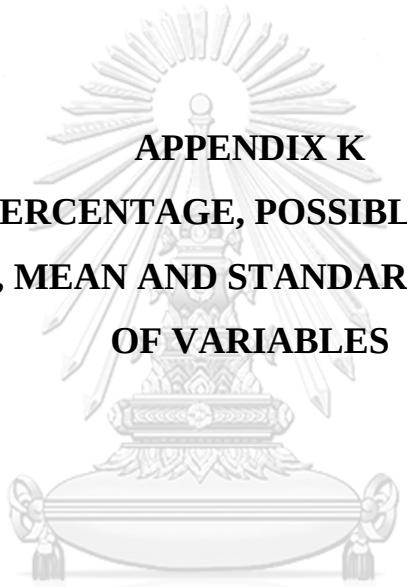
The confirmatory factor analysis (CFA) technique was conducted to assess the research model's reliability and validity. According to Hair et al. (2019), the reliability measures of the constructs used in this study are Composite Reliability (CR), The minimum value for these five measurements is 0.70, but not above 0.95. Table 2 shows that all constructs have an adequate level.

Table 3: Reliability, multicollinearity, and convergent validity.

Variables	Indicators	loading	AVE	CR	DV
Comorbidity	X1	0.607	0.42	0.70	0.65
	X2	0.716			
	X2	0.623			
Cognitive function	X4	0.736	0.53	0.82	0.73
	X5	0.664			
	X6	0.736			
	X7	0.770			
Social support	X8	0.807	0.62	0.76	0.79
	X9	0.766			
Sleep quality	Y3	0.724	0.53	0.89	0.73
	Y4	0.759			
	Y5	0.628			
	Y6	0.736			
	Y7	0.809			
	Y8	0.729			
	Y9	0.722			
Mobility	Y19	0.640	0.59	0.88	0.77
	Y20	0.654			
	Y21	0.818			
	Y22	0.875			
	Y23	0.818			

Notes: AVE: average variance extracted; CR: composite reliability; DV: discriminant validity

APPENDIX K
FREQUENCY, PERCENTAGE, POSSIBLE RANGES, ACTUAL RANGES, MEAN AND STANDARD DEVIATION OF VARIABLES



APPENDIX K1

Comorbidity

Table 1: Frequency and percentage of Charlson Comorbidity of the study participants (N = 260)

Charlson Comorbidity items	n	%
Charlson comorbidity score 6		
Metastasis solid tumor	7	2.7
AIDS	1	0.4
Charlson comorbidity score 3		
Moderate or severe liver disease	5	1.9
Charlson comorbidity score 2		
Renal disease	46	17.7
Diabetes with chronic complication	10	3.8
Skin ulcer/Cellulitis	7	2.7
Hemiplegia	4	1.5
Any malignancy Leukemia & lymphoma	1	0.4
Charlson comorbidity score 1		
Hypertension	187	71.9
Diabetes without chronic complication	92	35.4
Cerebrovascular disease	19	7.3
Chronic pulmonary disease	16	6.2
Congestive heart failure	14	5.4
Peptic ulcer disease	9	3.5
Peripheral vascular disease	8	3.1
Depression	7	2.7
Warfarin	5	1.9
Myocardial infarction	2	0.8
Rheumatologic disease	2	0.8
Mild liver disease	1	0.4
Dementia	0	0

Note: One patient may have more than one disease.

Table 2: Frequency and percentage of others diseases of the study participants (N = 260)

Others diseases	n	%
Dyslipidemia	65	25
Chronic anemia	19	7.3
Atrial Fibrillation	12	4.6
COVID 19	10	3.8
Parkinson	7	2.7
Benign prostatic hyperplasia	6	2.3
Hypothyroidism	4	1.5
Hyperparathyroidism	4	1.5
Hyperthyroidism	3	1.2
Systemic lupus erythematosus	2	0.8
Thalassemia	2	0.8
Vitamin D deficiency	2	0.8
Bradycardia	1	0.4
Atrioventricular block	1	0.4
Palpitation	1	0.4
Atherosclerosis	1	0.4
Old Tuberculosis	1	0.4
Bladder dysfunction	1	0.4
G6PD	1	0.4

Note: One patient may have more than one disease.

Table 3: Frequency and percentage of musculoskeletal diseases of the study participants
(N = 260)

Musculoskeletal diseases	n	%
Osteoporosis	47	18.1
Osteoarthritis knee	21	8.1
Spinal stenosis	21	8.1
Gout	6	2.3
Arthritis	2	0.8
Cervical spondylosis myelopathy	1	0.4

Note: One patient may have more than one disease.

APPENDIX K2

Cognitive function

Table 4: Frequency and percentage of nine questions of the GPCOG patient section (N = 260)

GPCOG patient section items	Correct n (%)	Incorrect n (%)
Time orientation (date)		
- What is the date?	191 (73.5)	69 (26.5)
Visuospatial skills (clock-drawing test)		
- Please mark in all the numbers to indicate the hours of a clock (correct spacing required)	84 (32.3)	176 (67.7)
- Please mark in hands to show 10 minutes past eleven o'clock (11:10)	90 (34.6)	170 (65.4)
Information		
- Can you tell me something that happened in the news recently?	209 (80.4)	51 (19.6)
Recall (name and address)		
- Name	253 (97.3)	7 (2.7)
- Surname	195 (75)	65 (25)
- House number	81 (31.2)	179 (68.8)
- Road name	68 (26.2)	192 (73.8)
- Province	173 (66.5)	87 (33.5)

Table 5: Frequency and percentage of six questions of the GPCOG informant section (N = 260)

GPCOG informant section items	Correct n (%)	Incorrect n (%)
1. Does the patient have more trouble remembering things that have happened recently?	160 (61.5)	100 (38.5)
2. Does he or she have more trouble recalling conversations a few days later?	205 (78.8)	55 (21.2)
3. When speaking, does the patient have more difficulty in finding the right word or tend to use the wrong words more often?	247 (95)	13 (5)
4. Is the patient less able to manage money and financial affairs (e.g., paying bills, budgeting)?	214 (82.3)	46 (17.7)
5. Is the patient less able to manage his or her medication independently?	165 (63.5)	95 (36.5)
6. Does the patient need more assistance with transport?	128 (49.2)	132 (50.8)

APPENDIX K3

Social support

The mean score in the perceived social support dimension, the highest support in the perception of the participants was “my friends and family are there for me when I am sick” ($\bar{x}$ = 3.59, SD = 0.54), followed by “my friends and family are prepared to help me with making decisions” ($\bar{x}$ = 3.51, SD = 0.54), and “my friends and family are there for me when I need them” ($\bar{x}$ = 3.48, SD = 0.59), respectively. Besides the average mean score in the instrumental support dimension of social support, the highest support in the perception of the participants was “my friends and family provide transportation for me” ($\bar{x}$ = 3.67, SD = 0.57), followed by “my friends and family help me to do household chores” ($\bar{x}$ = 3.66, SD = 0.56), and “my friends and family do my shopping” ($\bar{x}$ = 3.63, SD = 0.56), respectively. The results of social support among the participants were summarized in Appendix I4.

Table 6: Possible range, actual range, mean, and standard deviation of items of GOSSS (N = 260)

GOSSS items	Possible range	Actual range	Mean	SD
Perceived Social Support score				
- My friends and family understand me	1-4	2-4	3.19	0.62
- I do feel listened to by my friends and family	1-4	2-4	3.08	0.67
- My friends and family are there for me when I am sick	1-4	2-4	3.59	0.54
- I can talk with my friends and family about my deepest problems	1-4	1-4	2.76	0.71
- My friends and family are there for me	1-4	2-4	3.48	0.59

GOSSS items	Possible range	Actual range	Mean	SD
when I need them				
- I can share happiness and sorrow with my friends and family	1-4	2-4	3.03	0.67
- My friends and family are prepared to help me with making decisions	1-4	2-4	3.51	0.54
Instrumental Support score				
- My friends and family help me with my exercises	1-4	1-4	2.04	0.88
- My friends and family provide meals for me	1-4	1-4	3.59	0.61
- My friends and family do my shopping	1-4	2-4	3.63	0.56
- My friends and family provide transportation for me	1-4	1-4	3.67	0.57
- My friends and family help me to do household chores	1-4	1-4	3.66	0.56

APPENDIX K4

Pain

According to the pain location, the most pain location was hip (38 %, n = 99), followed by knee pain (23.5 %) and back pain (7.3 %).

Table 7: Frequency and percentage of pain location of the study participants (N = 260)

Pain location	n	%
Hip	99	38
Knee	61	23.5
Back	19	7.3
Leg	8	3.1
Shoulder	6	2.3
Arm	6	2.3
Thigh	6	2.3
Ankle	5	1.9
Body	4	1.5
Neck	1	0.4
Hand and finger	1	0.4
Waist	1	0.4

Note: one patient may have more than one pain location

APPENDIX K5

Fatigue

Fatigue symptoms items showed the items that indicate the participants' fatigue symptoms are "exercise brings on my fatigue" ($\bar{x}$ = 4.56, SD = 1.79), "fatigue causes a frequent problem for me such as mobility" ($\bar{x}$ = 4.35, SD = 1.75), "fatigue interferes with carrying out certain duties and responsibilities such as mobility" ($\bar{x}$ = 4.34, SD = 1.81) and "fatigue interferes with my work, family or social life" ($\bar{x}$ = 4.17, SD 1.13)

Table 8: Possible range, actual range, mean, and standard deviation of items of FSS (N = 260)

	FSS items	Possible range	Actual range	Mean	SD
a.	My motivation is lower when I am fatigued	1-7	1-7	3.31	1.50
b.	Exercise brings on my fatigue	1-7	1-7	4.56	1.79
c.	I am easily fatigued	1-7	1-7	3.10	1.49
d.	Fatigue interfere with my physical functioning	1-7	1-7	3.23	1.64
e.	Fatigue causes frequent problem for me	1-7	1-7	4.35	1.75
f.	My fatigue prevents sustained physical functioning	1-7	1-7	3.22	1.41
g.	Fatigue interferes with carrying out certain duties and responsibilities	1-7	1-7	4.34	1.81

	FSS items	Possible range	Actual range	Mean	SD
h.	Fatigue is among my three most disabling symptom	1-7	1-7	3.14	1.53
i.	Fatigue interferes with my work, family or social life	1-7	1-7	4.17	1.83

APPENDIX K6

Sleep quality

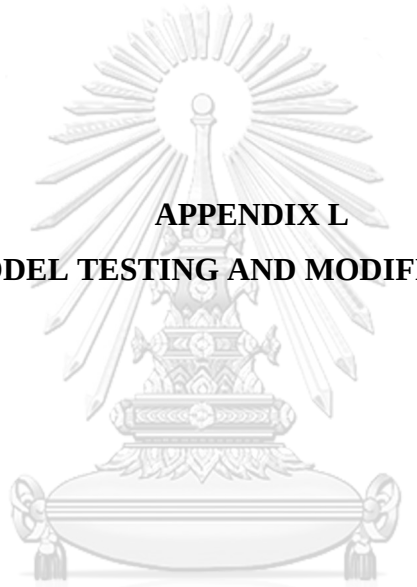
Table 9: Frequency and percentage of PSQI (N = 260)

PSQI items	Very good	Fairly good	Fairly bad	Very bad
1. During the past month, what time have you usually gone to bed at night?				
2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?	< 15 minutes 81 (31.2%)	16-30 minutes 121 (46.5%)	31-60 minutes 54 (20.8%)	> 60 minutes 4 (1.5%)
3. During the past month, what time have you usually gotten up in the morning?				
4. During the past month, how many hours of actual sleep did you get at night?	$\bar{x}$ = 5.72 hours, SD = 1.20, Min = 3, Max = 8.5			
5. During the past month, how often have you had trouble sleeping because you…	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
a. Cannot get to sleep within 30 minutes	33 (12.7%)	49 (18.8%)	97 (37.3%)	81 (31.2%)
b. Wake up in the middle of the night or early morning	6 (2.3%)	34 (13.1%)	85 (32.7%)	135 (51.9%)
c. Have to get up to use the bathroom	18 (6.9%)	36 (13.9%)	90 (34.6%)	116 (44.6%)
d. Cannot breathe comfortably	239 (91.9%)	10 (3.9%)	7 (2.7%)	4 (1.5%)
e. Cough or snore loudly	162 (62.3%)	31 (11.9%)	34 (13.1%)	33 (12.7%)

PSQI items	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
f. Feel too cold	215 (82.7%)	23 (8.8%)	19 (7.3%)	3 (1.2%)
g. Feel too hot	244 (93.9%)	11 (4.2%)	4 (1.5%)	1 (0.4%)
h. Bad dreams	232 (89.2%)	21 (8.1%)	5 (1.9%)	2 (0.8%)
i. Have pain	164 (63.1%)	30 (11.5%)	33 (12.7%)	33 (12.7%)
j. Others	220 (84.6%)	13 (5.0%)	18 (6.9%)	9 (3.5%)
	very good	fairly good	fairly bad	very bad
6. During the past month, how would you rate your sleep quality overall?	5 (1.9%)	137 (52.7%)	111 (42.7%)	7 (2.7%)
	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
7. During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?	161 (61.9%)	6 (2.3%)	42 (16.2)	51 (19.6%)
8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?	47 (18.1%)	95 (36.5%)	79 (30.4%)	39 (15.0%)
9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?	93 (35.8%)	92 (35.4%)	69 (26.5%)	6 (2.3%)

PSQI items	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
10. If you have a roommate or bed partner, ask him/her how often in the past month you have had:				
a. Loud snoring	209 (80.4%)	13 (5%)	11 (4.2%)	2.7 (10.4%)
b. Long pauses between breaths while asleep	259 (99.6%)	1 (0.4%)	0	0
c. Legs twitching or jerking while you sleep	254 (97.7%)	3 (1.15%)	3 (1.15%)	0
d. Episodes of disorientation or confusion during sleep	217 (83.5%)	15 (5.8%)	14 (5.4%)	14 (5.4%)

APPENDIX L
MODEL TESTING AND MODIFICATION



APPENDIX L1

Fit indices of the initial mobility model

Syntax used for analyzing

```
INPUT INSTRUCTIONS

      TITLE:  MOBILITY MODEL
      DATA:
            FILE IS "C:\finalPathmobility\dataall.txt";
            TYPE IS CORRELATION;
            NGROUPS = 1;
            NOBSERVATIONS = 260;
      VARIABLE:
            NAMES ARE X1 X2 X3 X4 X5 X6 X7 X8 X9 Y1 Y2 Y3 Y4 Y5 Y6 Y7
Y8 Y9 Y10 Y11 Y12 Y13 Y14 Y15 Y16 Y17 Y18 Y19 Y20 Y21 Y22 Y23;
      USEVARIABLES ARE X1 X2 X3 X4 X5 X6 X7 X8 X9 Y1 Y2 Y3 Y4 Y5 Y6
Y7 Y8 Y9    Y10 Y11 Y12 Y13 Y14 Y15 Y16 Y17 Y18 Y19 Y20 Y21 Y22 Y23;
      ANALYSIS:
            TYPE IS GENERAL;
            ESTIMATOR IS ML;
            ITERATIONS = 1000;
            CONVERGENCE = 0.00005;
      MODEL:
            COMBID by X1 X2 X3;
            COG by X4 X5 X6 X7;
            SOSUP by X8 X9;
            PAIN by Y1 Y2;
            SLEEP by Y3 Y4 Y5 Y6 Y7 Y8 Y9;
            FATIG by Y10 Y11 Y12 Y13 Y14 Y15 Y16 Y17 Y18;
            MOBI by Y19 Y20 Y21 Y22 Y23;
            PAIN on COMBID;
            SLEEP on COG;
            FATIG on COMBID PAIN SLEEP;
            MOBI on COMBID COG SOSUP PAIN SLEEP FATIG;
            OUTPUT:  SAMPSTAT MODINDICES (0) STANDARDIZED;
```

Printout of initial model testing of mobility

```
MODEL FIT INFORMATION
Number of Free Parameters
78
Loglikelihood
        H0 Value                          -9087.747
        H1 Value                          -8309.087

Information Criteria
          Akaike (AIC)                    18331.495
          Bayesian (BIC)                   18609.228
          Sample-Size Adjusted BIC         18361.937
            (n* = (n + 2) / 24)

Chi-Square Test of Model Fit
          Value                             1557.321
          Degrees of Freedom                     450
          P-Value                             0.0000

RMSEA (Root Mean Square Error Of Approximation)
          Estimate                               0.097
          90 Percent C.I.                0.092  0.103
          Probability RMSEA <= .05               0.000

CFI/TLI
          CFI                                    0.829
          TLI                                    0.811

Chi-Square Test of Model Fit for the Baseline
Model
          Value                             6960.902
          Degrees of Freedom                     496
          P-Value                             0.0000

SRMR (Standardized Root Mean Square Residual)
          Value                                  0.051
```

APPENDIX L2

Fit indices of the modified mobility model

Syntax used for analyzing

```
INPUT INSTRUCTIONS
      TITLE:  MOBILITY MODEL
      DATA:
            FILE IS "C:\finalPathmobility\dataall.txt";
            TYPE IS CORRELATION;
            NGROUPS = 1;
            NOBSERVATIONS = 260;
      VARIABLE:
            NAMES ARE X1 X2 X3 X4 X5 X6 X7 X8 X9 Y1 Y2 Y3 Y4 Y5 Y6 Y7
Y8 Y9 Y10 Y11 Y12 Y13 Y14 Y15 Y16 Y17 Y18 Y19 Y20 Y21 Y22 Y23;
      USEVARIABLES ARE X1 X2 X3 X4 X5 X6 X7 X8 X9 Y1 Y2 Y3 Y4 Y5 Y6
Y7 Y8 Y9    Y10 Y11 Y12 Y13 Y14 Y15 Y16 Y17 Y18 Y19 Y20 Y21 Y22 Y23;
      ANALYSIS:
            TYPE IS GENERAL;
            ESTIMATOR IS ML;
            ITERATIONS = 1000;
            CONVERGENCE = 0.00005;
      MODEL:
            COMBID by X1 X2 X3;
            COG by X4 X5 X6 X7;
            SOSUP by X8 X9;
            PAIN by Y1 Y2;
            SLEEP by Y3 Y4 Y5 Y6 Y7 Y8 Y9;
            FATIG by Y10 Y11 Y12 Y13 Y14 Y15 Y16 Y17 Y18;
            MOBI by Y19 Y20 Y21 Y22 Y23;
            PAIN on COMBID;
            SLEEP on COG;
            FATIG on COMBID PAIN SLEEP;
            MOBI on COMBID COG SOSUP PAIN SLEEP FATIG;
            Y20 WITH Y19;
            Y5 WITH Y4;
            Y23 WITH Y22;
            Y17 WITH Y16;
            Y23 WITH Y8;
            Y22 WITH Y5;
            Y22 WITH Y21;
            Y16 WITH Y15;
            Y7 WITH Y3;
            Y4 WITH Y2;
            Y23 WITH Y21;
            Y23 WITH Y18;
            Y17 WITH Y15;
            Y14 WITH Y12;
            X4 WITH X3;
            X7 WITH X6;
            X5 WITH X1;
            X7 WITH X2;
            X2 WITH X1;
            X3 WITH X2;
            X6 WITH X4;
            Y14 WITH Y3;
```

```
Y17 WITH Y13;
X9 WITH X5;
Y14 WITH Y10;
Y23 WITH X2;
Y22 WITH X6;
Y22 WITH X8;
Y22 WITH X4;
Y21 WITH X6;
Y22 WITH X5;
Y21 WITH X5;
Y7 WITH X1;
Y21 WITH X2;
Y17 WITH X5;
Y1 WITH X7;
Y11 WITH Y1;
Y20 WITH Y18;
Y14 WITH X3;
Y3 WITH X8;
Y19 WITH Y18;
Y11 WITH X4;
Y5 WITH X2;
X4 WITH X2;
Y7 WITH X4;
Y10 WITH X4;
Y7 WITH X3;
Y8 WITH X1;
Y22 WITH Y6;
Y17 WITH Y14;
Y10 WITH Y8;
Y20 WITH X1;
Y20 WITH Y9;
Y9 WITH Y6;
Y14 WITH Y8;
Y19 WITH Y15;
Y17 WITH Y8;
Y8 WITH X5;
Y9 WITH X8;
```

Printout of modified model testing of mobility

MODEL FIT INFORMATION

Number of Free Parameters	137	
Loglikelihood		
H0 Value	-8564.204	
H1 Value	-8309.087	
Chi-Square Test of Model Fit		
Value	510.233	
Degrees of Freedom	391	
P-Value	0.0000	
RMSEA (Root Mean Square Error Of Approximation)		
Estimate	0.034	
90 Percent C.I.	0.025	0.042
Probability RMSEA <= .05	1.000	
CFI/TLI		
CFI	0.982	
TLI	0.977	
Chi-Square Test of Model Fit for the Baseline Model		
Value	6960.902	
Degrees of Freedom	496	
P-Value	0.0000	
SRMR (Standardized Root Mean Square Residual)		
Value	0.043	

APPENDIX L3
Fit indices of the final mobility model

Syntax used for analyzing

```
INPUT INSTRUCTIONS
TITLE:  MOBILITY MODEL
      DATA: FILE IS "C:\finalPathmobility\dataall.txt";
            TYPE IS CORRELATION;
            NGROUPS = 1;
            NOBSERVATIONS = 260;
      VARIABLE:
            NAMES ARE X1 X2 X3 X4 X5 X6 X7 X8 X9 Y1 Y2 Y3 Y4 Y5 Y6 Y7
Y8 Y9 Y10 Y11 Y12 Y13 Y14 Y15 Y16 Y17 Y18 Y19 Y20 Y21 Y22 Y23;
      USEVARIABLES ARE X1 X2 X3 X4 X5 X6 X7 X8 X9 Y1 Y2 Y3 Y4 Y5 Y6
Y7 Y8 Y9    Y10 Y11 Y12 Y13 Y14 Y15 Y16 Y17 Y18 Y19 Y20 Y21 Y22 Y23;
      ANALYSIS:
            TYPE IS GENERAL;
            ESTIMATOR IS ML;
            ITERATIONS = 1000;
            CONVERGENCE = 0.00005;
      MODEL:
            COMBID by X1 X2 X3;
            COG by X4 X5 X6 X7;
            SOSUP by X8 X9;
            PAIN by Y1 Y2;
            SLEEP by Y3 Y4 Y5 Y6 Y7 Y8 Y9;
            FATIG by Y10 Y11 Y12 Y13 Y14 Y15 Y16 Y17 Y18;
            MOBI by Y19 Y20 Y21 Y22 Y23;
            PAIN on COMBID;
            SLEEP on COG;
            FATIG on COMBID PAIN SLEEP;
            MOBI on COMBID COG SOSUP PAIN SLEEP FATIG;
            Y20 WITH Y19;
            Y5 WITH Y4;
            Y23 WITH Y22;
            Y17 WITH Y16;
            Y23 WITH Y8;
            Y22 WITH Y5;
            Y22 WITH Y21;
            Y16 WITH Y15;
            Y7 WITH Y3;
            Y4 WITH Y2;
            Y23 WITH Y21;
            Y23 WITH Y18;
            Y17 WITH Y15;
            Y14 WITH Y12;
            X4 WITH X3;
            X7 WITH X6;
            X5 WITH X1;
            X7 WITH X2;
            X2 WITH X1;
            X3 WITH X2;
            X6 WITH X4;
            Y14 WITH Y3;
            Y17 WITH Y13;
            X9 WITH X5;
            Y14 WITH Y10;
            Y23 WITH X2;
            Y22 WITH X6;
            Y22 WITH X8;
            Y22 WITH X4;
```

```
        Y21 WITH X6;
        Y22 WITH X5;
        Y21 WITH X5;
        Y7 WITH X1;
        Y21 WITH X2;
        Y17 WITH X5;
        Y1 WITH X7;
        Y11 WITH Y1;
        Y20 WITH Y18;
        Y14 WITH X3;
        Y3 WITH X8;
        Y19 WITH Y18;
        Y11 WITH X4;
        Y5 WITH X2;
        X4 WITH X2;
        Y7 WITH X4;
        Y10 WITH X4;
        Y7 WITH X3;
        Y8 WITH X1;
        Y22 WITH Y6;
        Y17 WITH Y14;
        Y10 WITH Y8;
        Y20 WITH X1;
        Y20 WITH Y9;
        Y9 WITH Y6;
        Y14 WITH Y8;
        Y19 WITH Y15;
        Y17 WITH Y8;
        Y8 WITH X5;
        Y9 WITH X8;
        Y23 WITH Y7;
        Y12 WITH Y10;
        Y13 WITH Y3;
        Y14 WITH Y6;
        Y14 WITH Y13;
        Y14 WITH X6;
        Y6 WITH X3;
        Y14 WITH Y2;
        X9 WITH X7;
        Y18 WITH Y4;
        Y18 WITH X2;
        Y13 WITH Y6;
        Y12 WITH Y6;
        Y11 WITH Y3;
        Y15 WITH Y8;
        Y16 WITH Y10;
        Y8 WITH X9;
        Y21 WITH Y7;
        Y14 WITH Y11;
MODEL INDIRECT:
       MOBI IND SLEEP;
       MOBI IND PAIN;
       MOBI IND COG;
       MOBI IND COMBID;
```

Printout of final model testing of mobility

MODEL FIT INFORMATION

Number of Free Parameters	156	
Loglikelihood		
H0 Value	-8516.686	
H1 Value	-8309.087	
Information Criteria		
Akaike (AIC)	17345.372	
Bayesian (BIC)	17900.839	
Sample-Size Adjusted BIC	17406.258	
(n* = (n + 2) / 24)		
Chi-Square Test of Model Fit		
Value	415.198	
Degrees of Freedom	372	
P-Value	0.0605	
RMSEA (Root Mean Square Error Of Approximation)		
Estimate	0.021	
90 Percent C.I.	0.000	0.032
Probability RMSEA <= .05	1.000	
CFI/TLI		
CFI	0.993	
TLI	0.991	
Chi-Square Test of Model Fit for the Baseline Model		
Value	6960.902	
Degrees of Freedom	496	
P-Value	0.0000	
SRMR (Standardized Root Mean Square Residual)		
Value	0.036	

VITA

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