A Causal Model of Health-Related Quality of Life in Thai Children with Cancer

Pranee Khamchan

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in Nursing (International Program)
Prince of Songkla University
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ABSTRACT

The path analytic study aims to develop and test a hypothesized causal model of health-related quality of life in Thai children with cancer. The revised Wilson and Clary conceptual model of HRQOL by Ferrans et al. (2005) and previous evidences were used to develop the model. Seven independent variables including family functioning, coping, symptom distress, trait anxiety, state anxiety, functional status, and self-care behavior were examined in the model. Data were collected using a set of questionnaires. Back translation technique was performed with two instruments developed in English. The reliability of instruments was tested and the results showed that all instruments had an acceptable value of reliability between .82 and .93. Purposive sampling was used to recruit 199 children with cancer and caregivers from eight tertiary hospitals in three parts of Thailand. Children were 9-18 years old, received chemotherapy at least one cycle, had good consciousness, and had no serious conditions. Data were analyzed using path analysis. The results showed that:

1) The goodness of fit measures of the hypothesized model was not met.

2) The goodness of fit measures of the modified model was met.

3) The modified model revealed that six independent variables including coping, symptom distress, trait anxiety, state anxiety, and functional status significantly

accounted for 33% of variance in HRQOL. Trait anxiety had both a significant direct negative effect ($\beta = -.35$, $p < .001$) and indirect negative effect on HRQOL ($\beta = -.08$, $p < .05$) via state anxiety and functional status. It had a significant total effect on HRQOL ($\beta = -.43$, $p < .05$). Functional status had a significant positive effect on HRQOL ($\beta = .34$, $p < .001$). However, coping, symptom distress, and state anxiety had no direct effect on HRQOL. Coping had a significant indirect effect on HRQOL via state anxiety and functional status ($\beta = .03$, $p < .05$). Symptom distress had a significant indirect effect on HRQOL via functional status ($\beta = -.05$, $p < .05$). Trait anxiety had a significant positive direct effect on state anxiety ($\beta =.44$, $p < .001$). Symptom distress and state anxiety had a significant negative direct effect on functional status ($\beta = -.16$, $p < .05$; $\beta = -.28$, $p < .001$, respectively). Coping had a significant negative direct effect on state anxiety ($\beta = -.22$, $p < .001$), whereas it had no direct effect on trait anxiety ($\beta = -.11$, $p > .05$). Besides, coping significantly and negatively correlated with symptom distress ($r = -.19$, $p < .01$).

These findings provide the empirical evidences regarding the magnitude and directional effects of the factors influencing HRQOL in Thai children with cancer. This provides useful information for nurses to develop effective interventions to enhance HRQOL in Thai children with cancer.

ชื่อวิทยานิพนธ์ โมเดลเชิงสาเหตุคุณภาพชีวิตเด็กไทยโรคมะเร็ง

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บทคัดย่อ

การศึกษาเชิงวิเคราะห์เส้นทางความสัมพันธ์เชิงสาเหตุมีวัตถุประสงค์เพื่อสร้างและทดสอบโมเดลเชิงสาเหตุคุณภาพชีวิตเด็กไทยโรคมะเร็ง โมเดลนี้สร้างโดยใช้ แบบจำลองความคิดคุณภาพชีวิตของวิลสันและแคลรี่ที่ปรับปรุงโดยเฟอรานส์และคณะ (2005) และงานวิจัยที่ผ่านมา เจ็ดตัวแปรอิสระได้แก่ การทำหน้าที่ของครอบครัว การปรับตัว ความรู้สึกทุกข์ทรมานรบกวนการดำเนินชีวิตจากอาการ ความวิตกกังวลแฝง ความวิตกกังวลขณะกำลังเผชิญ ความสามารถในการปฏิบัติกิจกรรม และพฤติกรรมการดูแลตัวเอง ถูกเลือกมาทดสอบในโมเดล เก็บรวบรวมข้อมูลโดยใช้ชุดแบบสอบถาม แบบสอบถาม 2 ชุดที่มีต้นฉบับเป็นภาษาอังกฤษได้รับการแปลโดยใช้เทคนิคการแปลย้อนกลับ ความเที่ยงของเครื่องมือได้รับการทดสอบและมีค่าที่ยอมรับได้ อยู่ระหว่าง .82 - .93 กลุ่มตัวอย่างเป็นเด็กป่วยโรคมะเร็ง จำนวน 199 คนและผู้ดูแล ได้ผ่านการคัดเลือกแบบเฉพาะเจาะจงตามคุณสมบัติการคัดเลือกกลุ่มตัวอย่าง จากแปดโรงพยาบาลใน 3 ภาคของประเทศไทยโดยเด็กโรคมะเร็งมีอายุ 9 - 18 ปี เคยได้รับยาเคมีบำบัดอย่างน้อย 1 ครั้ง รู้สึกตัวดี และไม่มีปัญหาสุขภาพที่รุนแรง วิเคราะห์ข้อมูลโดยใช้สถิติเชิงการวิเคราะห์เส้นทางผลการศึกษาพบว่า

1. โมเดลเชิงสาเหตุคุณภาพชีวิตเด็กไทยโรคมะเร็งตามสมมุติฐานไม่มีความสอดคล้องกับข้อมูลเชิงประจักษ์

2. โมเดลเชิงสาเหตุคุณภาพชีวิตเด็กไทยโรคมะเร็งที่ปรับแก้ไขมีความสอดคล้องกับข้อมูลเชิงประจักษ์

3. โมเดลที่ปรับแก้ไขซึ่งประกอบด้วยตัวแปรอิสระ หกตัว ได้แก่ การปรับตัว ความรู้สึกทุกข์ทรมานรบกวนการดำเนินชีวิตจากอาการ ความวิตกกังวลแฝง ความวิตกกังวลขณะกำลังเผชิญ และความสามารถในการปฏิบัติกิจกรรม สามารถอธิบายความแปรปรวนของคุณภาพชีวิตเด็กไทยโรคมะเร็งได้อย่างมีนัยสำคัญทางสถิติร้อยละ 33 โดยความวิตกกังวลแฝงมีอิทธิพลเชิงลบต่อคุณภาพ

ชีวิตทั้งทางตรง ($\beta = -.35$, $p < .001$) และทางอ้อม ($\beta = -.08$, $p < .05$) อย่างมีนัยสำคัญทางสถิติโดยผ่านความวิตกกังวลขณะกำลังเผชิญ และความสามารถในการปฏิบัติกิจกรรมและมีอิทธิพลรวมเชิงลบอย่างมีนัยสำคัญทางสถิติต่อคุณภาพชีวิต ($\beta = -.43$, $p < .05$) ส่วนความสามารถในการปฏิบัติกิจกรรมมีอิทธิพลทางตรงเชิงบวกอย่างมีนัยสำคัญทางสถิติต่อคุณภาพชีวิต ($\beta = .34$, $p < .001$) การปรับตัว ความรู้สึกทุกข์ทรมานรบกวนการดำเนินชีวิตจากอาการ และความวิตกกังวลขณะกำลังเผชิญไม่มีอิทธิพลทางตรงต่อคุณภาพชีวิต แต่การปรับตัวมีอิทธิพลทางอ้อมต่อคุณภาพชีวิตอย่างมีนัยสำคัญทางสถิติโดยผ่านความวิตกกังวลขณะกำลังเผชิญ และความสามารถในการปฏิบัติกิจกรรม ($\beta = .03$, $p < .05$) ความรู้สึกทุกข์ทรมานรบกวนการดำเนินชีวิตจากอาการมีอิทธิพลทางอ้อมต่อคุณภาพชีวิตอย่างมีนัยสำคัญทางสถิติโดยผ่านความสามารถในการปฏิบัติกิจกรรม ($\beta = -.05$, $p < .05$) ความวิตกกังวลแฝงมีอิทธิพลทางตรงเชิงบวกอย่างมีนัยสำคัญทางสถิติต่อความวิตกกังวลขณะกำลังเผชิญ ($\beta =.44$, $p < .001$) ความรู้สึกทุกข์ทรมานรบกวนการดำเนินชีวิตจากอาการและความวิตกกังวลขณะกำลังเผชิญ มีอิทธิพลทางตรงเชิงลบอย่างมีนัยสำคัญทางสถิติต่อความสามารถในการปฏิบัติกิจกรรม ($\beta = -.16$, $p < .05$; $\beta = -.28$, $p < .001$ ตามลำดับ) ส่วนการปรับตัวมีอิทธิพลทางตรงเชิงลบอย่างมีนัยสำคัญทางสถิติต่อความวิตกกังวลขณะกำลังเผชิญ ($\beta = -.22$, $p < .001$) แต่ไม่มีอิทธิพลทางตรงต่อความวิตกกังวลแฝง ($\beta = -.11$, $p > .05$) นอกจากนี้การปรับตัวยังมีความสัมพันธ์เชิงบวกอย่างมีนัยสำคัญทางสถิติกับความรู้สึกทุกข์ทรมานรบกวนการดำเนินชีวิตจากอาการ ($r = -.19$, $p < .01$)

ผลการศึกษาเป็นข้อมูลเชิงประจักษ์ในแง่ของขนาดและ ทิศทางของปัจจัยที่มีอิทธิพลต่อคุณภาพชีวิต ในเด็กไทยโรคมะเร็ง ซึ่งเป็นข้อมูลที่ประโยชน์ต่อพยาบาลเพื่อพัฒนาโปรแกรมที่มีคุณภาพในการส่งเสริมคุณภาพชีวิตเด็กไทยโรคมะเร็ง

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CHAPTER 1

INTRODUCTION

This chapter provides the background and significance of the problem, objectives of the study, research questions, conceptual framework of the study, research hypotheses, definition of terms, scope of the study, and significance of the study.

Background and Significance of the Problem

Childhood cancer, a chronic illness, is recognized as one of the major causes of death in children. In Thailand, according to the 2016 report of the Ministry of Public Health, cancer caused the death of 825 children less than 15 years of age (Ministry of Public Health, 2016). The incidence rate for cancer in Thai male children aged below 5 years, 5-9 years, and 10-14 years has been reported at 21.7, 16.6, and 10.2 per 100,000 population, respectively. Meanwhile, in Thai female children, it stands at 14.1, 10.5, and 9.4 per 100,000 population, respectively (Imsamran et al., 2015).

Nowadays, advances in medicine have resulted in a more successful pediatric cancer treatment. Consequently, the five-year survival rate of children below 20 years old, who have been diagnosed with acute lymphoblastic leukemia and non-Hodgkin lymphoma, has increased to 88% and 89%, respectively (National Cancer Institute, 2017). The mortality rate for children and adolescents aged 1–19 years has decreased from 2.85 to 2.20 deaths per 100,000 population in the United States, (Curtin, Minino, & Anderson, 2016). Nevertheless, the affected children still suffer from the severity of the symptoms associated with their disease and the treatment they receive

(Miller, Jacop, & Hockenberry, 2011; Li, Lopez, Chung, & Chiu, 2013). Ruland, Hamilton, and Schjødt-Osmo (2009) reported in their review that children and adolescents face numerous and complex experiences and problems during and after cancer treatment, e.g., physical, psychological or emotional, and school-related or behavioural problems. These problems affect their quality of life (Ferreira et al., 2008; Li et al., 2013).

Quality of life (QOL) is defined as "an individual's perceptions of their position in life including physical health, psychological status, level of independence, social relationships and personal beliefs and their relationship to salient features of their environment in the context of the culture and value system in which they live, and in relation to their goals, expectations, standards and concerns" (World Health Organization, 1995) (p. 1405). Since health, illness, and treatment are aspects of quality of life (Ferrans, Zerwic, Wilbur, & Larson, 2005), another associated term is health-related quality of life (HRQOL). However, the terms HRQOL is often used interchangeably with QOL in research and literature (Taylor, Gibson, & Franck, 2008; Varricchio, & Ferrans, 2010). Varni, Burwinkle, Rapoff, Kamps, and Olson (2004) defined HRQOL as an individual's perception of health and its treatment impact on daily life. In addition, Sinclair (2013) defined HRQOL for a child as the insight of the impact of a medical condition or disease state on physical and/or psychosocial well-being, and satisfaction with life in relation to cognitive and developmental levels.

In regards to children with cancer, HRQOL has been defined as the perception of an individual concerning functioning, functioning feeling, and health assigned to the duration of life value (Davis et al., 2006). Hinds et al. (2004) identified that children with cancer perceive quality of life as "an overall sense of well-being based on being able to participate in usual activities; interact with others; cope with uncomfortable physical, emotional, and cognitive reactions; and find meaning in the illness experience" (p. 768).

Several studies have reported that children with cancer have a low level of HRQOL when comparing with other children. The overall HRQOL has been reported poorer than that of general children among both newly-diagnosed cancer patients (Landolt, Vollrath, Niggli, Gnehm, & Sennhauser, 2006) and those undergoing therapy (Landolt et al., 2006; Shankar et al., 2005; Wu et al., 2007). Additionally, when comparing with children suffering from chronic conditions such as rheumatoid conditions and headaches, children with cancer report lower social and school functioning (Powers, Patton, Hommel, & Hershey, 2003). Furthermore, caregivers perceive the quality of life of children with cancer—both newly-diagnosed (Eiser, Eiser, & Stride, 2005) and surviving with cancer (Eilertsen et al., 2012; Speechley, Barrera, Shaw, Morrison, & Maunsell, 2006)—to be lower than that of the general population.

In Thailand, the overall QOL in children with cancer has been reported at a high level. However, in some of its domains—especially the psychological domain—it has been reported at a moderate level (Punthmatharith, Buddharat, & Wattanasit, 2008). Similarly, in the physical domain that is related to illness and treatment, it has been reported at a moderate level (Jitnumsub, 2009; Punthmatharith et al., 2008). Additionally, qualitative research has identified that the aspects of physical and emotional function, life satisfaction, self-concept, illness condition, and side effects from chemotherapy can affect QOL in children with cancer (Reungsawat & Aomsin, 2008; Visespanit, 1998).

Obviously, the quality of life in children with cancer is lower than that of the healthy children (De Clercq, De Fruyt, Koot, & Benoit, 2004; Eilertsen, Jozefiak, Rannestad, Indredavik, & Vik, 2012; Eiser, et al., 2005; Shankar et al., 2005; Speechley et al., 2006, Wu et al., 2007) and those suffering from other chronic illnesses (Powers et al., 2003). This is probably due to the impact of the factors contributing to it. Several studies have examined the factors, both non-modifiable and modifiable, that contribute to the quality of life in children with cancer. Non-modifiable factors comprise socio-demographics and medical status. The socio-demographics that are associated with a low quality of life in children with cancer are older age, gender (Landolt et al., 2006; Zebrack & Chester, 2002; Wu et al., 2007), low family income and a low level of caregiver education (Punthmatharith, Buddharat, & Wattanasit, 2013; Wannapong, Chanpia, Chintanadilok, Chanwattana, & Preungwat, 1999), and personality (De Clercq et al., 2004).

Based on literature review, socio-demographic factors are associated with the overall QOL (Punthmatharith et al., 2013; Wu et al., 2007) and some QOL domains, especially the physical (Wu et al., 2007), psychological (Landolt et al., 2006) and spiritual domains (Zebrack & Chesler, 2002). Furthermore, the medical status aspects that affect the quality of life in children with cancer are type of cancer (Chou & Hunter, 2009; Hinds et al., 2009; Klassen, Anthony, Khan, Sung, & Klaassen, 2011; Zebrack & Chester, 2002), treatment (Klassen et al., 2011; Landolt et al., 2006; Maurice-Stam, Grootenhuis, Brons, Caron, & Last, 2007; Reimers, Mortensen, Nysom, & Schmiegelow, 2009; Stam, Grootenhuis, Caron, & Last, 2006), complications (Landolt et al., 2006), prognosis (Maurice-Stam et al., 2007; Maurice-Stam, Oort, Last, Brons et al., 2009; Zebrack & Chester, 2002), sickness duration

(Punthmatharith et al., 2013; Subonggot, 2006; Wannapong et al., 1999), and treatment duration (Maurice-Stam, Oort, Last, Brons et al., 2009). Medical status associate with the overall QOL and some of its domains, especially the physical, psychological and social function domains.

Furthermore, modifiable factors such as symptoms, functional status, coping, anxiety, family functioning, and self-care behavior are associated with either the overall QOL or individual QOL domains. Baggott et al. (2011) reported that the QOL of American children following myelosuppressive chemotherapy was correlated with number of symptoms, symptom severity and symptom distress. They found that the number of symptoms was negatively related to the overall QOL and each domain of QOL. A higher symptom distress score was associated with poorer QOL. Functional status was associated with the overall QOL; the individual QOL domains affected were physical functioning, emotional functioning, social functioning, and school functioning (Baggott et al., 2011). In addition, disease-related cognitive coping has been found to influence the psychological domain in Dutch school-aged children with non-central nervous system cancer after completion of treatment (Maurice-Stam, Oort, Last, Brons et al., 2009). Moreover, Stam et al. (2006) reported that cognitive coping could predict the physical and mental component of HRQOL in young Dutch adults with cancer. A lower level of trait anxiety was associated with higher scores of disease-related cognitive coping (Maurice-Stam, Oort, Last, Brons et al., 2009). Sato et al. (2013), who conducted a study in children with brain tumors, found that HRQOL was associated with trait anxiety, and state anxiety. Fortier et al. (2013) reported that a child’s state anxiety was able to predict the HRQOL in American children with cancer that were receiving treatment. Family functioning has also been reported to influence both the physical and psychosocial domains of HRQOL in American adolescents with cancer (Barakat, Marmer, & Schwartz, 2010). Furthermore, the quality of life in Thai children with cancer had been shown to be influenced by self-care behavior (Punthmatharith et al., 2013; Wannapong, et al., 1999).

It is evident, therefore, that several factors can affect HRQOL. Wilson and Cleary's conceptual model of HRQOL (WCM) is a theoretical model that identifies an approach for explaining and predicting HRQOL (Wilson & Cleary, 1995). The WCM has been widely applied in several patients such as patients with cancer, renal disease, HIV/AIDS (Sousa & Kwok, 2006), and heart disease (Heo, Moser, Riegel, Hall, & Cristman, 2005; Krethong, Jirapaet, Jitpanya, & Sloan, 2008; Sousa & Kwok, 2006). However, some components of the model have been deemed not well-defined (Bakas et al., 2012; Ferrans, Zerwic, Wilbur, & Larson, 2005). The revised version of the WCM by Ferrans and colleagues provides a theoretical background for each component of the model and the example of the instrument to measure some of the components such as symptoms, functional status, general health perception, and QOL (Ferrans et al., 2005). Therefore, the revised version of the WCM was used as a conceptual model of this study. Moreover, since the terms QOL and HRQOL can be used interchangeably (Ferrans et al., 2005), the same was the case in this study.

Based on the revised WCM by Ferrans et al. (2005), the relationships among the factors that affect HRQOL are complex. These effects could be classified as direct, mediating, and indirect. Although previous studies suggest that the quality of life in children with cancer could be predicted, only the relationship among pairs of variables and their prediction have been explored, which has indicated only a direct relationship. Especially in the Thai context, only the prediction between self-care behavior and QOL in Thai children with cancer has been explored (Punthmatharith et al., 2013). However, other variables such as coping, trait anxiety, state anxiety, family functioning, symptom distress, and functional status have yet to be explored. In terms of the full model of HRQOL in children with cancer, only one research study has examined a full model of causal relationships in adolescents with cancer in the Thai context. However, it covered only the causal relationship among spiritual well-being, depression, and HRQOL (Suwannaosod, 2017).

As mentioned previously, a causal model of HRQOL in children with cancer can provide empirical knowledge about their quality of life. Moreover, the ensuing findings of such research may be useful in providing appropriate nursing care in order to improve the quality of life in children with cancer. In this study, the researcher examined whether modifiable factors such as coping, trait anxiety, state anxiety, family functioning, self-care behavior, symptom distress, and functional status can predict HRQOL in children with cancer. These factors were selected based on the findings of prior research studies and supported by the revised WCM by Ferrans et al. (2005). The selected factors have been shown to have a statistical support of a moderate-to-high level, in terms of either correlation or prediction coefficients, with QOL (Cohen, 1988). Besides, most of these factors are important predictors of HRQOL, and relevant to the Thai context

The causal model of HRQOL in Thai children with cancer can identify the direct, mediating, and indirect effects of factors on HRQOL in children with cancer with the aim of providing appropriate nursing care and developing effective interventions in order to improve the quality of life in children with cancer in Thailand and beyond.

Objectives of the Study

The purposes of this study were to develop and test a hypothesized causal model of health-related quality of life in children with cancer.

Research Questions

The research questions were as follows:

1. Does the initial model fit the data?

2. Does family functioning have a direct and positive effect on HRQOL in children with cancer?

3. Does coping have a direct and positive effect on HRQOL and an indirect and negative effect on HRQOL in children with cancer via trait anxiety and state anxiety?

4. Does symptom distress have a direct and negative effect on HRQOL and an indirect and negative effect on HRQOL in children with cancer via functional status?

5. Does trait anxiety have a direct and negative effect on HRQOL in children with cancer and an indirect and negative effect on HRQOL via state anxiety?

6. Does state anxiety have a direct and negative effect on HRQOL in children with cancer?

7. Does functional status have a direct and positive effect on HRQOL in children with cancer?

8. Does self-care behavior have a direct and positive effect on HRQOL in children with cancer?

9. Does coping have a direct and negative effect on trait anxiety in children with cancer?

10. Does trait anxiety have a direct and positive effect on state anxiety in children with cancer?

11. Does symptom distress have a direct and negative effect on functional status in children with cancer?

Conceptual Framework

The model was developed based on Wilson and Cleary's health-related quality of life conceptual model (WCM) as revised by Ferrans et al. (2005) and empirical evidence regarding the factors that were associated with HRQOL in children with cancer. Six variables—family functioning, symptom distress, trait anxiety, state anxiety, functional status, and HRQOL were supported by the revised WCM by Ferrans et al. (2005) and literature review. Two other variables—coping and self-care behavior—were chosen based on evidence from previous research. Following are the definition of terms and concepts employed in this study:

1. The revised version of Wilson and Cleary's HRQOL conceptual model

The WCM was developed based on theory, clinical practice, and the result of researches (Wilson & Cleary, 1995). The WCM comprises seven direct and indirect variables: biological/physiological function, symptom status, functional status, general health perceptions, individual characteristics, environmental characteristics, and non-medical factors (Sousa, 1999; Wilson & Cleary, 1995). This conceptual model captures both the health and the two aspects of the person and environment from the nursing domain. These two aspects concern the holistic nature of the patient and the integrated responses to the environment, which are considered central to the domain of nursing (Sousa, 1999).

Wilson and Cleary's HRQOL conceptual model had been widely applied in adult patients such as patients with cancer, heart disease, renal disease, and HIV/AIDS (Bakas et al., 2012; Sousa & Kwok, 2006). According to Sousa and Kwok (2006), the WCM has been certified in HIV patients. Their results reported that the HRQOL model fit the data adequately. In heart failure patients, the WCM was tested, and the results showed that health perception, symptom status, and age-predicted HRQOL and health perception were mediators of the effect of symptom status on HRQOL (Heo et al., 2005).

In cancer patients, the WCM was partially tested in long-term survival adults with Hodgkin's lymphoma (Wettergren, Björkholm, Axdorph, & Langius-Eklöf, 2004). It was found that the functional status was included in general health perception and coping was included in the characteristics of the individual. Moreover, only financial situations were evaluated in the characteristics of the environment, and nonmedical factors were not mentioned. The results also identified the determinants of health-related quality of life in long-term survival patients with Hodgkin's lymphoma to be coping capacity, biological and physiological variables, symptom status, general health perceptions, and financial situation. However, there is no known evidence supporting that the WCM testing was performed in children.

In the Thai context, the WCM had been tested only in patients with heart failure (Krethong et al., 2008). In this study, the causal relationships among bio-physiological status, symptoms, functional status, general health perception, and HRQOL were tested. Social support was also added into the model. The results showed that the model fit adequately with empirical data (Krethong et al., 2008).

Even though the WCM has been tested and commonly applied in many populations, some components of the original WCM have not been well described (Bakas et al., 2012; Ferrans et al., 2005). In a revised version developed by Ferrans et al. (2005), details concerning the individual and environmental characteristics were added to better explain HRQOL (Ferrans et al., 2005). The relationship between biological function and the characteristic of individual and also relationship between biological function and the characteristic of environmental were added. Additionally, nonmedical factors and the labeling on the arrows were deleted (Sandau, Bredow, & Peterson, 2009).

One model testing, which was based on the revised version of WCM by Ferrans et al. (2005), has been carried out in Thai adolescents with cancer. The characteristics of the individual, biological function, symptoms, and overall QOL from seven concepts were added to test in this model. Age and gender, spiritual well-being were tested under characteristics of the individual. Cancer type, treatment, and time since diagnosis were tested as biological function. Symptoms were represented by depression. The results showed that the model fit with the empirical data (Suwannaosod, 2017).

Although only one model testing had been reported in children with cancer, according to Bakas et al. (2012), the revised version of WCM by Ferrans et al. (2005)

was appropriate for application in research because it offers a better explanation of HRQOL than the original version. Therefore, the revised WCM was deemed suitable in serving as the framework of this study. According to Ferrans et al. (2005), the revision of HRQOL comprises the following 6 components that can influence the overall quality of life: biological function, symptoms, functional status, general health perception, characteristics of the individual, and characteristics of the environment. The details of each component are given below.

Biological function involves the result of laboratory, physical examination, and diagnoses. This component has an indirect effect on HRQOL though symptoms, functional status, and general health perception. The interaction of the individual with the environment's characteristics also influences biological function (Ferrans et al., 2005).

In children with cancer, biological functions that influence the quality of life are the type of cancer (Chou & Hunter, 2009; Hinds et al., 2009; Zebrack & Chester, 2002), treatment (Landolt et al., 2006; Maurice-Stam et al., 2007; Reimers et al., 2009; Stam et al., 2006), complications (Landolt et al., 2006), prognosis (Maurice-Stam et al., 2007; Maurice-Stam et al., 2009; Zebrack & Chester, 2002), sickness duration (Punthmatharith et al., 2013; Wannapong et al., 1999), and the duration of treatment (Maurice-Stam et al., 2009). According to prior studies, even though each factor can predict QOL in children with cancer, this component of the conceptual model of the HRQOL is a non-modifiable factor. Therefore, the biological function component was excluded in this study.

Symptoms refer to physical, emotional, and cognitive indications that are recognized by a patient (Ferrans et al., 2005). In the revised WCM, symptoms have an indirect effect on HRQOL via the functional status and general health perception. In addition, symptoms are influenced by biological function and the interaction of the individual with the environment's characteristics (Ferrans et al., 2005). Besides, symptoms can provide either global or symptom-specific measurements. Frequency, intensity, and distress are the most common dimensions of symptoms (Ferrans et al., 2005). Many physical and psychological symptoms appear in children after their diagnosis and during their treatment of cancer. The most common physical symptoms experienced by hospitalized children with cancer are nausea, fatigue, and pain (Miller et al., 2011). According to Dodd, Miaskowski, and Paul (2001), fatigue and pain can predict functional status in patients with cancer (β = -.41, -.42, $p < .05$). This has also been observed in leukemic Thai children, where it was found that fatigue occurs frequently in such children receiving chemotherapy, and that it interferes with their functional status at a moderate level (Prajimtis, 2004). As for psychological symptoms, Chung, Li, Chiu, and Lopez (2012) reported that the quality of life in Chinese survivors of childhood cancer was predicted by depressive symptom (β = -.53, $p < .001$). Besides, trait anxiety associated with disease-related cognitive coping (Maurice-Stam et al., 2009). Sato et al. (2013) identified that the perception of HRQOL of children with brain tumors was affected by their trait anxiety (β = -.43, $p < .05$). Also, Fortier et al. (2013) reported state anxiety to be a negative predictor of HRQOL in American children with cancer undergoing treatment for cancer (β = -.29, $p = .01$). Similarly, Kanellopoulos, Hamre, Dahl, Fossa, and Ruud (2013) reported that the level of hospital anxiety was able to predict QOL in Norwegian survivors of childhood acute lymphoblastic leukemia and lymphoma (*OR* = 1.13, $p = .03$). Even though trait anxiety is a non-modifiable factor, in stressful conditions, the trait anxiety of children has been found to be a positive predictor of their state anxiety (β = .57, p = .01) (Li & Lopez, 2005).

Symptoms, moreover, are related to the overall QOL (Baggott et al., 2011) and some domains of HRQOL among children with cancer, especially physical functioning, emotional functioning, and social functioning (Baggott et al., 2011; Hind et al., 2009a). Baggott et al. (2011) identified that the number of symptoms, symptom severity, and symptom distress were negatively related to the HRQOL of American children following myelosuppressive chemotherapy (r = -.52, r = -.62, r = -.64 respectively, $p < 0.001$). In Thai children with cancer, even though there is no data to support the claim that symptoms can predict HRQOL, several prior studies have identified symptoms to be associated with HRQOL in cancer children. Jitnumsub (2009) reported that a lower level of HRQOL was present in Thai patients who had nausea, vomiting, bad appetite, weakness, and fatigue. In this study, symptom distress and trait-and state- anxiety were measured as symptoms.

Functional status is defined as the capability to perform physical, psychological, and social functions. It is considered to have an indirect effect on HRQOL via the patient's general health perception. This component is influenced by symptoms, characteristics of an individual, and environmental characteristics (Ferrans et al., 2005). Previous studies have reported functional status to be positively related to the overall HRQOL (r =.63, p < .001) in American children following myelosuppressive chemotherapy (Baggott et al., 2011). This has also been found in some domains of HRQOL—physical functioning and emotional functioning—in Swiss children newly diagnosed with cancer (Landolt et al., 2006). Additionally, in Thai children with a chronic illness, the activities of daily living that are a part of physical functioning have been reported to constitute one factor related to the quality of life (Subonggot, 2006). Even though functional status might overlap with the physical functioning domain of HRQOL, in this study, play performance was used to evaluate functional status because the participants of this study covered school-age children and adolescents. Play is necessary for children and adolescents to promote their development and contribute to cognitive, physical, social, and emotional well-being (Goldstein, 2012). Therefore, this variable was included in this study as well.

General health perception is defined as a subjective perception of individual health (Ferrans et al., 2005). Even though this component has been reported to have a direct influence on HRQOL, based on previous studies on children with cancer, no evidence to suggest that general health perceptions have a direct influence on HRQOL has been offered. Therefore, this component was excluded from this study.

Characteristics of the individual are considered the effect from demographic data, developmental stage, psychological factors, and biological factors on health outcomes. Demographic factors related to the incidence of disease such as sex, age, marital status, and ethnicity. Psychological factors are defined as a cognitive response (e.g., one's beliefs, attitudes), affective response (e.g., anxiety, fear, sadness), and motivation. Biological factors consist of body mass index, skin color, and family history related to a genetically-linked disease and disease risk. This component has both a direct and indirect influence on HRQOL via the biological function, symptoms, functional status, and general health perception (Ferrans et al., 2005).

In children with cancer, the demographic factors that can influence QOL are age (Landolt et al., 2006; Zebrack & Chester, 2002), gender (Jitnumsub, 2009; Landolt et al., 2006; Zebrack & Chester, 2002), adequate income (Punthmatharith et al., 2013; Wannapong et al., 1999), parents' level of education (Wannapong et al., 1999), and child's level of education (Punthmatharith et al., 2008). However, the demographic, developmental, and biological factors are non-modifiable factors. Therefore, these components were not included in this study. Regarding psychological factors, especially trait anxiety and state anxiety were added to the symptom domain to test in this study's model.

Characteristics of the environment are defined as the influence of interpersonal or social aspects on health outcomes such as the influence from family, friends, or health care providers (Ferrans et al., 2005). In the revised WCM, the characteristics of the environment had a direct and an indirect effect on HRQOL, and they can influence other variables such as biological function, symptoms, functional status, and general health perceptions. In this study, the characteristics of the environment were represented by family functioning. Family functioning is defined as the characteristic of family system in order to maintain the homeostasis of the family (McCubbin & Thompson, 1991 [as cited in Suttiamnuaykul, 2002]). In American adolescents with cancer, research has shown that dysfunction in the role domain of family functioning can predict both the physical and psychosocial domains of HRQOL ($\beta = -.21$, $p < .1$, $\beta = -.32$, $p < .01$, respectively) (Barakat et al., 2010). Even though no evidence supporting either the prediction or relationship between HRQOL in Thai children with cancer and family functioning exists at present, family functioning is positively correlated with children with cancer and sibling adjustment

($r = .19$; *95% CI*: .13 – .24) (Van Schoors et al., 2017). Along the same lines, coping have been shown to influence HRQOL in children with cancer (Chung et al., 2012; Stam et al., 2006). In addition, the Thai traditional family is a significant unit that can offer meaningful support to children with cancer. Therefore, family functioning was included in this study.

Overall QOL refers to subjective well-being or satisfaction with life as a whole (Ferrans et al., 2005). In the revised WCM, the characteristics of the individual, characteristics of the environment, and general health perceptions directly influence the overall QOL. Meanwhile, biological function, symptoms, and functional status indirectly influence overall QOL (Ferrans et al., 2005). In this study, HRQOL was interchangeably utilized with overall QOL to identify the perception of children concerning their position in life, functioning, and health.

2. Factors that are associated with QOL in children with cancer from previous studies

Previous studies have identified other variables like coping, and self-care behavior to associate with QOL in children with cancer. They were included in this study, and the detailed explanations concerning them are given below.

Coping is another factor that can predict QOL. According to the coping theory (Lazarus & Folkman, 1984), coping is the managing internal and external demands processes, which are evaluated as exceeding the resources of the individual. Mostly different forms of coping are required in order to deal effectively with various aspects of the disease. It has been shown that disease-related cognitive coping by predictive control strategy (being optimistic about the course of the disease) had a positive influence on the physical, and psychological domain, and the total score of quality of daily functioning in surviving Dutch children with cancer two months after completing treatment ($\beta = .33$, $\beta = .39$, $\beta = .35$, respectively, $p < .05$) (Maurice-Stam et al., 2007). Stam et al. (2006) also reported that cognitive coping was able to predict the physical and mental components of HRQOL in young Dutch adults with cancer. They identified that cognitive coping could explain the physical components of HRQOL at 40% of the total variance and the mental-health ones at 39% ($R^2 = .40$, and .39, respectively, $p < .001$).

In addition, coping significantly associated with anxiety. Maurice-Stam et al. (2009) identified that a higher score of disease-related cognitive coping was negative influence on lower levels of trait anxiety ($\beta = -.18$, $p < .05$). Frank, Blount, and Brown (1997) reported that child depressive attributions and avoidance coping could explain anxiety at a level of 19% of the total variance ($R^2 = .19$, $p < .001$), and that avoidance coping could predict levels of anxiety ($\beta = .29$, $p < .01$) in cancer children from various ethnic groups: African American, Caucasian, Hispanic, Indian, and Vietnamese. Furthermore, secondary control coping was a significant negative predictor for anxiety/depression in American children with cancer ($\beta = -.37$, $p < .001$) (Compas et al., 2014).

Self-care behavior is another factor that can influence QOL. Self-care agency is influenced by internal and external variables such as cognitive functioning, knowledge and environment (Orem, 1991). Evidence from previous studies suggests that self-care behavior can predict QOL in many populations, e.g., heart-failure patients (Macabasco-O'Connell et al., 2011). Furthermore, self-care behavior has been identified as a positive predictor of QOL in Thai children with cancer ($\beta = .32$,

p <.01) (Punthmatharith et al., 2013) and to correlate with QOL in Thai leukemic children (r = .476, p < .001) (Wannapong et al., 1999).

Based on the HRQOL conceptual model and evidence from previous research, several factors that can influence HRQOL in children with cancer have been identified. However, only modifiable factors that were related to the HRQOL conceptual model and those discovered from prior studies were included in the conceptual framework of this study. These factors were selected based on a moderate-to-high level statistical support either in correlation coefficients or prediction coefficients with QOL (Cohen, 1988). In addition, these factors are significant predictors of HRQOL in children with cancer and appropriate to the Thai context. The factors that were tested here comprise family functioning, disease-related cognitive coping, trait anxiety, state anxiety, self-care behavior, symptoms, and functional status. A diagram depicting their relationships and directions based on findings from previous research studies is shown in Figure 1.

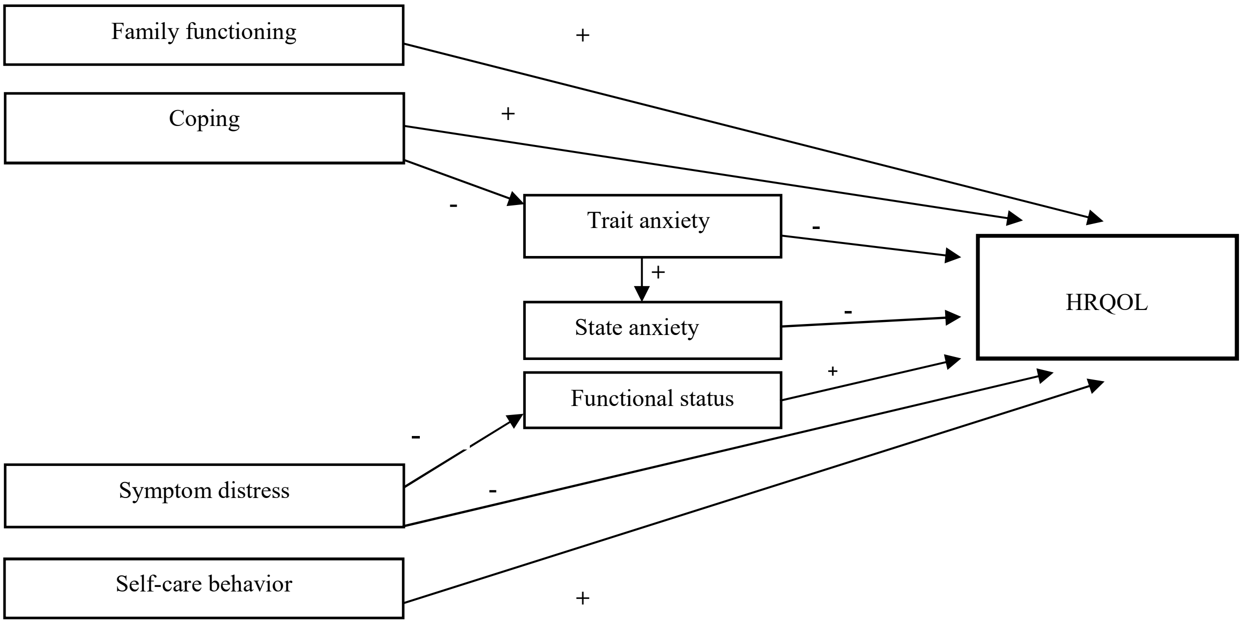

Figure 1. Conceptual model of health-related quality of life in children with cancer in this study

Research Hypotheses

The research hypotheses in this study were as follow:

1. The initial model fit the data.

2. Family functioning has a direct and positive effect on HRQOL in children with cancer.

3. Coping has a direct and positive effect on HRQOL in children with cancer and an indirect and negative effect on HRQOL via trait anxiety and state anxiety.

4. Symptom distress has a direct and negative effect on HRQOL and an indirect and negative effect on HRQOL in children with cancer via functional status.

5. Trait anxiety has a direct and negative effect on HRQOL in children with cancer and an indirect and negative effect on HRQOL via state-anxiety.

6. State anxiety has a direct and negative effect on HRQOL in children with cancer.

7. Functional status has a direct and positive effect on HRQOL in children with cancer.

8. Self-care behavior has a direct and positive effect on HRQOL in children with cancer.

9. Coping has a direct and negative effect on trait anxiety in children with cancer.

10. Trait anxiety has a direct and positive effect on state anxiety in children with cancer.

11. Symptom distress has a direct and negative effect on functional status in children with cancer.

Definition of Terms

Health-related quality of life was defined as the perception of children of their position in life, functioning, and health. It was composed of four domains: physical, psychological, social, and school functioning. The Thai version of Pediatric Quality of Life Inventory Version 4.0 (Thai PedsQL 4.0) was used to measure HRQOL (Sritipsukho, Wisai, & Thavorncharoensap, 2013).

Coping was defined as the ability of children with cancer to deal with their situation successfully after diagnosis and treatment. The mean score of coping ability of the Thai version of Coping of Disease Inventory (Thai CODI) was used to measure coping (Silapavitayatorn, 2008).

Trait anxiety was defined as the level of an uncomfortable feeling or worry in children with cancer that normally occurs that occurs in general like an individual's characteristic. The revised Thai versions of State-Trait Anxiety Inventory for Children (Thai STAIC-R form C-2) was used to measure trait anxiety in children with cancer (Chaiyawat, 2000).

State anxiety was defined as the level of an uncomfortable feeling or worry in children with cancer occurring after diagnosis with cancer and receiving cancer treatment. The revised Thai version of State-Trait Anxiety Inventory for Children (Thai STAIC-R form C-1) was used to measure state anxiety in children with cancer (Chaiyawat, 2000).

Self-care behavior was defined as the ability of children with cancer to take care of themselves. A self-care behavior questionnaire was used to measure self-care behaviour (Punthmatharith et al., 2008).

Family functioning was defined as the accomplishment of the responsibilities of the Thai family of cancer children. It comprised three components: cohesion, communication and expression of feelings, and problem solving. The Chulalongkorn Family Inventory (CFI) was used to measure family functioning (Trangkasombat, 2006).

Symptom distress was defined as the physical or psychological subjective suffering experienced by children with cancer after diagnosis and treatment. The Memorial Symptom Assessment Scale 10–18 (MSAS 10-18) (distress dimension) was used to measure symptom distress (Collins et al., 2000).

Functional status was defined as the ability of children with cancer to perform daily activities. The Play-Performance Scale for Children (PPSC) was used to measure functional status (Lansky, List, Lansky, Ritter-Sterr, & Miller, 1987).

Scope of the Study

This is a path analytic study that aimed to examine the causal relationship among modifiable factors such as coping, trait anxiety, state anxiety, family functioning, self-care behavior, symptom distress, functional status, and health-related quality of life in Thai children with cancer. The population of this study consisted of children with cancer between 9 and 18 years of age that were admitted in a tertiary hospital in Thailand and hospitalized or followed up at its Outpatient Unit and caregivers. The data collection was performed between July 2015 and March 2017.

Significance of the Study

A causal model of HRQOL in children with cancer can provide empirical knowledge about the quality of life in children with cancer. This knowledge could serve as useful information for nurses to develop effective interventions that aim to enhance the HRQOL in children with cancer. The magnitude and directional effects of independent variables on HRQOL could improve current interventions and also be used to develop new ones. A new intervention could integrate all significant factors—especially the mediating ones—that affect HRQOL in children with cancer according to the causal model of HRQOL. Besides, its findings could provide valuable insight for both healthcare providers and policy makers in order to afford proper support and enhance HRQOL in children with cancer.

CHAPTER 2

LITERATURE REVIEW

This research aims to examine the causal relationships between influencing factors and health-related quality of life in children with cancer in Thailand. Review of related literature is presented on the following topics.

1. Overview of childhood cancer
    1.1 Common types of childhood cancer
    1.2 Treatment of childhood cancer
    1.3 Impact from disease and treatment
2. Quality of life and health-related quality of life in children with cancer
    2.1 Definitions
    2.2 Domains
    2.3 Factors associated with quality of life in children with cancer
    2.4 Measurements
3. A proposed causal model of HRQOL in children with cancer
4. Instruments for independent variables in the study
5. Conclusion

1. Overview of childhood cancer

1.1 Common types of childhood cancer

Pediatric malignancies can occur in almost any tissue including blood, organs, bone, and nervous tissues and can affect many body systems (Bowden & Greenberg, 2010). There are several types of cancer in children. However, the common types of cancer in pediatrics compose of leukemia, central nervous system tumors, lymphoma, and the others as outlined in the following.

1.1.1 Leukemia: Leukemia, cancer of the blood or bone marrow, approximately one third of all leukemia cases is diagnosed in children less than 15 years of age (Bowden & Greenberg, 2010). Fever, bleeding, fatigue, weakness, and other symptoms may cause from Leukemia (Lanzkowsky, 2011). The four major classifications of leukemia are acute lymphoblastic leukemia (ALL), acute myelogenous leukemia (AML), chronic myeloid leukemia (CML), and chronic lymphocytic leukemia (CLL) (Bowden & Greenberg, 2010). However, ALL is found the high incidence in children (Lanzkowsky, 2011; Wynn, 2010).

1.1.2 Central nervous system tumors: The causes of CNS tumors remain unknown (Bowden & Greenberg, 2010). A brain tumor is a general term that composes of several types. The most common is astrocytomas located at the cerebellar, cerebral and brain stem sites, followed by primitive neuroectodermal tumors and others (Bowden & Greenberg, 2010). The clinical presentation of a child with CNS tumor depends on the size and location of the tumor and the child's age and developmental stage (Bowden & Greenberg, 2010). Most children will present with common symptoms such as nausea, vomiting, headaches, and dizziness blurred or double vision, (Lanzkowsky, 2011; Weeks & Taylor, 2010).

1.1.3 Lymphoma: It occurs in the lymphoid and reticuloendothelial systems (Bowden & Greenberg, 2010). It often affects lymph nodes and other organs. Different symptoms were found depending on what organs that this cancer is growing. The symptoms such as the edema of lymph nodes especially in the neck, armpit, or groin, weight loss, fever commonly occur (Lanzkowsky, 2011). Two major types of lymphomas include Hodgkin's lymphoma and non-Hodgkin's lymphoma (Bowden & Greenberg, 2010).

1.1.4 Neuroblastoma: This cancer occurs in nerve cells during the period of embryo or fetus. The origin of this tumor can start throughout the body but is usually in the abdomen. The common symptoms are bone pain and fever (Bowden & Greenberg, 2010).

1.1.5 Wilms tumor: This type of cancer occurs in the kidney. Swelling or lump in the abdomen is a common symptom. Symptoms such as fever, pain, nausea, or poor appetite will occur in some children (Bowden & Greenberg, 2010).

1.1.6 Rhabdomyosarcoma (RMS): RMS, a soft-tissue sarcoma, occurs in the head, neck, groins, abdomen, pelvis, arms, or legs. The commonly symptoms are pain and swelling in organs that cancer presents (Bowden & Greenberg, 2010).

1.1.7 Bone cancer: Bone cancer often occurs in older children and teens. The two most common type of bone tumor includes Ewing's sarcoma and osteogenic sarcoma. Most children present with pain in the affected limb that increases with activity. Pain and soft-tissue mass around the affected bone are the common clinical signs in Ewing's sarcoma (Bowden & Greenberg, 2010).

1.1.8 Retinoblastoma: Retinoblastoma is an eye cancer. The sign and symptom of retinoblastoma depend on the stage of cancer and may present strabismus, impaired vision, and cat's eye (Bowden & Greenberg, 2010).

1.2 Treatment of childhood cancer

The courses of treatment in childhood cancer are based on types of cancer, the sites of the cancer, and the extent of the disease. The current treatment of childhood cancer includes chemotherapy, radiotherapy, surgery and other treatments outlined as follows (Bowden & Greenberg, 2010; Groben, 2011).

1.2.1 Chemotherapy: The action of chemotherapy agents is the nucleic acids, deoxyribonucleic acid (DNA) or ribonucleic acid (RNA) function inhibition (Groben, 2011).

1.2.2 Radiotherapy: This treatment is usually used combination with chemotherapy or surgery. It can use for curative purposes or palliation to relieve symptoms (Groben, 2011).

1.2.3 Surgery: The main goal of surgery is to remove all traces of tumor and restore normal body function (Groben, 2011).

1.2.4 Other treatments: The other treatments that are used to cure child with cancer include bone marrow transplantation (BMT), biologic response modifiers, etc. (Bowden & Greenberg, 2010; Groben, 2011). For the BMT method, the donor stem cells are given to patients to produce functioning nonmalignant blood cells after the body is free of malignant cells (Groben, 2011).

1.3 Impact from disease and treatment

Childhood cancer requires long-term treatment and care. Therefore, not only the experiences from the disease can affect children's lives but also the problem or difficulties that arise from the procedure or treatment (Li, Lopez, Chung, Ho, & Chiu, 2013). Childhood cancer can influence children's physical, psychological, and social dimensions as follows.

1.3.1 Physical dimension

Disease, treatment, and procedure can affect physical dimension of children with cancer. The systematic review of Baggott, Dodd, Kennedy, Marina, and

Miaskowski (2011) showed that weight loss or weight gain, fever, sore throat, lack of energy, alopecia, drowsiness, bruising, round face, pain, and anorexia were the most common symptoms found among children with cancer in general. For hospitalized children with cancer, most common physical symptoms included nausea, fatigue, and pain (Miller et al., 2011). Two thirds of children who received treatment during the last week of treatment had one or more physical problems including fatigue, hair loss, nausea, poor eating, or pain (Enskär, & von Essen, 2008).

Nausea symptom in children with cancer related to treatments their received such as chemotherapy, radiation. Acute and chronic symptoms of nausea could affect their nutritional status and overall quality of life (Naiem et al., 2008).

The cause of pain in children with cancer can result from bone and central nervous system metastases, post operation, oral mucositis (Wang et al., 2003) and procedures such as a bone marrow aspiration, lumbar puncture (Wang et al., 2003; Pharnit, 2004; Treenai, 2004). According to Jacob, Hesselgrave, and Hockenberry (2007), most patients indicated having pain during their hospitalization which was mainly related to the procedure they received such as new central line, subcutaneous port access, and lumbar puncture and/or bone marrow aspiration.

Fatigue in children with cancer is often caused by from the hospital environment that related to the disruptions in sleep, low blood counts, and treatment and its side effects (Hockenberry-Eaton & Hinds, 2000). Li et al. (2013) reported in their survey in Hong Kong Chinese childhood cancer patients that most of the children reported that fatigue was their major concern. In Thai leukemic patients, fatigue was one factor that was associated with lower HRQOL (Jitnumsub, 2009)

1.3.2 Psychological dimension

Cancer and its treatments may not only adversely affect the physical dimension of children with cancer but also their psychosocial dimension as well. Eiser et al. (2005) identified that children with cancer initially felt psychologically worse than normal children, especially during the period immediately following a cancer diagnosis. Many studies reported that cancer treatment had long-term adverse effects on the psychosocial dimension of survivors such as poor self-esteem (McCaffrey, 2006; Servitzoglou, Papadatou, Tsiantis, & Vasilatou-kosmidis, 2008; Woodgate, 2005; Zeltzer et al., 2009), high depression, low quality of life (Chung et al.,2012; Stam, et al., 2006; Zeltzer et al., 2009), high anxiety (Jorngarden, Mattsson, & von Essen, 2007; Servitzoglou et al., 2008) and interfered body image (McCaffrey, 2006; Pharnit, 2004).

Poor self-esteem and body image are a burden from the change in physical appearance changes, such as, hair loss (Enskär & von Essen, 2008). These problems were the major stressors of children and adolescents with cancer (McCaffrey, 2006).

Anxiety and depression appeared after shortly after the initial diagnosis in adolescents and young adults diagnosed with cancer (Jorngarden et al., 2007). Chung et al. (2012) reported that depressive symptoms were a predictor of the quality of life in Chinese survivors of childhood cancer. Additionally, the level of anxiety in children with cancer after diagnosis and treatment can influence overall QOL in children with cancer (Fortier et al., 2013; Sato et al., 2013).

1.3.3 Social dimension

The effects from disease and treatments such as treatment-related pain, hair loss are a traumatic experience of having cancer and significant risk for social difficulties (Enskär & von Essen, 2008; Ruccione, Lu, & Meeske, 2013) and repeated absences from school and peers (Enskär & von Essen, 2008; Pharnit, 2004). Two thirds of the Swedish children receiving treatment could not play any game they wanted to and felt isolated in the hospital (Enskär & von Essen, 2008). Additionally, low level of social functioning, and school functioning was also reported in American adolescents diagnosed with central nervous system (CNS) tumor after finishing treatment within 6 months (Ruccione et al., 2013).

2. Quality of life and health-related quality of life in children with cancer

2.1 Definitions

There are many terms that have a conceptually similar meaning with quality of life (QOL) such as well-being, happiness, conditions of living, and satisfaction especially the term life satisfaction (Meeberg, 1993). Each term is a purely subjective term referring to the achievement of an individual goal or feelings of contentment regarding one's life (Taylor et al., 2008) and they could be a component of QOL. From the previous studies, QOL has both subjective and objective aspects and more than one dimension (Arnold et al., 2004; Mandzuk & McMillan, 2005; Meeberg, 1993; Taylor et al., 2008). Therefore, each term do not fully define QOL. In addition, Zhan (1992) mentioned that QOL is composed of four aspects including life satisfaction, self-concept, health and functioning, and socio-economic factors.

WHO (1995) defined quality of life as “an individual’s perceptions of their position in life including physical health, psychological status, level of independence, social relationships and personal beliefs and their relationship to salient features of their environment in the context of the culture and value system in which they live, and in relation to their goals, expectations, standards and concerns” (p. 1405). Haas (1999) concluded that “QOL is multidimensional evaluations of an individual’s current life circumstances in the context of the culture in which they live and values they hold” (p. 738). QOL can assess a subjective perception of well-being including physical, psychological, social, and spiritual aspect and objective perception have on individuals who cannot perceive subjectively (Haas, 1999)

In terms of health related quality of life (HRQOL), the aspects of quality of life that are not related to health such as cultural and political aspects, and society have been excluded. As a result, this term was focused on the quality of life that affect from health, illness, and treatment (Ferrans et al., 2005). Even though HRQOL has more narrow focus than QOL, the term HRQOL and QOL was regularly use interchangeably in health care research (Taylor et al., 2008). Varni et al. (2004) defined health related quality of life as the impact of a health condition and its treatment on daily life from individual’s evaluation. Sinclair (2013) defined HRQOL for a child as the insight of the impact on the child’s medical condition, disease state on physical well-being, psychosocial well-being, and satisfaction with life that related to child’s cognitive and developmental level.

Additionally, in regards to the point of view of children with cancer, Davis et al. (2006) identified in their review for a pediatric quality of life instrument, HRQOL was defined as life position, functioning, functioning feelings, living, and health. Hinds et al. (2004) identified that children with cancer perceive quality of life as an overall aspect of well-being based on the ability to join in usual activities, social interaction, and coping ability in physical, emotional, and cognitive reactions, and illness experience meaning

In the conceptual analysis of young people with chronic illness, health-related quality of life was defined as individual perception or self-evaluation in multi-dimensions including aspects of physical, psychological, and social function and it can change depending on illness trajectory and the progress of disease (Taylor et al., 2008). As mentioned above, even though there is still no universal accepted definition of HRQOL, HRQOL can be defined as an individual's feeling of overall life satisfaction in his or her current life situation encompassing multi-dimensions which include physical, psychological, social, and spiritual dimensions.

In this study, HRQOL in children with cancer was defined as an individual perception about the satisfaction with life that related to one's health depending on the illness trajectory and stage of disease and composed of multi-dimensions.

2.2 Domains

QOL is a multidimensional concept that covered functional ability, psychological status, social functioning, physical health and health perception (Arnold et al., 2004). Varni et al. (2004) identified that quality of life in children could distinct in four dimensions as follows.

1. Physical functioning is the activities of daily living. Physical functioning can be affected by feelings of weakness, tiredness, infection, pain, fatigue, or a decreased vitality.

2. Emotional functioning refers to emotional reaction of individual to a situation experience such as sadness, worry, guilt, futility, joy, hope, or others.

3. Social functioning refers to environmental factors that can affect the individual or family functions including financial factors, logistical factors, housing, childcare, accessible health care, and family relationships or family dynamics as well.

4. School functioning is essential to consider because school-age children spent a lot of time in the school like a society for the school-age children. Children had interaction, activities and relationships friends or teachers.

Tayler et al. (2008) identified that HRQOL in young people with chronic illness is composed of three domains which are physical, psychological, and social function. Impact of illness is included in physical function; coping and adaptation is included in psychological function; interaction with family, friends, and peers is included in social function. Barakat et al. (2010) and Sato et al. (2013) measured QOL in the four domains of physical, emotional, social, and school domain. In some studies, HRQOL was identified in seven domains which were physical functioning, basic motor functioning, autonomy, cognitive, social functioning, positive emotional, and negative emotional aspects (Landolt et al., 2006; Maurice-Stam, Oort, Last, Brons et al., 2009), or included physical functioning, psychological functioning, social functioning, cognitive functioning, body image, outlook on life, and intimate relations (Chou & Hunter, 2009). Punthmatharith et al. (2008) measured QOL in the following eight domains included pleasure in life, health and functioning, problem-related to health and treatment, psychological, cognitive, body image, social and economic, and spiritual dimensions.

Additionally, Eiser (2007) identified that the core domains of QOL including physical, social, emotional, and cognitive functioning and body image, autonomy domains thought to be proposed in young adults. Furthermore, the spiritual domain has been added to the quality of life in childhood cancer survivors (Zebrack & Chesler, 2002). Mandzuk and McMillan (2005) identified that health and functioning could include in the physical domain. Emotional well-being, spirituality, fulfillment, and personal satisfaction were used to reflect the psychological domain. The social domain could include social support, social roles, and family.

From the prior studies, the number of domains of QOL or HRQOL varied depending on the instrument. The most commonly measured domains composed of physical, psychological including cognitive and emotional, and social. Few articles determine the spiritual domain and this was often added in to the psychological domain. Body image and autonomy have been added in the domain of QOL especially in the study of adolescent cancer.

Therefore, in this study, HRQOL in children with cancer composed of multi-dimensions that were separated in the three main domains of physical domain, psychological domain, and social domain.

1. Physical domain: This domain included physical function and the impact of illness on appearance.

2. Psychological domain: This domain included emotional, spiritual, and cognitive which includes body image and autonomy.

3. Social domain: This domain included social support, social roles, friendship, and family.

2.3 Factors associated with quality of life in children with cancer

There are many factors that influence the quality of life in children with cancer. From the prior studies, the influencing factors composed of non-modifiable factors and modifiable factors as follows.

1. Non-modifiable factors: The non modifiable factors that are associated with QOL in children with cancer can be classified into the following two groups; socio-demographics and medical status.

1.1 Socio-demographics: Socio-demographic data that was associated with the quality of life in children with cancer included age (Landolt et al., 2006; Reimers et al., 2009; Wu et al., 2007; Zebrack & Chester, 2002), gender (Jitnumsub, 2009; Landolt et al., 2006; Wu et al., 2007; Zebrack & Chester, 2002), family income (Punthmatharith et al., 2013; Wannapong et al., 1999), parent's education level and child's level of education (Punthmatharith et al., 2008), and personality (De Clercq et al., 2004)

1.1.1 Age: Several studies supported that an older age was related to poorer QOL (Dijk et al., 2007; Landolt et al., 2006; Wu et al., 2007). In Dutch children and adolescents with retinoblastoma, an older age had negatively influenced on the psychological well-being (e.g. life satisfaction and positive emotion) ($\beta = -.306$, $p = .006$) and self-perception (e.g. body image and self-esteem) ($\beta = -.343$, $p < .018$) (Dijk et al., 2007), and was negatively related to emotional functioning ($r = -.42$, $p < .01$) in Swiss children with cancer in the first year after diagnosis (Landolt et al., 2006). Wu et al. (2007) identified that in American adolescents with cancer while on-therapy, an older age was a predictor as an increased risk for poorer HRQL in the overall QOL (18–20 years: $OR = 3.4$, $p = .02$)

when compared to adolescent between the ages of 13 and 14 years and 15 and 17 years and on-therapy (*OR* = 2.5, $p = .05$; *OR* = 2.6, $p = .02$, respectively). In the physical domain, an older age negatively influenced physical functioning in Dutch children with cancer ($\beta = -.32$, $p < .05$) (Maurice-Stam et al., 2007). In the social domain, both positive and negative associations were reported. In Dutch retinoblastoma survivors, an older age negatively influenced parent relations and home life ($\beta = -.299$, $p = .008$) (Dijk et al., 2007). However, older children positively correlated with better scores for autonomy and social functioning ($r = .36$, $p < .01$) in Swiss children with cancer at 6 weeks after diagnosis (Landolt et al., 2006).

In addition, an older age at diagnosis can predict QOL especially in the physical, psychological and social domains (McDougall &Tsonis, 2009). Stam et al. (2006) reported that an older age at diagnosis can predict the mental component in young Dutch adults ($\beta = -.19$, $p < .001$). In Danish brain tumor survivors, an older age at diagnosis had a positive influence on relationships to peers ($\beta = .04$, $p < .05$) and intimate relations ($\beta = .08$, $p < .05$) (Reimers et al., 2009). On the other hand, the survivors diagnosed at an older age had a negative influence on social functioning ($\beta = -.17$, $p < .05$) in American cancer children (Zebrack & Chesler, 2002)

1.1.2 Gender: Both male and female American adolescents with cancer during on-therapy was a predictor on the overall QOL (*OR* = 2.3, $p = .03$; *OR* = 3.5, $p = .001$, respectively) (Wu et al., 2007). Landolt et al. (2006) reported that gender negatively correlated with autonomy ($r = -.28$, $p < .05$), cognitive functioning ($r = -.33$, $p < .05$) and negative emotion ($r = -.36$, $p < .01$) (Landolt et al., 2006). Besides, they also found that the better score in autonomy was significantly reported in girls, while boys reported better in the cognitive and emotional domains (Landolt et al., 2006). Zebrack and Chesler (2002) reported that the male gender who had low scores in spiritual well-being can predict low QOL ($\beta = -.29$, $p < .01$). Moreover, both the physical component and mental component were influenced by gender in young Dutch adult survivors ($\beta = .13$ and .13, respectively, $p < .01$) (Stam et al., 2006). Jitnumsub (2009) reported that gender was related to the social and family domain and females reported a significantly better score in QOL than males in Thai acute leukemic patients.

1.1.3 Adequate income: Adequate income was one of factors that influenced quality of life in Thai cancer children ($\beta = .14$, $p < .01$) (Punthmatharith et al., 2013) and correlated with QOL in Thai leukemic children ($r = .236$, $p < .05$) (Wannapong et al., 1999).

1.1.4 Education: Education was another factor that influenced QOL. Punthmatharith et al. (2008) found that children's education level can predict QOL in Thai cancer children ($\beta = .198$, $p < .01$). Parent's education levels significantly correlated with QOL in Thai leukemic children with cancer ($r = .32$, $p < .001$) (Wannapong et al., 1999)

1.1.5 Personality: Personality was another factor that can predict QOL. De Clercq et al. (2004) identified that personality traits in benevolence, neuroticism (referred to emotional instability), and imagination (referred to facets of openness and intellect) predicted self-reported QoL in Belgian childhood cancer survivors ($\beta = .16$, -.38 and .21, respectively, $p < .05$).

Observably, socio-demographics were associated with the overall QOL and some domains of QOL. Age had a positive effect on physical, psychological, and social functioning. The female gender had a higher score in the spiritual domain than the male gender, while the female gender had a lower score in the psychological domain including emotional and cognitive domains than the male gender. Adequate income of a family, child and parent education levels, and a child's personality had a positive effect on the overall of QOL.

1.2 Medical status: Medical status that affected the quality of life in children with cancer included type of cancer (Chou &Hunter, 2009; Hinds et al., 2009; Zebrack & Chester, 2002), treatment (Landolt et al., 2006; Maurice-Stam et al., 2007; Reimers et al., 2009; Stam et al., 2006), complications (Landolt et al., 2006), prognosis (Maurice-Stam, Oort, Last, Brons et al., 2009; Maurice-Stam et al., 2007; Zebrack & Chester, 2002), sickness duration (Punthmatharith et al., 2013; Wannapong et al., 1999), the duration of treatment (Maurice-Stam, Oort, Last, Brons et al., 2009), and the knowledge of parents (Wannapong et al., 1999).

1.2.1 Type of cancer: Type of cancer correlated with overall QOL in Taiwanese children cancer survivors ($r = .562$, $p < .001$) (Chou & Hunter, 2009). Zebrack and Chester (2002) reported that a brain tumor can predict a low overall QOL and low social functioning in American children cancer survivors ($\beta = .16$, $p < .05$ and $\beta = .36$, $p < .001$, respectively). Children who diagnosed with leukemia were significantly reported better overall HRQOL when compared with lymphoma and solid tumors in American adolescents with cancer (Wu et al., 2007). Pek et al. (2010) compared HRQOL between haematologic malignancy and solid malignancy Singaporeans children and found that solid malignancy patients had worse in physical health summary score of PedsQL than haematologic cancer children.

1.2.2 Treatment: Therapy was a predictor on poorer overall QOL (*OR* = 3.3, p = .002) and physical functioning (*OR* = 11.8, p < .001) in American adolescents with cancer (Wu et al., 2007). In newly diagnosis Swiss cancer children, the intensity of therapy negatively correlated with emotional (r = -.329, p < .05) and physical and motor functioning (r = -.30 and -.34, respectively, p < .01) (Landolt et al., 2006). Reimers et al. (2009) identified that treatment with radiation in long-term survivors of Dane children with brain tumors can influence lower scores for physical functioning and energy, such as, difficulty with breathing (β = -.36, p < .05), tired or unsteady in arms or legs (β = -.36, p < .05), social functioning, such as, relationships to peers or interpersonal relationships (β = -.39, p < .01), cognitive functioning (β = -.41, p < .01), body image, such as, satisfaction with one's body (β = -.31, p < .05), feelings about one's body (β = -.33, p < .05), outlook on life (β = -.27, p < .05), intimate relationships (β = -.66, p < .01). In addition, lower scores for body image in feelings about one's body (β = -.32, p < .05) was present in the patients requiring a shunt to be inserted (Reimers et al., 2009).

1.2.3 Duration of treatment: The duration of the end treatment can predict the physical domain and the psychological domain in Dutch school-aged children with non-central nervous system cancers (Maurice-Stam, Oort, Last, Brons et al., 2009). The finding showed that the duration after finishing the treatment in 1, 2, 3, and 4 years were positive predictors for the physical domain of quality of life (β = .36, .32, .33, and .44, respectively, p < .05) and a positive predictor for the psychological domain of quality of life after finishing the treatment 1 and 2 years (β = .36, .54, p < .05) (Maurice-Stam, Oort, Last, Brons et al., 2009).

1.2.4 Complications: Complications negatively correlated with positive emotions ($r = -.36, p < .01$) and was negatively related to motor functioning 6 weeks after diagnosis in Swiss children with cancer ($r = -.28, p < .05$) (Landolt et al., 2006).

1.2.5 Prognosis: A good prognosis was a positive predictor on autonomy ($\beta = .35, p < .01$) (Maurice-Stam, et al., 2007). Zebrack and Chester (2002) reported that a medical condition requiring a doctor's care significantly influenced lower overall quality of life ($\beta = -.270$, $p < .001$) and lower quality of life in the physical ($\beta = -.193$, $p < .05$), psychological ($\beta = -.234$, $p < .01$), and social domains ($\beta = -.317, p < .001$) in American children cancer survivors.

1.2.6 Sickness duration: The duration of a patient's sickness influenced the overall QOL in Thai cancer children ($\beta = .19, p < .01$) (Punthmatharith et al., 2013) and correlated with Thai leukemic children ($r = .182$, $p < .05$) (Wannapong et al., 1999).

Actually, medical status was associated with overall QOL and some domains of QOL especially the physical, and psychological domains and social functioning. Brain tumors can affect the social functioning of QOL more than other kinds of cancer. A good prognosis and finishing treatment had a positive effect on the QOL in children with cancer.

2. Modifiable Factors: The modifiable factors that are associated with QOL in children with cancer are as follows.

2.1 Symptoms: The number of symptoms and symptom severity are associated with the QOL of American children following myelosuppressive chemotherapy (Baggott et al., 2011). The findings showed that the number of symptoms and symptom severity negatively correlated with overall QOL (r = -.52, r = -.61; $p < .001$, respectively). In addition, higher symptom distress scores correlated with poorer QOL in overall QOL and each domain of QOL including physical functioning, emotional functioning, social functioning, and school functioning (r = -.64, -.59, -.53, -.47, and -.36, respectively, $p < .01$) (Baggott et al., 2011). Hinds et al. (2009) also reported that only some domains of QOL including physical functioning, emotional functioning, and school functioning were influenced by symptom distress (b = -1.4, -.6, and -.7 respectively, $p < .05$) in American adolescents with either osteosarcoma or AML. Besides, Chou and Hunter (2009) identified that illness-related risks, such as, disease and symptoms was another factor that correlated with QOL and resilience in Taiwanese survivors of childhood cancer (r = -.556, r = -.38, respectively, $p < .001$).

Fatigue was one of symptoms that was associated with QOL (Meeske, Patel, Palmer, Nelson, & Parow, 2007; Ruccione & Meeske, 2013). According to Meeske et al. (2007), fatigue was associated with poorer overall HRQOL in children with cancer 8–18 years of age in the United States. In American adolescents, lower psychosocial functioning negatively correlated with fatigue after having finished treatment within 6 months (r = -.70, $p < .001$) (Ruccione et al., 2013). The level of fatigue can predict QOL in Norwegian survivors of acute childhood lymphoblastic leukemia and lymphoma (OR = 1.30, $p < .001$) (Kanellopoulos et al., 2013). Additionally, other symptoms that correlated with lower psychosocial functioning scores in American adolescents after having finished treatment within 6 months included pain, depression, and posttraumatic stress (r = -.63, -.46, and -.68 respectively, $p < .001$) (Ruccione et al., 2013). Kanellopoulos et al. (2013) identified that the level of depression was a predictor of QOL in Norwegian survivors of acute childhood lymphoblastic leukemia and lymphoma (*OR* = 1.48, $p < .001$). Moreover, Chung, Li, Chiu, and Lopez (2012) identified that depressive symptom was a negative predictor of QOL in Hong Kong Chinese children with cancer ($\beta = -.53$, $p < .001$).

However, not only QOL can be affected by symptoms but also functional status associated with the symptoms (Dodd et al., 2001). Dodd et al. (2001) identified that symptoms, such as, fatigue and pain were negatively related to functional status in American cancer patients. They found that at the end of the third cycle of chemotherapy, fatigue and pain negatively correlated with functional status ($r = -.41$ and $-.42$, respectively, $p < .05$). In addition, Ameringer, Elswick, Shockey, and Dillon (2013) identified that fatigue negatively correlated with trait anxiety in American adolescents with cancer during chemotherapy ($r = -.82$, $p < .001$)

2.2 Health status: Stam et al. (2006) reported that health status or health problems in regards to physical problem, psychosocial/ cognitive problem, and neurological problems can explain the physical components of HRQOL with 32% of the total variance and can explain the mental health components of HRQOL with 27% of the total variance in young Dutch adults with cancer ($R^2 = .32$, and .27, respectively, $p < .001$).

2.3 Illness uncertainty: Fortier et al. (2013) reported that illness uncertainty can influence HRQOL in American children with cancer ($\beta = -.30$, $p = .01$) and is related to physical functioning, emotional functioning, social functioning, and school functioning ($r = -.37$, $-.48$, $-.43$, and $-.27$, respectively, $p < .01$).

2.4 Functional status: Functional status was correlated with the overall QOL and each domain of QOL composed of physical functioning, emotional functioning, social functioning, and school function (r = .63, .65, .36, .56, and .3, respectively, p < .001) in American children following myelosuppressive chemotherapy (Baggott et al., 2011). In Swiss children newly diagnosis with cancer, low functional status negatively correlated with some domains of HRQOL including motor functioning at 6 weeks and 1 year after diagnosis (r = -.49, and -.36, respectively, p < .05) and negative emotions at 1 year after diagnosis (r = -.30, p < .05) (Landolt et al., 2006). In Thai children with chronic illness, daily life activities that are a part of physical functioning was one factor related to the quality of life (Subonggot, 2006).

2.5 Coping: Coping ability of children with cancer after diagnosis and treatment can influence anxiety and overall QOL in children with cancer. The evidence showed that disease-related cognitive coping had a positive influence on the physical, and psychological domains, and the overall QOL in Dutch children survivors (β = .33, β = .39, β = .35 respectively, p < .05) (Maurice-Stam et al., 2007). According to Stam et al. (2006), disease-related cognitive coping can explain the physical components of HRQOL with 40% of the total variance and can explain the mental health components of HRQOL with 39% of the total variance of HRQOL in young Dutch adults with cancer (R^2 = .40, and .39, respectively, p < .001). They found that predictive control strategies had a positive influence on the physical and mental components of HRQOL (β = .23 and β = .39, respectively, p < .001). On the other hand, interpretative control strategies influenced poorer levels of the physical component of HRQOL (β = -.12, p < .01) (Stam et al., 2006). Ruccione et al. (2013) identified that coping behaviors with humor was a positive predictor on the psychosocial QOL in American adolescents with cancer 6 months after the completion of treatment (b = 2.06, p < .05). Chou and Hunter (2009) reported that defensive coping was negatively related to resilience and QOL (r = -.67 and r = -.77, respectively, p <.001) in Taiwanese survivors of childhood cancer.

Additionally, coping was associated significantly with anxiety. Maurice-Stam, Oort, Last, Brons et al. (2009) identified that higher scores of disease-related cognitive coping was associated with lower levels of trait anxiety (β = -.18, p < .05). Frank, Blount, and Brown (1997) reported that child depressive attributions and avoidance coping can explain anxiety in 19% of the total variance (R^2 = .19, p < .001) and avoidance coping can predict levels of anxiety (β = .29, p < .01) in several ethnic children with cancer including African American, Caucasian, Hispanic, Indian, and Vietnamese. In addition, Compas et al. (2014) reported that secondary control coping was a significant negative predictor on anxiety/depression in American children with cancer (β = -.37, p < .001)

2.6 Resilience: Resilience is a positive adjustment when faces with difficulty situation. Chou and Hunter (2009) reported that factors related to the quality of life in Taiwanese survivors of childhood cancer included resilience (r = 0.524, p < .001).

2.7 Trait anxiety and State anxiety: The level of anxiety in children with cancer after diagnosis and treatment can influence the overall QOL in children with cancer. Sato et al. (2013) identified that Japanese children with brain tumors perception of HRQOL can be influenced by trait anxiety (β = -.43, p < .05) while state anxiety correlated with HRQOL (r = -.27, p < .05). Fortier et al. (2013) reported that child state-anxiety was a negative predictor in HRQOL in American children with cancer while receiving treatment for cancer (β = -.29, p = .01). Kanellopoulos et al. (2013) identified that the level of hospital anxiety can predict QOL in Norwegian survivors of childhood acute lymphoblastic leukemia and lymphoma (*OR* = 1.13, $p = .03$).

2.8 Self-esteem: Chung et al. (2012) identified that self-esteem positively correlated with QOL ($r = .46$, $p < .01$) while self-esteem negatively correlated with depressive symptom ($r = -.53$, $p < .01$) in Hong Kong Chinese children with cancer.

2.9 Family functioning: Family functioning can affect QOL in American adolescents with cancer (Barakat et al., 2010). According to Barakat, et al. (2010), lack of a clarity role in the family had a negative effect in the psychological domain of quality of life ($\beta = -.32$, $p < .01$) and a negative effect in the physical domain of quality of life ($\beta = -.21$, $p < .10$).

2.10 Self-care behavior: Self-care behavior can influence QOL (Punthmatharith et al., 2013). Self-care behavior can influence the quality of life in Thai children with cancer ($\beta = .32$, $p < .01$) (Punthmatharith et al., 2013) and was correlated in Thai leukemic children ($r = .476$, $p < .001$) (Wannapong et al., 1999).

2.11 Protective factor: Protective factors include family, peers, school and social relationships (Hasse, 2004 as cited in Chou & Hunter, 2009). Chou and Hunter (2009) reported that protective factors correlated with resilience ($r = .978$, $p < .001$) and QOL ($r = .458$, $p < .001$) in Taiwanese survivors of childhood cancer. Overprotection from family had a positive effect in the psychological domain of quality of life ($\beta = .20$, $p < .1$) in American children with cancer (Barakat et al., 2010). Zebrack and Chester (2002) identified that the psychological domain of quality of life was influenced by living arrangements. They found that living alone in American adolescents surviving cancer was a negative predictor on QOL ($\beta = -.26$, $p < .001$)

(Zebrack & Chester, 2002). In addition, government assistance correlated with overall QOL ($r = -.27$, $p < .01$) (Chou & Hunter, 2009). Wannapong et al. (1999) reported that relationships at school positively correlated with QOL of Thai leukemic children ($r = .476$, $p < .001$). In addition, Maurice-Stam et al. (2007) identified that the exchange of emotion by more parents asking had negatively influenced physical functioning, cognitive functioning, and negative moods ($\beta = -.26$, $\beta = -.34$, $\beta = -.33$, respectively, $p < .05$).

2.12 Physical activity: Paxton et al. (2010) reported that leisure-time physical activity can influence HRQOL ($\beta = .27$, $p < .001$) among American adolescent survivors of childhood cancers.

2.13 Pessimism and optimism: Williams, Davis, Hancock, and Phipps (2010) identified that pessimism and optimism can influence some domains of QOL. Pessimism can negatively influence mental health, general behavior, and impact on family ($\beta = -.22$, $\beta = -.26$, $\beta = -.22$, $p < .001$, respectively) while optimism can positively influence low rating body pain, self-esteem, mental health, and general behavior ($\beta = .22$, $\beta = .38$, $\beta = .20$, $\beta = .18$, $p < .001$, respectively).

2.14 Parent's knowledge in caring for their children had a significant correlation with QOL in Thai leukemic children with cancer ($r = .32$, $r = .34$, respectively, $p < .001$) (Wannapong et al., 1999)

The findings from the literature review showed that several factors associated with QOL in children with cancer (Figure 2). The correlation and prediction coefficient among modifiable variables on QOL in children with cancer were presented in Figure 3.

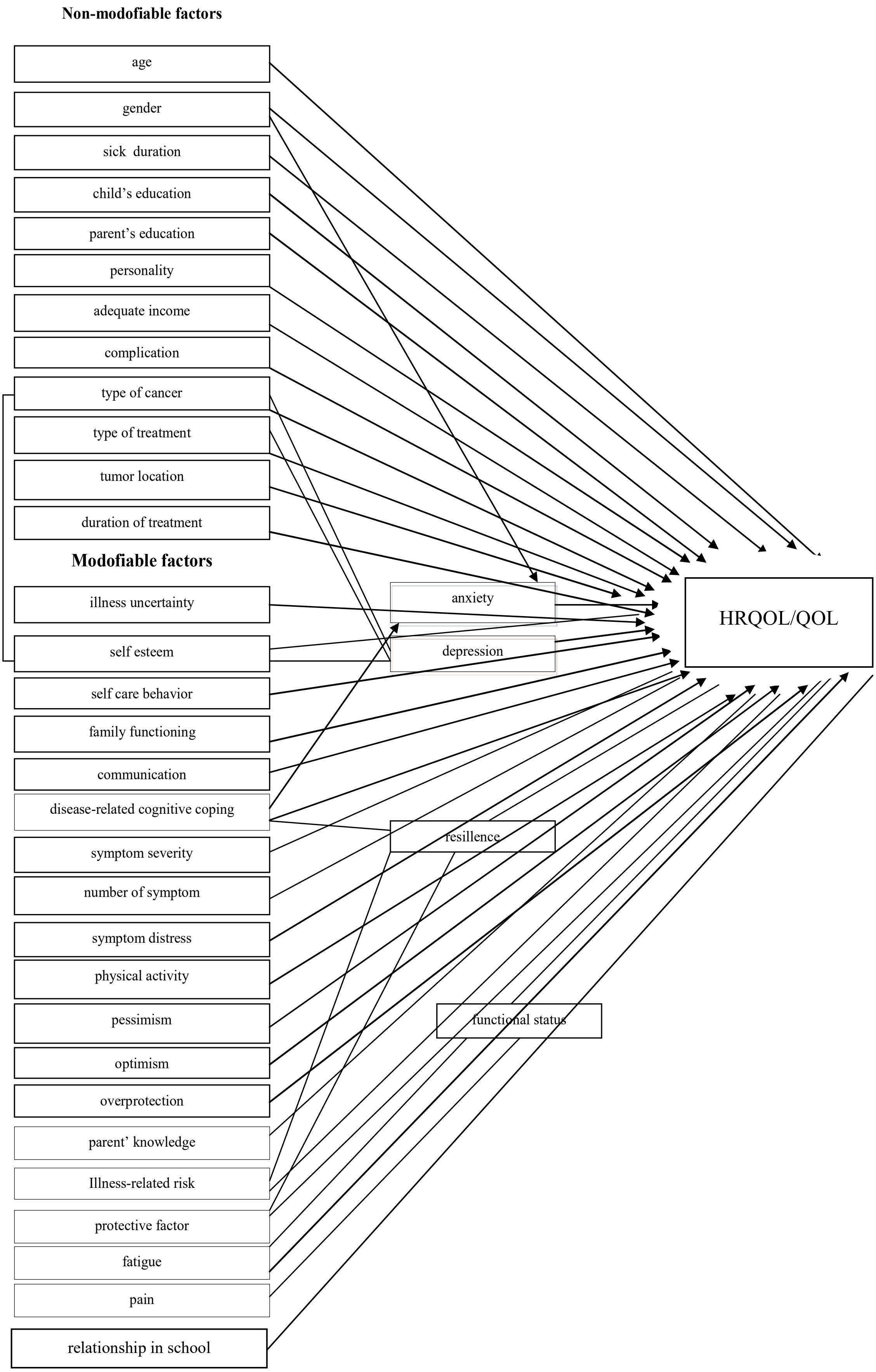

Figure 2. The relationships among predictive and relative non modifiable and modifiable variables on QOL/HRQOL

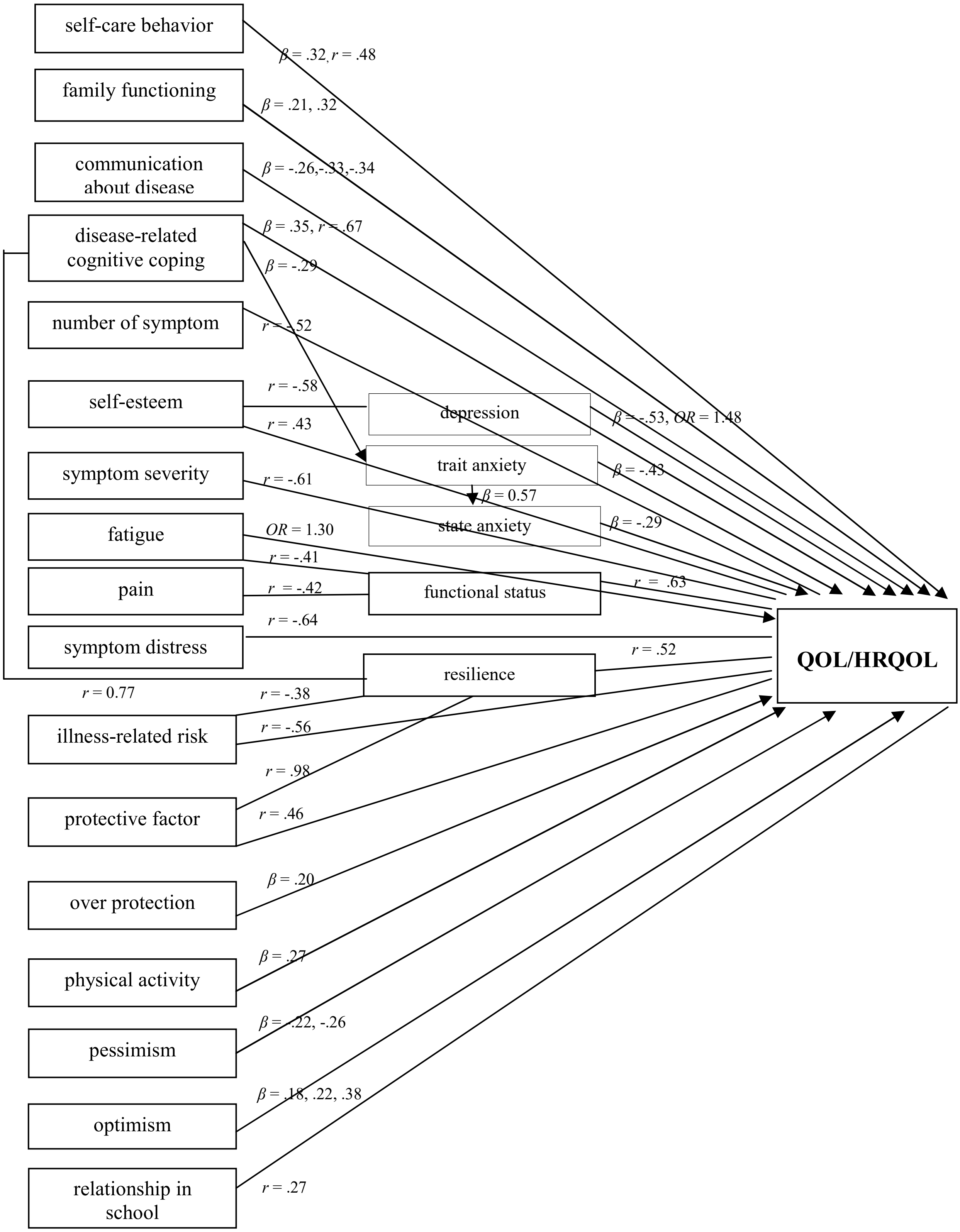

Figure 3. The relationships among predictive and relative modifiable variables on QOL/HRQOL

2.4 Measurements

HRQOL instruments are normally multi-dimensions and used to measure the effects of disease and treatment covered physical, psychological, and social functioning dimensions from subjective point of view (Solans et al., 2008). Davis et al. (2006) proposed that the instruments used to measure QOL in children must have clear operational definition of QOL; have QOL theory base in children; comprise of the significant domains of life, and have well-constructed items. Even though HRQOL is a broad construct, two types of HRQOL instruments were found including generic and specific instruments (Guyatt, Feeny, & Patrick, 1993). Hinds (2010) identified that the instruments that were more generally used to assess HRQOL in pediatric cancer patients contained a wide variety of domains. Physical, social, school or cognitive, and emotional health aspects were the most commonly measured domains. However, autonomy, self-esteem, aggressiveness, play manipulation, compliance, and sexuality aspects were the less commonly measured domains (Hinds, 2010).

The generic or cancer-specific HRQOL instruments, age appropriate for children and adolescents 9-18 years of age instruments, and self-report instruments are the following.

1. Generic HRQOL instruments

1.1 The Child Health Questionnaire Child Form (CHQ-CF87): This instrument has been used to measure HRQOL in children and adolescents ages 10-18 years (Hullmann, Ryan, Ramsey, Chaney, & Mullins, 2011) either healthy or experiencing acute or chronic illness, such as, arthritis, systemic lupus erythematosus (SLE). The CHQ-CF87 has a similar structure as the Short Form 36 Health Survey

(SF-36) (Hullmann, Ryan, Ramsey, Chaney, & Mullins, 2011). The construct of CHQ-CF87 covers to measure the self-perceived physical and psychosocial well-being of children. The instrument consists of 87 items added in 10 dimensions including physical functioning, role functioning-emotional, role functioning-behavior, role functioning-physical, bodily pain, general behavior, mental health, self-esteem, general health, and family cohesion. It has a Likert-type summated rating scale. The quality of the instrument was tested in healthy children and adolescents 9-17 years of age. The internal consistency reliability ranged from .56 - .90 (Physical functioning had Cronbach alpha below .70). The stability of the instrument was test by using test-retest. Only some items were presented in acceptable value (Raat, Landgraf, Bonsel, Gemke, & Essink-Bot, 2002). The CHQ-CF87 could significantly discriminate between children without and children with chronic diseases, such as, allergies, eczema, migraine, and asthma (Raat et al., 2002; Raat, Mangunkusumo, Landgraf, Kloek, & Brug, 2007). However, the acceptable value of consistency reliability for new instrument was more than .70 (Polit, & Beck, 2012). The questionnaire was considerate too long. Therefore, this instrument was not suitable for this study.

1.2 KINDL-R: This instrument has been used to measure HRQOL in healthy and sickness children and adolescents aged between 4-16 years old based on a self-report and proxy report from parents (Hullmann et al, 2011). The KINDL-R consisted of 6 dimensions and 24 items with a 5-point Likert scale from 1 (never) to 5 (all of the time). It consists of physical well-being, emotional well-being, self-esteem, family, friends, and everyday functioning in school dimensions (Erhart, Ellert, Kurth, & Ravens-Sieberer, 2009; Hullmann et al, 2011). Besides, in the case of prolonged illness or hospitalization case, an optional subscale of disease has been added (Hullmann et al., 2011).

A higher value demonstrates better HRQOL. The scores are transformed into values between 0 and 100 and a higher value indicates better HRQOL (Erhart et al, 2009). According to Erhart et al. (2009), the psychometric properties of instrument were tested in children, adolescents, and their parents. The Cronbach's alpha values for the sub-dimensions ranged from .53 to .72 and for the total score, the Cronbach's alpha was .83. The convergent validity showed correlation with the Strength and Difficulties Questionnaire (SDQ) (r = .33 - .59). However, this instrument did not use in this study because the internal consistency in some sub-dimensions was lower than .70. Therefore, this instrument was not suitable for this study.

1.3 KIDSCREEN-52: This instrument is a self-report and is used to measure HRQOL in healthy children and adolescents aged between 8 and 18 years and those with chronic illness (Ravens-Sieberer et al., 2005). This instrument has been applied in 12 countries in European (Ravens-Sieberer et al., 2005). The existing from the literature review, expert consultation, and focus group with children and adolescents were used to develop this instrument. After items generation, a translation process following international translation guidelines, cognitive interviews and a pilot test were performed (Ravens-Sieberer et al., 2001). The instrument consists of 10 dimensions including physical well being, psychological well-being, moods and emotions self-perception, autonomy, parent relations and home life, social support, school environment, social acceptance, and financial resources and 52 five-point Likert scale items. (Ravens-Sieberer et al., 2005). Scores each dimension are computed and transformed into T-values with a mean of 50 and a standard deviation of 10 with higher scores indicating higher HRQOL and well-being. The psychometric properties showed Cronbach's alpha ranging from .77 to .89. Correlation coefficients that used to assess the similar constructof instrument between KINDL-R and KIDSCREEN-52 dimensions were highly reported (*r* = .51 - .68) (Ravens-Sieberer et al., 2005). Even though the quality of the instrument had presented with an acceptable value, the instrument has been developed and widely used in Europe that not related to the Thai context. Therefore, this instrument was not suitable for this study.

1.4 TNO-AZL Children's Quality of Life - Child form (TACQOL -CF): This instrument is a self-report generic instrument used to measure HRQOL in children and adolescents with chronic illness aged between 8 and 15 years (Verrips, et al., 1999). The TACQOL composes of 56 items added in 7 dimensions including physical functioning, basic motor functioning, autonomy, cognitive, social functioning, positive emotional functioning, and negative emotional functioning (Verrips, et al., 1999). Children were asked to rate the problems on a 4-point Likert-scale. Greater scores indicated better HRQOL. The quality of the instrument was evaluated in healthy children aged 8-11 years old. The internal consistency ranged from .65 to .84. The correlation coefficients between TACQOL and KINDL ranged from .24 to .60 (Verrips et al., 1999). In Dutch children with cancer, the internal consistency ranged from .66 to .85, except the internal consistency of social functioning was lower than .60 (Maurice-Stam et al., 2007). Since the reliability of the instrument had presented with an unacceptable value, this instrument was not suitable for this study.

1.5 The Pediatric Quality of Life Inventory Version 4.0 (PedsQL 4.0): The PedsQL 4.0 is a generic instrument and has been used to evaluate the HRQOL in healthy children and adolescents aged 2-18 years old as well as those with acute and chronic illness (Hullmann et al, 2011). The instrument was developed to measure the main dimensions of health that had been outlined in a WHO definition (Hullmann et al, 2011). The construct of the instrument was based on a literature review, interviews with patients and their families, and discussion with pediatric healthcare professionals (Varni, Seid, & Rode, 1999). The instrument consists of a 23 five-point items with Likert scales ranging from 0 to 4 from (0 = never a problem, 1 = almost never a problem, 2 = sometimes a problem, 3 = often a problem, and 4 = almost always a problem). The PedsQL composes of four domains including physical, emotional, social, and school functioning. The scores are counted as two summary scores including physical health summary score and the psychosocial health summary score that cover the emotional, social, and school functioning subscales. In addition, the overall can be counted. The higher scores indicate better HRQOL (Varni, Seid et al., 1999). This instrument has many versions such as version for children aged 2-4 years old, 5-7 years old, 8-12 years old, and adolescent aged 13-18 years. This instrument was developed for child self-report and parent-proxy report (Varni, Seid et al., 1999).

The internal consistency reliability of the instrument had been presented as follows; for the total scale score (α = .88 child, .90 parent report), physical health summary score (α = .80 child, .88 parent report), and psychosocial health summary score (α = .83 child, .86 parent report) (Varni, Seid, & Kurtin, 2001). The internal consistency reliability was reported an acceptable value (Polit & Beck, 2012). This instrument can discriminate between healthy children and children with acute or chronic illness (e.g., orthopedic, diabetes, heart disease, or rheumatoid arthritis) (Varni et al., 2001). In children with cancer, the internal consistency reliability of the instrument had presented with an acceptable value (α = .88 child, .93 parent report for the total scale score) (Varni, Burwinkle, Katz, Meeske, & Dickinson, 2002). Even though the quality of this instrument had been reported within proper values, the instrument had been developed and tested in Western countries. Therefore, this instrument was not suitable to use in Thai context.

1.6 The Thai version of the Pediatric Quality of Life Inventory Version 4.0 (Thai PedsQL 4.0): This instrument has been used to evaluate the HRQOL in healthy children, adolescents and those with chronic illness (Varni, 2015). The instrument was translated from the Pediatric Quality of Life Inventory Version 4.0. The Thai PedsQL 4.0 was similar to the original version and the number of items was equal to those of the original version (Varni, 2015). According to Sritipsukho, Wisai, & Thavorncharoensap (2013), the Thai version of PedsQL could be used to measure HRQOL in Thai children aged 8 - 15 years. The reliability and validity of instrument was tested. The internal consistency reliability for the total scale score for self-report and proxy-report presented suitable values (α = .84 self-report, .88 proxy-report). For the physical health summary score and psychosocial health summary score, the internal consistency reliability was higher than .70 (α = .76 self-report, .79 proxy-report; α = .74 self-report, .85 proxy-report, respectively). The mean scores of HRQOL in School children higher than those with chronic health conditions including heart disease, asthma, renal disease, and thalassemia for all subscales with mean differences of 3.1 - 12.4 for self-report ($p < .03$) and 7.7 - 15.6 for proxy-report ($p < .001$).

Test-retest reliability had shown correlation coefficients above .60 in all subscales (*p* < .001). In Thailand, this instrument had been widely used in children with chronic illness, such as, HIV (Punpanich et al., 2010), thalassemia (Thavorncharoensap et al., 2010), and cerebral palsy (Tantilipikorn et al., 2013). Besides, the reliability of instrument had presented with an adequate value (Punpanich et al., 2010; Sritipsukho et al., 2013; Tantilipikorn et al., 2013)

Since this instrument was suitable for the Thai context and the reliability of the instrument had been reported with an acceptable value. Therefore, this instrument was appropriate to use in this study. However, before using this instrument, the reliability of the instrument was tested in children with cancer to confirm the internal consistency of the instrument in children with cancer in the Thai context.

2. Cancer specific instruments

2.1 Minneapolis-Manchester Quality of Life Adolescent Questionnaire (MMQL): The instrument is a multidimensional and self-report instrument to assess HRQOL in adolescents surviving with cancer (Bhatia et al., 2002). The MMQL was developed by Bhatia and colleagues in 2002. This instrument had three versions depending on the development including the MMQL-Youth Form (children aged 8-12 years), the MMQL-Adolescent Form (adolescent aged 13 - 20 years), and the MMQL-Young Adult Form (adult aged 21 - 45 years) (Bhatia et al., 2002). According to Wu et al. (2007), the MMQL instrument composed of 46-items form in seven domains including physical, cognitive, psychological, social functioning, body image, intimate relations, and outlook on life. It had a 5 - point Likert scale. Higher scores on the MMQL indicated few negative impact and greater HRQOL. The quality of the

MMQL-Adolescent Form had been tested in healthy adolescents 13-20.9 years of age as well as those with cancer. The internal consistency reliability for all items ranges from .67 to .89 (overall α = .92). For the discriminate validity, the MMQL could discriminate three different populations including healthy adolescents, on and off therapy adolescents with cancer. This instrument had a high correlation with the Child Health Questionnaire (CHQ). The MMQL-Adolescent Form had very stable in all scales tested after demonstrated with the test-retest reliability method also (Bhatia et al., 2002). Even though the instrument had been developed specifically for cancer survivors, the internal consistency reliability in some items was present lower than .70. The acceptable value of consistency reliability for a new instrument was more than .70 (Polit, & Beck, 2012). However, the quality of the instrument had been reported only in adolescents and had not cover MMQL-Youth Form (8 to 12 years). Therefore, this instrument was not suitable for this study.

2.2 The Pediatric Cancer Quality of Life Inventory (PCQOL): This instrument has been used to evaluate HRQOL in children with cancer (Varni, Katz, Seid, Quiggins, Friedman-Bender et al., 1998). The instrument had been constructed from a literature review, interviews with patients and their families, and discussion with health-care professionals. The PCQOL composes of 84 items that covered the 5 domains of physical functioning, disease-related and treatment-related symptoms, psychological functioning, social functioning, and cognitive functioning. It is a 4-point Likert scale (from 0 = never a problem to 3 = always a problem). Patients were asked to think back over a 1-month period. The PCQOL was addressed in two forms depending on child development including a child form (8 to 12 years old), and an adolescent form (13 to 18 years old) (Varni, Katz, Seid, Quiggins, Friedman-

Bender et al., 1998). The psychometric properties of the instrument had not been reported. Only a concordance with both children and adolescents with their parents was reported in the medium effect size (Varni, Katz, Seid, Quiggins, Friedman-Bender et al., 1998). The length of the scale was too long and the psychometric properties of the instrument had not been presented. Therefore, the PCQOL was not suitable for this study.

2.3 The Pediatric Cancer Quality of Life Inventory-32 (PCQL-32): This instrument is a short form of PCQOL used to measure HRQOL in cancer children aged between 8 -18 years old during on and off treatment (Varni, Katz, Seid, Quiggins, & Friedman-Bender, 1998). There are two forms of the instrument including a patient self-report form and parent proxy-report form. The PCQOL composes of 32 items and covers in the 5 domains of physical functioning, disease-related and treatment-related symptoms, psychological functioning, social functioning, and cognitive functioning. It is a 4-point Likert scale (from 0 = never a problem to 3 = always a problem). The internal consistency of the instrument was tested in pediatric cancer and their parents. Both patient and parent forms have reported internal consistency reliability at high levels in the overall scale (.91 and .92, respectively) and each domain in the patient form ranged from .69 to .83 and for the parents form results ranged from .64 -.85. (Varni, Katz, Seid, Quiggins et al., 1998). In addition, feasibility and a range of measurements had been evaluated. The result showed very good feasibility and range of measurement (Varni, Rode et al., 1999). However, this instrument was not appropriate to be used in this study because the internal consistency reliability values of some domains were lower than an acceptable value.

2.4 The Pediatric Cancer Quality of Life Inventory 3.0 (PedsQL 3.0): This instrument is used to measure HRQOL in pediatric patients with cancer who are on or off treatment with discrete version for different age groups of children; 5-7 years old, 8-12 year olds, and 13-18 years old. The instrument composed of 27 items with a 5-point Likert scales and encompasses 8 domains including pain and hurt, nausea, procedural anxiety, treatment anxiety, worry, cognitive problems, perceived physical appearance, and communication (Varni et al., 2002). The higher scores indicate better HRQOL. Psychometric analysis had shown acceptable internal consistency reliability for parents and some domains of the child report. Cronbach's alpha coefficients were more than .70 for all parents and children 13-18 years of age, and from .37 to .84 for children 8-12 years of age (Varni et al., 2002). The internal consistency coefficients of some domains of this instrument had demonstrated lower than adequate values. Therefore, this instrument was not used in this study.

2.5 The Quality of Life for Children with Cancer Scale (QOLCC): This instrument was developed in Taiwan and is used to assess QOL in pediatric patients with cancer (7–18 years) who were on and off treatment as well as their caregivers (Yeh, Chao, & Hung, 2004). The instrument composed of three versions including a patient self-report (QOLCC-7-12, for children aged 7-12 years; QOLCC-ADO for adolescents aged 13-18 years) and a parent proxy-report (QOLCC-PAR). A literature review and interviews with children with cancer and their caregivers were guided to develope The QOLCC (Yeh, Chao et al., 2004). The instrument composed of 40 items with a 4-point Likert scales (0 = never, 1 = sometimes, 2 = often, and 3 = always being a problem) and is covered in the seven domains of physical, psychological, social, disease/treatment, cognitive, understanding, and communication.

Higher scores indicated a higher level of symptoms or health-related problems (Yeh, Chao et al., 2004). Psychometric validation had been tested in children with cancer. The Cronbach's alpha coefficients ranged from .65 to .90. The construct validity that was tested by a confirmatory factor analysis (CFA) showed the goodness of fit (Yeh, Chao et al., 2004). The feasibility for the QOLCC was very good (Yeh, Hung, & Chao, 2004). However, this instrument was not used in this study because the internal consistency reliability value of some parts of the instrument had been reported with unacceptable values.

In conclusion, from the prior studies, the instruments used to assess HRQOL in children with cancer varied. However, in this study, the Thai PedsQL 4.0 was suitable to use because this instrument is a generic instrument that can be applied to measure HRQOL in generally and can be used to explore the impact of illness on life as a whole (Ferrans, 2010). This type of instrument can be applied to several types of patients and healthy people (Ferrans, 2010; Tian-hui, Lu, & Michael, 2005) and was useful to make comparisons about HRQOL between with healthy population and other illness patients (Ferrans, 2010). On the other hand, disease-specific instruments provided more specific data but cannot be used to compare HRQOL between illness groups or healthy populations (Spieth & Harris, 1996). This instrument is a self-assessment and is appropriate for children with cancer aged 9-18 years old. The instrument had been translated from English into Thai and the content validity had been examined until it demonstrated suitability with disease and the Thai context. In addition, the reliability of the instrument had been reported in acceptable values.

3. A proposed causal model of health-related quality of life in children with cancer

The variables were selected and tested in the model based on the revised Wilson and Cleary conceptual model of HRQOL (WCM) by Ferrans et al. (2005) and previous evidence. According to Bakas et al. (2012), the revised WCM of HRQOL by Ferrans et al. (2005) was appropriate for application in this study because it offers a better clarification than the original version. Besides, the revised version provided a theoretical background for each component of the model and the examples of the instrument to measure some of the components (Ferrans et al., 2005). Therefore, the revised version of the WCM was used as a conceptual model for this study. According to Ferrans et al. (2005), the revision of the WCM comprises the following 6 components that can influence the overall quality of life including biological function, symptoms, functional status, general health perception, characteristics of the individual, and characteristics of the environment. In addition, there are several research studies that provide evidence identifying the factors that are associated with QOL in children with cancer including non-modifiable factors and modifiable factors.

However, in this study, only the modifiable factors that could be improved by health care providers, patients, and care givers were selected. The selected factors have been shown to have a statistical support of a moderate-to-high level (Cohen, 1988), in terms of either correlation or prediction coefficients, with QOL or HRQOL. Additionally, most of these factors are important predictors of HRQOL, and relevant to the Thai context. From the reviews, the variables that were tested in the model were as follows.

Family functioning: This component represented the characteristics of the environment which is one component of the revised WCM. In the revised WCM, this component had a direct effect on overall QOL and indirect effect on overall QOL via biological function, symptoms, functional status, and general health perception. From the prior study, this family functioning can influence both physical and psychosocial domains of HRQOL in American adolescents with cancer (Barakat, Marmer, & Schwartz, 2010). Although Thai families were different from Western families, in Thai adolescents with asthma which was a chronic illness like cancer, family functioning could predict self-esteem and resourceful coping (Preechawong et al., 2007). Both self-esteem and coping could influence QOL in children with cancer (Chung et al., 2012; Stam et al., 2006). Besides, the meta-analysis results reported that family functioning had positively correlated with children with cancer and sibling adjustment ($r = .19$; *95% CI*: .13–.24) (Van Schoors, et al., 2017).

Coping: This component was selected based on the prior studies. Coping is often defined as efforts to diminish distress. Disease-related cognitive coping can influence the psychological domain in Dutch school-aged children with non-central nervous system cancer after successful treatment. (Maurice-Stam, Oort, Last, Brons et al., 2009). Stam et al. (2006) reported that disease- related cognitive coping can predict physical and mental components of HRQOL in young Dutch adults with cancer. In addition, lower levels of trait anxiety were associated with the higher scores of disease-related cognitive coping (Maurice-Stam, Oort, Last, Brons et al., 2009).

Trait anxiety and State anxiety: Those factors represented symptoms which is one component of the revised WCM. In the version of the WCM, this component had indirect effect on overall QOL via functional status, and general health perception, and also affected by characteristics of the individual, characteristics of the environment, and biological function. The prior studies found that trait anxiety and state anxiety can predict HRQOL in children with cancer. The lower levels of trait anxiety were associated with the higher scores of disease-related cognitive coping (Maurice-Stam, Oort, Last, Brons et al., 2009). Sato et al. (2013) identified that from the perception of children with brain tumors, HRQOL was affected by their trait and state anxiety. Fortier et al. (2013) reported that child state-anxiety was a negative predictor on HRQOL in American children with cancer while receiving treatment for cancer.

Symptom distress: This factor also represented symptoms. As previously mentioned, this component had an indirect effect on overall QOL via functional status, and general health perception, and also affected by characteristics of the individual, characteristics of the environment, and biological function. In the revised WCM, symptoms also provide either global or symptom-specific measurements. Frequency, intensity, and distress are the most common dimensions of symptoms (Ferrans et al., 2005). There are many physical and psychological symptoms after diagnosis and treatment in children with cancer. The most common physical symptoms experienced by hospitalized children with cancer were nausea, fatigue, and pain (Miller et al., 2011). According to Dodd, Miaskowski, and Paul (2001), fatigue, and pain can predict the functional status of a patient with cancer. This is similar in Thai leukemic children, in that fatigue occurred frequently in leukemic children receiving chemotherapy and interfered with functional status at a moderate level (Prajimtis, 2004). For the psychological symptoms, Chung et al. (2012) reported that depressive symptoms were a predictor of the quality of life in Chinese survivors of childhood cancer. Besides, symptoms were related to the overall QOL (Baggott et al., 2011) and some domains of HRQOL especially physical functioning, emotional functioning, and social functioning (Baggott et al., 2011; Hinds et al., 2009). Baggott et al. (2011) identified that the number of symptoms, symptom severity, and symptom distress related to HRQOL of American children following myelosuppressive chemotherapy. In Thai children with cancer, even though no evidence supports symptoms that predict HRQOL, several prior studies identified those symptoms were associated with HRQOL in cancer children. Jitnumsub (2009) reported that lower HRQOL was present in Thai patients who had nausea, vomiting, bad appetite, weakness, and fatigue.

Functional status: This factor is one component in the revised WCM. It is considered to have an indirect effect on HRQOL via the general health perception. This component was also influenced by symptoms, characteristics of an individual, and environmental characteristics (Ferrans et al., 2005). Functional status was related to the overall HRQOL in American children following myelosuppressive chemotherapy (Baggott et al., 2011) and some domains of HRQOL including physical functioning, and emotional functioning, as well as in Dutch children newly diagnosis with cancer. In Thai children with chronic illness, daily life activities that are a part of physical functioning was one factor related to the quality of life (Subonggot, 2006).

Self-care behavior: This factor was selected from the prior research studies. The evidence from the previous studies identified that self-care behavior can predict QOL in many populations, such as, heart failure patients (Macabasco-O'Connell, et al., 2011). In Thai children with cancer, the finding showed that self-care behavior was a positive predictor of quality of life in Thai children with cancer (Punthmatharith et al., 2013) and had correlated with Thai leukemic children (Wannapong et al., 1999).

From the prior studies, there were several factors that can influence HRQOL in children with cancer. The mediating factors were trait anxiety state anxiety and functional status. The predictive factors were family functioning, coping, symptom distress, and self-care behavior. The proposed model in this study was presented in Figure 4.

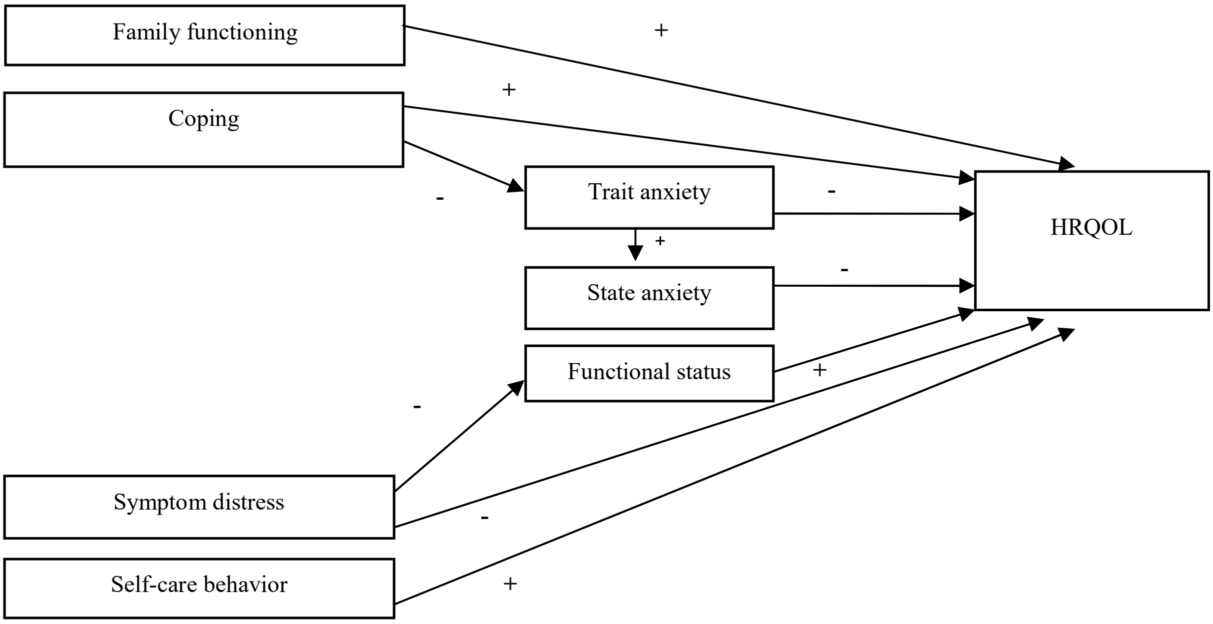

Figure 4. The proposed causal model of HRQOL in children with cancer

4. Instruments of independent variables in the study

Seven independent variables included coping, trait anxiety, state anxiety, symptom distress, family functioning, self-care behavior, and functional status were tested in this study. The selected instruments used to measure each independent variable in this study depended on the self-report instrument [except the Play-

Performance Scale for Children (PPSC) (parent's rating)], age appropriate for children and adolescents, the quality of instruments present with an acceptable value, and were suitable for use in the Thai context as follows.

1. Coping

1.1 Cognitive Control Strategies Scale (CCSS) was used to examine disease-related cognitive coping (Maurice-Stam, Oort, Last, Brons et al., 2009). The instrument was developed based on the model of Rothbaum, Weisz, & Snyder (1982). The instrument consists of 25 items that are grouped into 4 scales: predictive control (deal with the illness by using optimistic), vicarious control (attributing power to medical, caregivers and treatment), interpretative control (recognize emotional reactions and gain insight into the situation by searching for information), and illusory control (effort the chance-determined outcome) and was measured on a 4-point Likert scale. A higher score indicated higher cognitive coping. The Cronbach's alpha in the prior study ranged from .69 to .83 (Maurice-Stam, Oort, Last, Brons et al., 2009).

1.2 Schoolagers' Coping Strategies Inventory (SCSI): This instrument used to evaluate the frequency and effectiveness of stress-coping strategies for children 8-12 years old. The construct of instrument was based on Lazarus's stress-coping theory. The instrument composed of 26 items scored on 4-Likert scale and consisted of 2 parts including frequency and effectiveness (Ryan-Wenger, 1990). The reliability of the instrument was tested in school-aged children. The internal consistency for frequency scale, effectiveness scale and total scale were .76, .77, and .79, respectively. Test-retest reliability after 2 weeks ranged from .73-.82. (Ryan-Wenger, 1990).

3. KIDCOPE: This instrument is a brief coping scale and self-report instrument used to evaluate coping behavior in children (7-12 years old) and youths (13-18 years old) with chronic illness, such as, diabetes, and cancer (Blount et al., 2008). The instrument was developed based on the existing previous coping instruments that were too long in the number of items. This instrument composed of 10 items covering the common categories of coping which are problem-solving, distraction, social support, social withdrawal, cognitive restructuring, self-criticism, blaming others, emotional expression, wishful thinking, and resignation (Spirito, Stark, & Williams, 1988). The instrument was scored on a 4-point Likert scale for frequency and a 5-point Likert scale for effectiveness. The quality of the instrument was tested in healthy adolescents. Test-retest reliability of the KIDCOPE showed minimal consistency within individuals over time when administered 3 days, 7 days, or 10 weeks apart. The convergent and discriminate validity of the instrument revealed moderate to high correlations between the KIDCOPE and Coping Strategies Inventory (range = .55 to .77) and Adolescent Coping Orientation for problem experiences (range = .42 to .62) (Spirito et al., 1988).

4. **Coping of Disease Inventory (CODI):** This instrument is a self-report instrument and is used to evaluate coping in children and adolescents (8-18 years old) with chronic illness (e.g. asthma, epilepsy, diabetes, arthritis, atopic dermatitis, cerebral palsy, and cystic fibrosis) and has been used in Europe (Petersen, Schmidt, & Bullinger, 2004). The construct of the instrument was developed based on a focus group in children with chronic illness (Petersen et al., 2004). CODI consists of 29 items added in 6 domains including acceptance, avoidance, cognitive–palliative

distance, emotional reaction wishful thinking and distance. The internal consistency in each domain ranges from .69-.83 (Petersen et al., 2004).

5. The Thai version of Coping of Disease Inventory (Thai CODI): This instrument was translated from the English version of CODI and back translated from English into Thai (Silapavitayatorn, 2008). The Thai version of CODL composes of the same 6 domains as the original version. However, item of this instrument was deleted following advice from an expert panel. Therefore, 28 items are included in 6 domains and is measured on a 5-point Likert scale in the Thai version. The content validity of the instrument overall items showed was tested by an expert panel. The internal consistency of the instrument was tested in Thai children with cancer, and the Cronbach's alpha coefficients was .86 (Silapavitayatorn, 2008).

From the review, there were several instruments used to measure coping in children. However, the Thai version of CODI was suitable for this study because in previous studies, the quality of this instrument had presented with an acceptable value in children with cancer. In addition, this instrument had been modified from the original version until it was appropriate for use in the Thai context.

2. Anxiety

2.1 State-Trait Anxiety Inventory for children (STAIC): This instrument has been used to determine anxiety in children (Maurice-Stam, Oort, Last, Brons et al., 2009; Sato el al., 2013). STAIC is one of the most frequently used measures of anxiety in applied psychology research. This instrument was developed by Spielberger et al. (as cited in Chaiyawat & Brown, 2000). The instrument composes of 40 items of self-report scales in two questionnaires, state anxiety (A-State) and trait anxiety (A-Trait). The A-State scale measures temporary anxiety. The scale consists of subjective, the perception of nervousness, tension, and worry. This intensity of this type of anxiety varies and fluctuates over time to indicate current experiences of a particular symptom. The A-Trait scale measures personal trait. This type of anxiety relates to the character that perceives the threatening and responds to the elevation in anxiety (Papay & Spielberger, 1986). Each scale consists of 20 items, and the items are scored from 1 to 3, with the total score on each scale ranging from 20 to 60. Higher scores on both scales indicated a higher level of anxiety (Southam-Gerow, Flannery-Schroeder, & Kendall, 2003). The quality of instrument was examined in healthy children. The internal consistencies of the STAIC scales were reported in acceptable value. Alpha coefficients for male subjects were .78 (A-Trait scale) and .82 (A-State scale), and for female subjects .81 (A-Trait scale) and .87 (A-State scale). The test and retest reliability of the A-Trait were .65 and .71 for male and female subjects respectively; the test and retest correlation coefficients of the A-State scale were .31 and .47 for male and female subjects, respectively (Chaiyawat & Brown, 2000). Concurrent validity was examined with the correlation of the STAIC with the Children's Manifest Anxiety Scale (CMAS) (r = .75); and the General Anxiety Scale for children (GAS) (r = .63). For construct validity, the A-State scale could significantly discriminate between children in norm and test conditions.

Even though this instrument was tested in healthy children, the instrument was widely used in children with chronic illness included chronic renal disease (Kiliś-Pstrusińska et al., 2013), and cancer (Maurice-Stam et al., 2007; Fortier et al., 2013; Sato, 2013). Cronbach’s alpha coefficients reported in children with cancer for state - and trait- scale were .89 and .89, respectively (Sato, 2013). From prior studies, there were many versions, such as, the Japanese version (Sato, 2013), and Dutch version (Maurice-Stam et al., 2007; Sato, 2013). However, they were not suitable for use in Thai children with cancer.

2.2 The Thai versions of State-Trait Anxiety Inventory for Children: This instrument was translated from STAIC used to identify State-Trait Anxiety in children 8-13 years of age into Thai by Chaiyawat and Brown (2000). The validity of the instrument showed high content validity index (CVI) of A-State scale, and A-Trait scale at 90% and 95%, respectively. The alpha coefficients were .84, .82, at the first administration and .87, .88, at the second administration for A-Trait scale and A-State scale, respectively. Test-retest reliability coefficient for the STAIC was .62 for A-State scale and .68 for A-Trait scale (Chaiyawat & Brown, 2000). However, the acceptable value to examine the internal consistency of the items equals .70 (Polit & Beck, 2012). Additionally, some items were not suitable for Thai context (Chaiyawat & Brown, 2000). Therefore, this instrument was not appropriate for this study.

2.3 The revised Thai versions of State-Trait Anxiety Inventory for Children (STAIC-R): This instrument was modified from STAIC which used to identify State-Trait Anxiety in children 8-13 years of age (Chaiyawat, 2000). Several items of the Thai versions of STAIC have been reworded without changing the meaning. In A-State 4 items were deleted because those items were not suitable for Thai culture and 3 items that were appropriate for Thai children were added by the researchers after the pilot study process. Consequently, A-State consists of 19 items. Half of the items indicate the presence of anxiety and the absence of anxiety is indicated in the other half. The items are scored from 1 to 3 as follows: 3 represent the highest degree of feeling and 1 represent the lowest degree of feeling, with the total score on each scale ranging from 19 to 57. Half of the items need to reverse scored.

The A-Trait scale consists of 20 items. The items are scored from 1 to 3 as follows: 1 hardly, 2 sometimes, and 3 often, with the total score on each scale ranging from 20 to 60. The higher scores indicate higher anxiety levels. The content validity was tested by the expert panel. The validity of the instrument showed high content validity index (CVI) of A-State scale, and A-Trait scale at 89.5% and 90%, respectively and two items were reworded based on suggestions from the experts. The construct validity of the instrument was examined by known-groups technique, convergent validity, and exploratory and confirmatory factor analysis. The STAIC-R can differentiate between children with high anxiety and low anxiety. Significant correlation was present between A-State scale, and A-Trait scale of the revised Thai versions of STAIC-R, A-State scale of the revised Thai versions of STAIC-R and The Thai version of child medical fear scale-revised (CMFS-R), and A-Trait scale of the revised Thai versions of STAIC-R and The Thai version of CMFS-R. The exploratory and confirmatory factor analysis presented 3 correlated factors. Test-retest reliability coefficient for Thai versions of STAIC-R was .58 for A-State scale and .72 for A-Trait scale. The alpha coefficients were .83, .81, at the first administration in no anxiety group and .87, .86, at the second administration in the no anxiety group for A-State scale and A-Trait scale, respectively. The alpha coefficients were .82, .85 in the anxiety group for A-State scale and A-Trait scale, respectively (Chaiyawat, 2000).

In this study, the revised Thai version of STAIC-R was used. Even though the low test-retest reliability was reported in this instrument and it had been developed for Thai children 8-13 years old, the value was passable because anxiety is the feeling that can change all the time. In this study, the data was collected from older children who had better development. As a result, this instrument can be used in this study and it fits within the Thai context. Besides, A-State scale has been used in the context of Thai children with cancer. The alpha coefficient was .86 (Khachaanant & Chaiyawat, 2009). However, before using this instrument, the reliability was tested in the children with cancer.

3. Self-care behavior

3.1 Self-care behavior questionnaire was used to examine caring behaviour (Punthmatharith et al., 2008). This instrument was developed based on a literature review and has been adapted from the caring behaviour questionnaire developed by Wannapong et al. (1999). The instrument consists of 25 items measured on a 4-point Likert scale in the Thai version ranging from 0 (never practice) to 3 (always practice). The questionnaire is determined by the highest score minus the lowest score and divided by the number of levels of self- care behaviour. The levels of self-care behaviour are composed of three levels; high (.00-1.00), medium (1.01-2.01) and low (2.02-3.00). The content validity of the instrument was tested by the expert panel and the reliability of the instrument was tested in 20 children with cancer and 20 caregivers. The Cronbach’s alpha was .87 and .85, respectively (Punthmatharith et al., 2008).

In this study, the self-care behavior questionnaire was suitable for this study because it was appropriate with Thai culture. In addition, from the prior study, the reliability had been properly tested.

4. Family functioning

4.1 Family Assessment Device (FAD) has been used to examine family functioning (Barakat et al., 2010). This instrument was developed based on the

McMaster Model of Family Functioning (MMFF) (Epstein, Baldwin, & Bishop, 1983). The instrument consists of six domains that influenced the emotional and physical health of family members including problem solving, communication, roles, affective responsiveness, affective involvement, and behavior control (Herzer et al., 2010). The FAD is a self-report 60-item instrument measured on a 4-point Likert scale and comprises of 7 subscales. Six of the subscales were based on the 6 dimensions of MMFF and the additional was subscale was general functioning (Epstein et al., 1983). Higher scores represented greater dysfunction (Barakat et al., 2010)

The quality of the instrument had been tested. The results indicated that the reliability was presented in an adequate value. The social desirability was tested and presented in low scores. Besides, the instrument could be differentiated between healthy and unhealthy families and had adequate sensitivity and specificity (Miller, Epstein, Bishop, & Keitner, 1985). The reliability had been tested in children. According to Bihun, Wamboldt, Gavin and Wamboldt (2002), low internal consistency of the instrument presented in children lower than 12 years old (α = .48 - .79). However, in children more than 12 years of age, the internal consistency of the instrument presented at a high level (α = .70 - .86). In addition, in adolescents with cancer, low internal consistency of the overall instrument was reported (α = .65) (Barakat et al., 2010). Obviously, reliability varied in different groups and this instrument had been developed in a Western country. The FAD was developed based on the American cultural context. Therefore, in this study, this instrument was not suitable for use because the Thai culture is different from the Western culture.

4.2 The Thai version of Family Functioning Scale: This instrument was translated from the English version of the FAD to the equivalent version in Thai by Oupramand (1994). The internal consistency of the FAD was .90 for the overall scale, .72 for problem solving, .65 for communication, .68 for roles, .66 for affective responsiveness, .79 for behavior control, and .71 for general functioning, but in the domain of affective involvement scale, the internal consistency was not presented (Oupramand, 1994). However, the limitations of Oupramand's study were no process in the back translation from the Thai version to the English version and the study did not include the key constructs of Thai culture. In addition, 11 items of the FAD (Thai version) had meanings slightly different from the English version (Suttiamnuaykul, 2002). Therefore, this instrument was not appropriate for use in this study.

4.3 The Thai Family Functioning Scale (TFFS): This instrument was modified from The Thai version of FAD and some items that were relevant to Thai culture and society had been added, especially in relation to Buddhist culture (Suttiamnuaykul, 2002). The TFFS is composed of 30 items. The three steps of the process of the development of this instrument are as follows: Step 1, the 60 items of FAD were back and forth translated into Thai and English and 37 items that are appropriate to Thai families were added by the researcher. Step 2, the content validity of the instrument was tested by the expert panel. After that, the items of the instrument were investigated in adolescents by a confirmatory factor analysis (CFA). Consequently, 67 items were deleted from the proposed model. The validity of the Thai Family Function Scale (TFFS) was tested in terms of construct validity, discriminant validity, and predictive validity. The construct validity of the instrument was tested by CFA. Therefore, only three distinguishing factors were identified;

cohesion, communication and feeling expression, and problem solving. The discriminant validity of TFFS was identified by comparing depressed and non-depressed adolescents on the total scale and in each subscale of the TFFS. The results of the t-test indicated that depressed adolescents reported significantly less healthy family functioning than non- depressed adolescents for the total scale and all subscales of the TFFS. Therefore, the TFFS can discriminate between depression and healthy adolescents. For the predictive validity, the multiple coefficient of determination (R^2) was used to indicate this. The result showed that the full scale of the TFFS predicted depression (Suttiamnuaykul, 2002). Step 3, the internal consistency of the instrument for the full scale of Cronbach's alpha was .88 and for each factor .75-.84. In the test-retest reliability, the total TFFS had high stability reliability (r = .80) over a one-week period. For the subscales, the reliability of the cohesion subscale communication/feeling expression subscale, and problem solving, ranged from .68 - .72 (Suttiamnuaykul, 2002). The results indicated that the TFFS had satisfactory content, construct, discriminant, and predictive validity. In addition, the total scale of the TFFS and each subscale had appropriate internal consistency. However, the stability reliability presented non appropriate values in some subscales. In addition, Buddhist culture was added in the construct of the instrument. Although most Thai people are Buddhist, the data in this study were collected from not only Buddhist participants. Consequently, this instrument was not suitable for this study.

4.4 Chulalongkorn Family Inventory (CFI): This instrument was modified from the Thai version of Family Functioning Scale based on McMaster Model of Family Functioning (MMFF) and is related to Thai culture (Trankasombat, 2001). This Thai language instrument is a self-report questionnaire. The perception of one's family was assesses and comprised of seven dimensions, six dimensions of family functioning which were problem solving, communication, roles, affective responsiveness, affective involvement, and behaviour control according to the McMaster Model and a general functioning scale. The CFI consists of 36 items, each with the score of 1 to 4. The higher scores reflect healthy functioning. The CFI was presented a good reliability (Cronbach's alpha = .88), mean inter-item correlation of 0.1978 (min -0.4125, max 0.6385), and item-total correlation of -0.0198 to 0.7535 in a community sample (Trangkasombat, 2006). The quality of this instrument has presented with appropriate values. This instrument has been widely applied to measure family functioning in several Thai research studies, such as, in psychiatric patients (Trangkasombat, 2006), and diabetes mellitus patients (Boonruangkhow, 2007)

The reliability of the CFI has been reported with suitable values and has been widely used in a number of Thai research studies both in children and adult. Therefore, this instrument was used in this study. However, no reliability has been reported in Thai children with cancer from previous studies. Therefore, before using this instrument, the reliability was tested in Thai children with cancer. In addition, although the CFI is a self-report questionnaire, the instrument has been designed to be examined in children or adult. In this study, the instrument was used to test by caregivers.

5. Symptoms

5.1 The memorial symptom assessment scale (MSAS 10-18) for children aged 10-18 years: This instrument was developed by Collins et al. (2000) and was used to examine symptoms. This instrument was adapted from the memorial symptom assessment scale for adults with cancer. The instrument is composed of 30 items in the three dimensions of the number of symptoms, symptom severity, and symptom distress and is measured on a four-point Likert scale. The total number of symptoms experienced is calculated by summing positive responses. The severity and distress ratings for all symptoms have been averaged to calculate the mean ratings. According to Collins et al. (2000), the instrument was administered to children with cancer to confirm the instrument’s reliability and validity. The alpha coefficients of the revised physical, psychological, and global symptom distress subscales were .83, .87, and .85, respectively. The test-retest reliability showed a significant correlation for 26 of the 30 symptoms (except pain, nervousness, drowsiness, and constipation). The convergent and discriminate validity of the MSAS 10-18 showed significant correlations between the MSAS 10-18 and other instruments, such as, Memorial Pain Assessment Card–pediatric (MPAC-pediatric) (Collins et al., 2000).

In this study, only symptom distress dimension was used. This dimension was appropriate to measure symptom distress. In addition, the psychometric properties of the instrument had been reported to have acceptable values and this instrument was commonly used in pediatric cancer. However, before use, this instrument was translated into Thai and the reliability was tested in Thai children with cancer.

6. Functional status

6.1 The Karnofsky Performance Status Scale (KPS): This instrument is used to examine the functional status of the cancer patients. This instrument was developed by Karnofsky and Burchenal (as cited in Mor, Laliberte, Morris, & Wiemann, 1984) to evaluate a patient's ability to survive chemotherapy for cancer.

KPS scores range from 0 (dead) to 100 (normal function) on an 11-point rating scale. The KPS has been the most widely used to clarify the functional status in patients with cancer. Mor et al. (1984) reported that the interrater reliability coefficient of this instrument was .97. The construct validity of the KPS was examined, and the KPS was found to be strongly related with physical functioning ($p < .001$) (Mor et al., 1984).

The KPS was not be selected to measure functional status in this study, even though the quality of instrument has presented with appropriate values and the KPS has widely used in cancer patients. The instrument was developed based on adult cancer patients and rating by clinicians. Therefore, this instrument was not suitable for this study.

6.2 Child Functional Status: This instrument is used to measure functional status after the diagnosis of children with cancer by a single item. The instrument was developed by Landolt, Vollrath, and Ribi (2002). The functional status was attendant physicians by using a 3-point Likert severity scale; 0 = good functional status (no functional impairment), 1 = moderate functional status (moderate functional impairment), and 2 = poor functional status (severe functional impairment). Even though the instrument was used to evaluate functional status in children with cancer (Landolt et al., 2006), the instrument was designed to for use by a physician. Besides, the psychometric property of this instrument has not been reported (Landolt et al., 2002). Therefore, this instrument was not appropriate for this study.

6.3 The Play-Performance Scale for Children (PPSC): This instrument was developed by Lansky et al. (1987) to examine the performance in children with cancer aged 1-16 years. The scores range from 0 (unresponsive) to 100 (fully active, normal) in an 11-point rating scale. This instrument was designed to measure the performance status of the child with any type of cancer, inpatients or outpatients, and in active treatment and long-term follow-up procedures (Lansky et al., 1987). The instrument was designed to be rated easily by a parent without the need for training.

The quality of the instrument has been tested. The validity of the instrument could differentiate performance status of different kinds of children with cancer such as inpatients, outpatients, and normal healthy children. The results showed significant differences of performance status between inpatients and normal children, and inpatients and outpatients children with cancer ($p < .05$). The correlations coefficient between parent ratings and nurses' global ratings and among parent ratings and clinicians' global ratings were reported with acceptable values ($r = .75$, $r = .92$, respectively, $p < .001$). The interrater reliability showed a good correlation coefficient between mother and father ($r = .71$, $p < .0001$) (Lansky et al., 1987).

In this study, PPSC was selected to measure functional status because the quality of the instrument has presented with an appropriate value and has been designed to be used with cancer children. In addition, the PPSC was designed to be rated simply without training by a parent. Therefore, this instrument used to rate by caregivers, in this study. However, before using this instrument, it was translated into the Thai language. The reliability was tested in the caregiver of children with cancer.

5. Conclusion

HRQOL is another term that is related to QOL. This term focuses on health, illness, and the treatment aspects of quality of life (Ferrans et al, 2005). In this study, these terms were used interchangeably. HRQOL can be defined as the perception of children with their position in life, functioning, and health.

From the prior studies, lower QOL was presented in children with cancer (De Clercq et al., 2004; Eilertsen et al., 2012; Eiser, et al., 2005 Shankar et al., 2005; Speechley et al., 2006). Several previous studies had examined the factors contributing to the quality of life in children with cancer including non-modifiable factors and modifiable factors. However, in this study, only modifiable factors improved by health care providers, patients, and caregivers were used to test in the model. Evidence from the previous studies had identified modifiable factors that included coping, anxiety, family functioning, self-care behavior, symptoms, functional status were associated with QOL in children with cancer. Therefore, the proposed causal model of HRQOL was developed and tested in Thai children with cancer in this study.

The finding of this study would provide the empirical evidence to develop effective interventions to improve the quality of life in children with cancer and afford the logically based information for health care providers and policy makers to enhance HRQOL in children with cancer.

CHAPTER 3

RESEARCH METHODOLOGY

The research design, setting, population and sample, research instrumentation, translation of research instruments, validity and reliability of research instruments, data collection, ethical consideration and data analysis are included in this chapter.

Research Design

A causal model was proposed in a path analytic research design to examine the causal relationship between modifiable factors including coping, trait anxiety, state anxiety, family functioning, self-care behavior, symptom, functional status, and health-related quality of life (HRQOL) in children with cancer. A set of questionnaires were used to explore influencing variables and HRQOL in children with cancer.

Settings

The target settings were initially planned to include tertiary hospitals in four parts of Thailand including Northern, Northeastern, Central, and Southern regions. However, due to inaccessibility, the hospitals in only three regions were included. The inclusion criteria for selection of the study settings included hospitals providing treatment to children with cancer. The selected hospitals composed of three hospitals from the Northern region (Buddhachinaraj Hospital, Chiangrai Prachanukroh Hospital, and Maharaj Nakorn Chiang Mai Hospital), two hospitals from the Northeastern region (Khonkaen hospital and Srinagarind hospital), and three hospitals from the Southern region (Songklanagarind Hospital, Hatyai Hospital, and Suratthani Hospital).

Population and Sample

The target population in this study comprised of children with cancer admitted to tertiary hospitals in Thailand and caregivers. The samples of this study composed of children with cancer aged 9-18 years old hospitalized in Thailand and caregivers or those following up at outpatient units in tertiary hospitals in Thailand and caregivers.

Inclusion criteria: The inclusion criteria of children with cancer composed of 1) had good level of consciousness, 2) were able to communicate in Thai language 3) had no serious conditions such as on oxygen or a ventilator or too weak from chemotherapy side effects and able to response to the questionnaires, 4) diagnosed with any type of cancer for at least one month, but no more than two years and undergoing therapy (Landolt et al., 2006, Vlachioti et al., 2016), 5) received treatment with chemotherapy at least one cycle, or chemotherapy at least one cycle in combination with surgery or radiation (Landolt et al., 2006; Stam et al., 2006)**,** and 6) had symptom experience. The inclusion criteria of caregivers comprised 1) were the main caregiver, 2) had the responsibility to take care of their child for at least 1 year, and 3) were able to communicate in Thai language.

Sample size: Sample size was estimated based on the criteria of the dataset required for the causal model that was 30 subjects per each independent variable (Nunnally & Bernstein, 1994). This study had 7 independent variables; therefore, the required sample of this study was 210 children with cancer and 210 caregivers.

Sampling technique: Convenience sampling was used to select three regions of Thailand. Purposive sampling was used to select eight hospital settings that treated children with cancer from three parts of Thailand and children with cancer and caregivers who met the inclusion criteria (Table 1).

Table 1

The selected settings and the number of samples in each setting

Part of Thailand	Settings	Number of populations (per-year)	Number of samples
Northern	Maharaj Nakorn Chiang Mai Hospital	145	30
	Chiangrai Prachanukroh Hospital	36	10
	Buddhachinaraj Hospital	67	20
Northeast	Srinagarind hospital	101	30
	Khon kaen hospital	82	20
Southern	Songklanagarind hospital	63	60
	Hatyai Hospital	35	20
	Suratthani Hospital	238	20
Total			210

Instrumentations

The instruments used to collect the data in this study were a set of questionnaires: 1) Demographic data questionnaire (DDQ), 2) The Thai Pediatric Quality of Life Inventory version 4.0 (Thai PedsQL 4.0), 3) The Thai version of Coping of Disease Inventory (Thai version of CODI), 4) The revised Thai versions of State-Trait Anxiety Inventory for Children (Thai STAIC-R), 5) Self-care Behavior Questionnaire, 6) Chulalongkorn Family Inventory (CFI), 7) The Memorial Symptom Assessment Scale 10–18 (MSAS10–18), and 8) The Play-Performance Scale for Children (PPSC) (Appendix A). The internal consistency following six instruments: Thai PedsQL 4.0, Thai version of CODI, Thai STAIC-R, Self-care behavior questionnaire, CFI, and MSAS 10–18 (distress dimension) was examined using

Cronbach’s alpha coefficients. For the PPSC, the reliability was examined using the test-retest method to examine its stability. The acceptable value is above .80 (Polit & Beck, 2012). In addition, the possible problems during the data collection process and the feasibility to use each instrument, such as, being readable, understandable, and the amount of time consumed to complete the questionnaire were detected. The reliability of each instrument was acceptable (Table 2).

Table 2

The Instruments of the study

Concepts	Variables	Instruments	Developed/Selected instrument	Level of measurement	Reliability coefficients
Demographics	Age	DDQ	Developed by the researcher based on existing literature.	Number of years-ratio	-
	Gender	DDQ		Male/Female-nominal	-
	Child’s education	DDQ		Level of education-ordinal	-
	Parent’s education	DDQ		Level of education-ordinal	-
	Family income	DDQ		Monthly household income in Thai Bath-ratio	-
	Type of cancer	DDQ		Diagnosis-nominal	-
	Treatment and procedure	DDQ		Type of treatment and procedure - nominal	-
Quality of life	Health-related quality of life	Thai PedsQL4.0	Selected based on the prior study and it was suitable for children with cancer aged 9-18 years old. The content was the same as the original version. The reliability coefficient was reported with an acceptable value in Thai chronic illness children e.g. thalassemia, cerebral palsy.	Mean score - interval	Cronbach’s alpha=.93
Coping	Coping	Thai version of CODI	Selected based on the prior study and the content was the same as the original version after translation. It was suitable for Thai children with cancer and the reliability coefficient was acceptable in Thai children with cancer.	Mean score - interval	Cronbach’s alpha=.88

Concepts	Variables	Instruments	Developed/Selected instrument	Level of measurement	Reliability coefficients
Anxiety	State-anxiety	Thai STAIC-R (Form C-1)	Selected based on the previous study. It was translated and deleted 1 item and it was also suitable for Thai context.	Total score - interval	Cronbach's alpha = .88
Anxiety	Trait- anxiety	Thai STAIC-R (Form C-2)	Selected reasons same as Thai STAIC-R (Form C-1). However, the content and the number of items were the same as the original version	Total score - interval	Cronbach's alpha = .89
Self-care	Self-care behavior	Self-care behavior questionnaire	Selected based on the prior study and it was appropriate for Thai children with cancer. The reliability coefficient was acceptable in Thai children with cancer.	Total score - interval	Cronbach's alpha = .82
Family functioning	Family Functioning	CFI	Selected based on the prior study widely used in Thai research studies both in children and adults.	Mean score - interval	Cronbach's alpha = .89
Symptoms	Symptom distress	MSAS10-18 (distress dimension)	Selected based on the prior study. However, distress dimension was selected. The reliability coefficient was acceptable in children with cancer.	Mean score - interval	Cronbach's alpha = .91
Functional Status	Functional Status	PPSC	Selected based on the prior study and it was suitable with children and also it was simply to be used. The quality of this instrument had presented with an acceptable value	Actual score - ratio	Intraclass correlation = .93

Note. DDQ = Demographic data questionnaire, Thai PedsQL 4.0= Thai versions of the Pediatric Quality of Life Inventory Version 4.0*,* Thai version of CODI = The Thai version of Coping of Disease Inventory, Thai STAIC-R = The revised Thai versions of State-Trait Anxiety Inventory for Children, CFI = Chulalongkorn Family Inventory, MSAS 10-18 = The memorial symptom assessment scale 10-18, PPSC = The Play-Performance Scale for Children

1. Demographic data questionnaire (DDQ)

This questionnaire was developed by the researcher based on existing literature. The questionnaire consisted of 8 items including age, gender, child's level of education, parent's level of education, family income, type of cancer, illness duration, and treatment and procedure (Appendix A).

2. The Thai version of Pediatric Quality of Life Inventory Version 4.0 (Thai PedsQL 4.0)

Two versions of the Thai PedsQL 4.0 including children 8-12 years old and 13-18 years old (Varni, 2015) were used to evaluate HRQOL in this study (Appendix A). This instrument has already been translated to several languages including Thai and consisted of 23 items that covered the 4 dimensions of physical functioning (8 items), emotional functioning (5 items), social functioning (5 items), and school functioning (5 items). The instrument measured the problems experienced during the past 1 month with a 5-point Likert scale ranging from 0 (never a problem), 1 (almost never a problem), 2 (sometimes a problem), 3 (often a problem), to 4 (almost always a problem). In this study, in school functioning domain, children who had study leave, the impacts were assessed by asking them to think of activities before taking the study leave. All items were stated negatively. Therefore, the item scores were reversed and transformed to a 0–100 scale. The higher score was an indicator of better HRQOL. The scores were calculated as the sum of the items divided by the number of items answered. The score was not computed if more than half of the items in the scale were missing. The scores can be reported as two summary scores and one overall score. The physical health summary score (8 items) and the psychosocial health summary score (15 items) covered the emotional, social, and school functioning subscales (Sritipsukho et al., 2013).

According to Sritipsukho et al. (2013), the Thai version of PedsQL had acceptable reliability and validity and appropriate to use in Thai children aged 8-15 years. The reliability of the instrument was tested in healthy children and children diagnosed with chronic illness, such as, heart disease, asthma, renal disease, and thalassemia and their parents. The internal consistency reliability coefficient for each part was as follows: The total scale score ($\alpha = .84$ self-report, .88 proxy-report), physical health summary score ($\alpha = .76$ self-report, .79 proxy-report), and psychosocial health summary score ($\alpha = .74$ self-report, .85 proxy-report). Test-retest reliability showed correlation coefficients above .60 in all subscales ($p < .001$). From the review, in the English version, the quality of the instrument was tested in children with cancer and the result showed that the internal consistency reliability for the total score was .88 for child reporting and .93 for parent reporting (Varni et al., 2002). In Thailand, this instrument was widely used in children with chronic illness, such as, HIV (Punpanich et al., 2010), thalassemia (Thavorncharoensap et al., 2010), and cerebral palsy (Tantilipikorn, Watter, & Prasertsukdee, 2013). The reliability of the instrument had presented an acceptable value (Punpanich et al., 2010; Sritipsukho et al., 2013; Tantilipikorn et al., 2013). In addition, in Thai adolescents with cancer the reliability of the instrument was .90 (Suwannaosod, 2017). In this study, the reliability of the instrument was examined by using internal consistency reliability. Cronbach’s alpha coefficient after testing with 20 Thai children with cancer was .93.

3. The Thai version of Coping of Disease Inventory (Thai version of CODI)

The Thai version of CODI was used to evaluate coping strategies and coping ability (Silapavitayatorn, 2008) (Appendix A). The instrument had been translated from the English version of CODI and back translated from English into Thai by Silapavitayatorn (2008). The instrument composed of 28 items in 6 domains which included acceptance, avoidance, cognitive–palliative distance, emotional reaction and wishful thinking. The 27- item Thai CODI has a 5-point Likert scale ranging from 1 (never), 2 (almost never), 3 (sometimes), 4 (often), to 5 (almost always) and the final item (item 28) evaluated the overall coping ability which was measured on a 5-point Likert scale ranging from 1 (bad), 2 (poor), 3 (moderate), 4 (good), to 5 (very good). The domain scores were computed as the sum of the items in each domain divided by the number of items. The content validity of the instrument was tested by a panel of experts. The internal consistency of the Thai version of CODI was tested in Thai children with cancer, yielding the entire scale coefficient of .86 (Silapavitayatorn, 2008). Therefore, it was considered appropriate to measure the coping ability of Thai children with cancer. In this study, the reliability of the instrument was examined by using internal consistency reliability. Cronbach's alpha coefficient after testing with 20 Thai children with cancer was .88.

4. The revised Thai version of the State-Trait Anxiety Inventory for Children (Thai STAIC-R)

The Thai STAIC-R was used to measure the level of anxiety (Chaiyawat, 2000) in this study (Appendix A). The instrument had been translated and modified from STAIC by Chaiyawat (2000). This instrument composed of two parts including A-State scale and A-Trait scale. A-State consisted of 19 items used to evaluate anxiety while facing a problem. The items were scored from 1 to 3 as follows: 3 represents the highest degree of feeling and 1 represents the lowest degree of feeling, with the total score on each scale ranging from 19 to 57 and 11 items need to be reverse scored. A-Trait scale consists of 20 items used to measure trait anxiety. The items were scored from 1 to 3 as follows: 1 (hardly), 2 (sometimes), and 3 (often), with the total score of each scale ranging from 20 to 60. The scores were computed as the sum scores of the items on each scale. The higher scores indicated higher anxiety levels (Chaiyawat, 2000).

The quality of the instrument was tested in Thai healthy school aged children. The validity of the instrument showed a high content validity index (CVI) of A-State scale, and A-Trait scale at 89.5% and 90%, respectively. The test-retest reliability coefficient was .58 for A-State scale and .72 for A-Trait scale. The alpha coefficients were .83, .81, at the first administration in a no anxiety group and .87, .86, at the second administration in no anxiety group for A-State scale and A-Trait scale, respectively. The alpha coefficients were .82, .85 in an anxiety group for A-State scale and A-Trait scale, respectively (Chaiyawat, 2000).

The original version of this instrument had been widely used to measure anxiety in children with cancer, such as, Japanese children with brain tumor (Sato et al., 2013), and American children with leukemia and lymphoma (Fortier et al., 2013). In the Thai version that was developed by Chaiyawat (2000), even though the quality of the instrument was tested only in healthy children, the instrument was modified until it was suitable for use in Thai context. Moreover, the instrument had been used in the context of Thai children being hospitalized, for example, preoperative Thai children (Pungsawong, 2002) and in the context of Thai children with cancer with an alpha coefficient of .86 for A-State scale (Khachaanant & Chaiyawat, 2009). In this study, the reliability of A-State scale and A-Trait scale was examined by using internal consistency reliability. Cronbach’s alpha coefficients after testing with 20 Thai children with cancer were .88 and .89, respectively.

5. Self- Care Behavior Questionnaire

The Self- Care Behavior Questionnaire was used to examine self-care behavior (Punthmatharith et al., 2008) (Appendix A). This instrument was developed by Punthmatharith et al. (2008). The instrument consists of 25 items in the Thai version. Cancer children are asked to rate their self-care behavior on a 4-point Likert scale ranging from 0 (‘‘never’’) to 3 (‘‘always’’). In this study, the total score was used and the higher score indicated high self-care behavior. The content validity of the instrument was tested by a panel of experts and the reliability of the instrument was tested in children with cancer. Cronbach’s alpha was .87 (Punthmatharith et al., 2008). This instrument is suitable for this study because it was developed specifically for Thai children with cancer. In addition, the quality of the instrument had reported an appropriate value. In this study, Cronbach’s alpha coefficient after testing with 20 Thai children with cancer was .82.

6. Chulalongkorn Family Inventory (CFI)

The CFI was used to examine family functioning (Trankasombat, 2001) (Appendix A). The instrument was modified from the Thai version of the Family Assessment Device (FAD) (Oupramand ,1994) developed based on the McMaster Model of Family Functioning (MMFF). This instrument was a self-report questionnaire in Thai language. The instrument consisted of 36 items and is measured on a 4-point Likert scale ranging from 1 (not agree), 2 (mildly agree), 3 (sometimes), to 4 (strongly agree) and 12 items were negatively worded so that the score needs to be reverse scored (Trankasombat, 2001). The score of the instrument used was determined by the sum score of the items divided by the number of items. The levels of family functioning composed of four levels including high (3.36-4), medium (2.51-3.25), low (1.76-2.5) and very low (1.-1.75) (Boonruangkhow, 2007). The quality of the instrument was tested in a community sample and presented in acceptable value with a reliability (alpha) of .88, mean inter-item correlation of 0.1978 (min -0.4125, max 0.6385), and item-total correlation of -0.0198 to 0.7535 (Trangkasombat, 2006). This instrument was appropriate for this study because the quality of the CFI has been reported with a suitable value and has been widely used in Thai research. In this study, the reliability of instrument was tested by caregivers of children with cancer with Cronbach's alpha measuring .89.

7. The Memorial Symptom Assessment Scale for children aged 10-18 years old (MSAS10–18)

This instrument was used to evaluate symptoms (Collins et al., 2000). The instrument was modified from MSAS for adults with cancer by Collins et al. (2000). This instrument consisted of two sections. Section I consisted of 22 symptoms which have occurred during the past week. Each symptom was evaluated as did not have (yes, no), if yes, how often did you have it (1= rarely to 4= almost constantly); if yes, how severe was it usually? (1= slight to 4= very severe); and if yes how much did it distressed or bother you? (0= not at all to 4= very much). Section II consisted of 8 symptoms that occurred during the past week. Each symptom was evaluated as did not have (yes, no) if yes, how severe was it usually? (1= slight to 4= very severe); and if yes how much did it distressed or bother you? (0= not at all to 4= very much).

The instrument was scored in the three subscales of psychological (PSYCH), physical (PHYS), and Global distress index (GDI). Scoring of the PSYCH was the average of the frequency, severity and distress scores of 6 psychological symptoms (feeling sad, worrying, feeling irritable, feeling nervous, difficulty sleeping, and difficulty concentrating). Scoring of PHYS was the average of the frequency, severity and distress scores of 11 symptoms (lack of appetite, lack of energy, pain, feeling drowsy, constipation, dry mouth, nausea, vomiting, and change in taste, weight loss, and dizziness). The GDI was the average of the frequency scores of 4 symptoms (feeling sad, worrying, feeling irritable, and feeling nervous) and the average of the distress scores of the 6 symptoms (of lack of appetite, lack of energy, pain, feeling drowsy, constipation, and dry mouth). Moreover, the total MSAS score was computed as the average of the symptom scores for all 30 items.

The quality of the instrument was tested in children with cancer. The internal consistency reliability for physical, psychological, and global symptom distress subscales were .83, .87, and .85, respectively. The test–retest reliability showed a significant correlation for 26 of the 30 symptoms (not including pain, nervousness, drowsiness, and constipation) (Collins et al., 2000). The MSAS 10–18 was appropriate for measuring symptom distress in this study because the psychometric properties of the instrument have been reported with acceptable values and this instrument was commonly used in pediatric cancer cases, such as, American children following myelosuppressive chemotherapy (Baggott et al., 2011).

In this study, only distress part (the following 30 distress items) that combined both section I and section II (Appendix A) was interpret as symptom distress and used for further analysis. The scores of symptom distress were computed as the sum of items divided by the number of items answered (the number of symptoms). The reliability of instrument was tested by 20 children with cancer and Cronbach's alpha was .91 in this study.

8. The Play-Performance Scale for Children (PPSC)

The PPSC was used to examine functional status (Lansky et al., 1987) (Appendix A). The PPSC is an 11-point continuous rating scale ranging from 0 (unresponsive) to 100 (fully active, normal) and is designed to be rated by a parent (Lansky et al., 1987). The quality of the instrument was tested and found to be able to differentiate between three groups of children who had different functioning (inpatients, outpatients, and normal healthy children) ($p < .05$). The correlations coefficient between parent ratings and nurses' global ratings and among parent ratings and clinicians' global ratings has been reported at adequate value ($r = .75$, $r = .92$, respectively, $p < .001$). The interrater reliability showed good correlation coefficient between mother and father ($r = .71, p < .0001$) (Lansky et al., 1987).

Since the quality of this instrument has demonstrated appropriate value and it has been designed specifically for children with cancer it could be rated easily by caregivers without the need for formal training. Therefore, the PPSC was suitable to measure the functional status in this study. The reliability of instrument was tested by 20 caregivers of children with cancer and the test-retest intraclass correlation coefficient was .93.

Translation of the Instruments

Before using the instruments developed in English including MSAS10–18 and PPSC, the process of translation and back translation was used based on Hilton and Skrutkowski (2002). The translation processes in this study were as follows.

1. The original instruments were translated from English to Thai language by three translators who can read and speak bilingually Thai and English languages. In this study, the three translators were composed of three nurse instructors with doctoral degrees. The translated of each questionnaire (MSAS10–18 and PPSC) from three translators were discussed and summarized into one Thai questionnaire by the researcher and the research advisor.

2. The next step was the back translation of the instruments from Thai language into English language without seeing the original version by another three doctorate qualified nurse instructors. The translated version of each questionnaire (MSAS10–18 and PPSC) from the three translators were discussed and summarized into one English questionnaire by the researcher and the advisory committee.

3. In the final step, the original versions and the back translated versions were compared by a native English speaker to examine the similarity of the meanings. All suggestions from the native English speaker were discussed with the advisory committee. If there were any dissimilarity, they were modified in consultation with the native English speaker and the translators.

Data Collection

The data collection process in this study consisted of two phases including the preparation phase and data collection phase as follows.

Preparation phase

In this phase, permission to collect data was obtained after the research proposal was approved by the Institutional Review Board of Faculty of Nursing. The researcher was asked for an approval letter from the Research Ethical Committee of the Faculty of Nursing, Prince of Songkla University before the target hospitals were asked for permission to collect the data. The reliability of instruments was then tested. In this study data was collected by the researcher and research assistants (RAs) working in the selected tertiary hospitals**.** All the RAs were registered nurses who had at least 1 year of experience in taking care of children with cancer. The RAs were trained by the researcher in the instruction for recruitment of potential participants, administration of the instruments, and issues pertaining to informed consent.

Data collection phase

After approval to collect data was obtained, the data were collected from the participants who met the inclusion criteria and had agreed to participate in this study as follows:

1. The objective of the study, the study procedures, the risks and benefits for the subjects, the rights and responsibilities of the subjects, and the confidentiality principle were explained to children with cancer and their parents.

2. Participants below and equal 12 years old were asked to sign assent form and their parents were asked to sign an informed consent form. Participants above 12 years old and their parents were asked to sign an informed consent form

3. The researcher or RAs explained how to fill in the questionnaire and an opportunity was provided for the participants and caregivers to ask any questions if they did not understand.

4. Each participant was requested to complete the five questionnaires and his/her caregiver was requested to complete three questionnaires. For the five questionnaires answered by the participant, RAs or caregivers could help to read the questions. While answering the questionnaires, if participants had any problems, such as, fatigue, data collection was stopped and started again if the participant was willing and able to continue completing the questionnaires. For outpatient participants, the questionnaires were answered either in the hospital or at home and could be returned in the next visit or by post.

5. The completeness and correctness of all questionnaires were checked by the researcher or RAs. If the information was incomplete or had any mistakes, the participants were asked to re-complete the questionnaires.

6. Data collection was performed from July 2015 - March 2017.

Ethical Considerations

Prior to data collection, a request form seeking approval to conduct the study and informed consent was submitted to the Ethical Committee, Faculty of Nursing, Prince of Songkla University, and permission was also obtained from the ethical committees of the hospitals chosen for the study (Appendix D). The approval document numbers granted by institutional review board each institute were as presented in Table 3.

Table 3

The approval documents numbers granted by institutional review board

Institutes	Approval document numbers
Prince of Songkla University, Faculty of Nursing	0521.1.05/3009
Maharaj Nakorn Chiang Mai Hospital	389/2016
Chiangrai Prachanukroh Hospital	0032.102/3499
Buddhachinaraj Hospital	094/59
Srinagarind hospital	HE591152
Khon kaen hospital	HE 60010
Songklanagarind hospital	58-339-19-19
Hatyai Hospital	74/2015
Suratthani Hospital	2/2560

The caregivers of children with cancer and children with cancer were contacted for their permission to take part in the study. The caregivers and participants were explained the protection of the subjects' rights based on three basic ethical principles for research including respect for persons, beneficence, and justice. Information including the purpose of the study, the name and address of the researcher, the assurance of the subjects' anonymity, and the risks from participating in this study and how to prevent or reduce them and the right to withdraw from the study at any time were described. Permission to take part in the study was requested from both participants and caregivers. Participants (children with cancer) below and equal 12 years old were asked to sign assent forms and caregivers were asked to sign informed consent forms. Participants (children with cancer) above 12 years and their caregivers also were asked to sign informed consent forms after giving a full oral explanation (Appendix C).

All data from participants (children with cancer) was not shown to persons not associated with the study to protect confidentiality. Codes were used during data collection, data analysis, research report and publication to protect the anonymity of the participants (children with cancer). Freedom from harm was another ethical concern and no one was harmed participating in this study. However, time-consuming measurement procedures may take place. Therefore, an unwillingness to participate or feelings of fatigue when answering the questionnaires might occur. Participants (children with cancer) could take a rest or make a decision to continue answer the questionnaires more than one time. Participants (children with cancer) and their parents were informed of the schedule measurement and time plan. Furthermore, the participants (children with cancer) could withdraw from this study at any time without any penalty. In this study, no participant felt fatigue from answering the questionnaires or receded from this study.

Data Analysis

The data in this study were analyzed as follows:

1. Data management

1.1 All data were managed by coding, data entry, data screening, data cleaning and editing. The total scores for each interval or ratio variables including Thai-STAIC-R, and SCBQ were summed from the scores of all the items measuring those variables. The mean scores for each interval or ratio variables including Thai PedsQ 4.0, CODI, MSAS 10-18, and CFI were summed from the scores of all the items and divided by the number of items. Single-item variables including age, income, illness duration and PPSC score were coded as raw data. A dummy code was used for gender, the level of education, family income, type of cancer, and treatment and procedure.

1.2 Missing data were checked. Missing data is a serious problem in the process of data analysis especially when it occurs more than 5% (Tabachnick & Fidell, 2007). According to Schlomer, Bauman, and Card (2010), the amount and source of missing data and the pattern of missing data should be considered and imputed. However, if missing data occurs in a few cases, deleting a case is one procedure to manage any missing data (Tabachnick & Fidell, 2007). Several methods are used to impute missing data such as mean substitution, regression, expectation maximization, and multiple imputation depending on the patterns of missing data (Schlomer et al., 2010; Tabachnick & Fidell, 2007). However, in this study, missing data were prevented by checking the completeness and correctness of all questionnaires by the researcher or RAs.

1.3 Univariate and multivariate outliers were checked. Outliers are extreme values that do not represent the population and can affect both type I and type II errors (Tabachnick & Fidell, 2007). According to Tabachnick and Fidell (2007), graph methods, such as, boxplot, and histogram can be used to identify outliers in univariate statistics. Moreover, Mahalanobis Distance is another method used to examine outliers in a set of independent variables in multivariate statistics. Mahalanobis Distance at $p < .001$ is suspected of being an outlier and evaluated as chi-square with a degree of freedom equal to the number of variables (Tabachnick & Fidell, 2007). The cutoff point that is used to specify significant values when the sample size ≥ 50 is Mahalanobis Distance approximate $(n-1)h_{ii}$, where n = sample size, and h_{ii} = hat elements or leverage, then $h_{ii} = 3p/n$ (where p = the number of independent variables, and n = sample size) (Stevens, 2002). In this study, 5 cases (no any symptom occurring) were omitted because these samples did not meet criteria. Besides, outliers were evaluated by boxplots. Six outliers were found in state anxiety (4 cases), and family functioning (2 cases). Thus, 6 outliers were excluded and further data analysis was performed on 199 samples. In addition, the multivariate outlier was checked. There was no value of Mahalanobis Distance $\geq$ 20.9 for all independent variables. Therefore, univariate outliers were managed and no multivariate outlier occurred.

1.4 The level of the measurement of the analysis of each variable was considered. The types of data required for dependent variables and independent variables are interval or ratio levels. For nominal level variables, the variables must be dummy coded (Munro, 2005a; Polit, 1996). In this study, HRQOL, coping, self-care behavior, symptom distress, trait-and state anxiety, and family functioning were measured at interval level. Functional status was measured at a ratio level. Therefore, this assumption was met.

2. Preliminary data analysis

2.1 The description of the demographic data such as age, gender, child's education level, parent's education level, family income, type of cancer, illness duration, and treatment and procedure were analyzed by descriptive statistics using frequencies, percentage, mean, and standard deviation.

2.2 The assumptions were tested. Since path analysis relies on multiple regression, the assumptions for path analysis were checked by normality, linearity, the absence of multicollinearity, homoscedasticity, non recursiveness, measurement error, autocorrelation, the specification of the model, and model identification. Therefore, the assumptions were tested as follows:

2.2.1 Normality: Normality is an assumption that is important before performing multivariate statistics. This assumption can use either graphical or statistical methods (Tabachnick & Fidell, 2007). In this study, the univariate normality was tested by using skewness and kurtosis. These parameters could be converted to a z-score by being divided by standard error. If the z-scores of skewness and kurtosis are greater than 3.29 or less than -3.29, it indicates that the data are not normally distributed (Ghasemi & Zahediasl, 2012; Kim, 2013). Two variables including family functioning and state anxiety were skewed (z-score = -3.74 and 3.76, respectively). To manage univariate normality, 6 outliers were excluded from this study. For multivariate normality, the multivariate outlier was detected using Mahalanobis distance (D^2). "Mahalanobis distance (D^2) is the distance of a case from the centroid where the centroid is the point defined by the means of all the variables taken as a whole" (Burdenski, 2000). In this study, the multivariate normality of variables was examined by using the scatterplot of Mahalanobis distance values with chi-squares (Burdenski, 2000). According to Burdenski (2000), the plotting of Mahalanobis distance against chi-square is presented in a straight line when this assumption was assumed. In this study, the plotting of Mahalanobis distance against chi-square presented in a straight line (Appendix D); therefore, the data showed multivariate normal distribution.

2.2.2 Linearity: The relations among the variables must be linear (Streinner, 2005). In this study, the univariate linearity and multivariate linearity was examined by scatter plot (Tabachnick & Fidell, 2007). The results showed that the plot presented along the straight line (Appendix D).

2.2.3 Absence of multicollinearity: Multicollinearity was the interactions among the variables (Streinner, 2005). A Pearson correlation coefficient of more than .85, Tolerance value close to 0 (Munro, 2005b), and Variance Inflation factor (VIF) more than 10 were used to detect multicollinearity (Hair et al., 2010; Munro, 2005b). In this study, no variable presented correlation coefficients more than .85, Tolerance value more than 0.6 and VIF less than 2 and the highest VIF was 1.46.

2.2.4 Homoscedasticity: This assumption is that the variance of the residual for all values of independent variables is constant. This assumption was checked by scatter plot, the residual plotted against the predicted values or against the independent variables (Statistics Solutions, 2013). The results showed that the plot presented the same distance from the line (Appendix D).

2.2.5 Recursive model: This assumption showed that the flow of causation in the model was unidirectional (Norris, 2013b). In this study, the arrow had only one way flow.

2.2.6 Measurement error: All variables in the model were assumed to have no measurement error (Norris, 2013b). This assumption was controlled by using a reliable instrument for all variables. The acceptable value of the internal consistency of instruments is .70 or greater for new instruments (Polit & Beck, 2012) and more than .80 for old instruments (Burns & Grove 2009). In this study, the reliability coefficients of all instruments were more than .80.

2.2.7 Autocorrelation: This assumption tested errors occurring when the high correlation between independent variables presented. The autocorrelation was tested by the Durbin-Watson statistic. The acceptable value is 1.5 - 2.5. This value indicates that no autocorrelation or residual are not correlated (Munro, 2005b). The value of Durbin-Watson in this study was 2.03

2.2.8 The specification of the model: This assumption was based on the evidence from previous research and theories. The relevant variables were included in the model, while the irrelevant variables were omitted (Streiner, 2005). In this study, all variables were selected based on evidence from previous research and theories.

2.2.9 Model identification: Models can be over-identified, just-identified, or under-identified (Norris, 2013). The over-identified model is defined as the number of data points being more than the number of parameters. The just-identified model is defined as the number of data points being equal to the number of parameters. The under-identified model is defined as the number of data points being less than the number of parameters (Ullman, 2007). The number of data points is determined by the number of variances and covariances or is equal $p(p+1)/2$ where p = the number of variables. The number of parameters is the number of regression coefficients, variances and covariances (Ullman, 2006). According to Ullman (2007), the model should be over identified. If the model is under-identified, the number of parameters needs to be reduced by fixing, constraining, or deleting some parameters (Ullman, 2007). In this study, there were 36 data points and the number of parameters was 18. Therefore, the model was over-identified.

3. Data analysis

3.1 Path analysis was used to estimate the parameter of the hypothesized causal model for the variables by using AMOS program.

3.1.1 Model estimation: There are many different model estimation techniques, such as, Maximum Likelihood (ML), Generalized Least Squares (GLS), Elliptical Distribution theory (EDT), and Asymptotically Distribution Free (ADF). However, suitable estimation techniques depend on sample size, normality of the distribution, and violation of the assumption of independence of factors and errors (Ullman, 2007). In medium to large sample sizes; ML, the Scaled ML, and GLS estimation procedures are appropriate for normality while the Scaled ML is suitable when the normality assumption is violated. The ML estimation method is frequently used (Norris, 2013b; Ullman, 2007). In addition, when the assumptions are violated, this method performs better than other methods (Hair et al., 2010; Norris, 2013b). Therefore, ML estimation procedure was used to test statistics in this study.

3.1.2 Model fit evaluation: The overall model fit was identified by using three types fit indices including absolute fit indices, incremental fit indices, and parsimonious fit indices (Hair et al., 2010).

3.1.2.1 Absolute fit indices: These indices are used to determine how well a model replicated the sample data (Hair et al., 2010). Chi-square (X^2), relative Chi-square, goodness-of-fit index (*GFI*), root mean square error of approximation (*RMSEA*), and standardized root mean square residual (*SRMR*) were used to assess these indices.

- Chi-square test is used as an index of the significance of the discrepancy between the sample correlation matrix and the estimated population correlation matrix estimated from the model. The results in which the Chi-square is non-significant or *p*-value more than .05 is recommended for the hypothesized model fitted with the data (Ullman, 2007).

- Relative Chi-square is the Chi-square index divided by the degrees of freedom. This value is used as an informal measure of fit. The acceptable value is less than or equal to 3 (Norris, 2013b).

- The goodness-of-fit index (*GFI*) is a measure of the proportion of all variances and covariances accounted for by the model and compares the squared residuals from the prediction with the actual data. The overall degree of fit ranges from 0 to 1 and *GFI* equal to or more than .90 indicates a better fit (Norris, 2013b; Hair et al., 2010).

- The adjusted goodness of fit index (*AGFI*) is an extension of *GFI* that is adjusted by the degree of freedom for the proposed model to the degree of freedom for the null model. *AGFI* ranges from 0 to 1, with a value closest to 1 indicating a good fit (Polit, 1996). The acceptable *AGFI* value is equal to or more than .90 (Ullman, 2007).

- Root mean square error of approximation (*RMSEA*) is the discrepancy which is expressed per degree of freedom in terms of the population. A cutoff value of less than .08 indicates a model fit (Hair et al., 2010).

- Standardized root mean square residual (*SRMR*) is the square root of the discrepancy between the sample covariance matrix and the model covariance matrix. The *SRMR* has a range of 0 to 1 (Ullman, 2007). The acceptable value of *SRMR* is less than .08 (Ullman, 2007; Hair et al, 2010)

3.1.2.2 Incremental fit indices: These indices are used to assess how well the estimated model can explain a set of observed data when compared with another model. Comparative fit indices (*CFI*), Normed fit index (*NFI*), Tuker-Lewis index (*TLI*) were used as indicators for these indices as follows.

- Comparative fit indices (*CFI*) is the comparative fitness index between a target model and the initial model and the acceptable value is equal to or more than .95 (Ullman, 2007; Norris, 2013b).

- Normed Fit index (*NFI*) is the difference between the chi-squared value of the hypothesized model and the chi-squared value of the null model. The acceptable value of *NFI* is equal to or more than .95 (Hair et al., 2010)

- Tuker-Lewis index (*TLI*) is a comparison of the normed chi-square values for the null and specified model. The range of *TLI* lies between 0 and 1. The value greater than .95 indicates a great fit (Hair et al., 2010).

3.1.2.3. Parsimonious fit indices: These indices are used to identify which model among a set of competing models is best. In this study, Akaike Information Criterion (*AIC*) was used to compare between models that non-nested estimated with the same data. Small *AIC* values indicated a good fitting and parsimonious model (Hooper, Coughlan, & Mullen, 2008)

3.1.3 Model modification: When an unacceptable model fit is found, the model can be revised based on modification indices and substantive reasoning (Ullman, 2007). In this study, the researcher modified the hypothesized model based on statistical and theoretical considerations. The non-significance parameters estimate were excluded or added in some parameters.

3.2 Interpreting the path diagram: After an acceptable model fit was created, the path coefficient (β) was put in and interpreted in the path diagram to indicate the pattern and magnitude of the relationship between the independent variables and the dependent variables. The p-value less than .05 indicated a significant relationship between the variables and supported the research hypothesis.

3.3 A direct effect, an indirect effect, and a total effect were calculated. The direct effect equals the path coefficient between two variables. The indirect effect is the effect on the dependent variable that occurs through a mediating variable. The total effect is the sum of the direct effect and the indirect effect (Polit, 1996).

CHAPTER 4

RESULTS AND DISCUSSION

This chapter provides information regarding the results and discussion. The demographic data, study variables, results of path analysis, and discussion are included in this chapter.

Results

1. The Demographic Data

The sample in this study comprised 210 Thai children with cancer hospitalized or followed up at the outpatient units in tertiary-care hospitals in Thailand and their parents. However, 5 children were excluded because of no symptom distress experience. Six children acted as outliers were also excluded. Consequently, 199 children and caregivers were included in the process of data analysis. The age of children with cancer ranged from 9 to18 years and the mean age was 11.93 years (*SD* = 2.23). The majority of children were male (64.8%) and were students in grades 4-6 (44.2%) and 1-3 (20.6%). Two-fifths of the children were diagnosed with leukemia (40.7%), 16.1% with brain tumor, and 12.6% with lymphoma and osteosarcoma, respectively. Regarding illness duration, 70.9% of the children were diagnosed with cancer for 1-12 months. Nearly two-thirds received chemotherapy (63.3%) and 21.2% underwent chemotherapy combined with surgery. Most caregivers were educated at the high school or the equivalent level, and only 1% had no formal education. Nearly half of the caregivers had a family income of 5,000-10,000 Baht/month (Table 4).

Table 4

Frequency, percentage, mean (M), standard deviation (SD), minimum-maximum (Min-Max), skewness value, kurtosis value of the demographic data of children with cancer and their caregivers (N = 199)

Demographic data	Frequency	Percent
Children		
Gender		
Male	129	64.8
Female	70	35.2
Age (years)		
9 - 12	129	64.8
13 - 18	70	35.2
Min-max = 9 - 18, *M* ± *SD* = 11.93 ± 2.23 Skewness value = .63, Kurtosis value = -.24		
Education		
Primary school		
Grade 1-3	41	20.6
Grade 4-6	88	44.2
Junior high school	67	33.7
Senior high school	3	1.5
Diagnosis		
Leukemia	81	40.7
Brain cancer	32	16.1
Lymphoma	25	12.6
Osteosarcoma	25	12.6
Ewing sarcoma	8	4.0
Histiocytosis	5	2.5
Hepatoblastoma	4	2.0
Neuroblastoma	2	1.0
Other (e.g., renal tumor, germ cell tumor of the ovary, rhabdomyosarcoma)	17	8.5

Table 4 *(continued)*

Demographic data	Frequency	Percent
Duration of illness (months)		
1-12	141	70.9
13-24	58	29.1
Min-max = 1-24, *M* ± *SD* = 9.17 ± 7.45 Skewness value = .79, Kurtosis value = -.76		
Treatment		
Chemotherapy only	126	63.3
Chemotherapy with surgery	44	22.1
Chemotherapy with radiation	8	4.0
Chemotherapy with radiation and surgery	21	10.6
Caregivers		
Education		
Illiterate	2	1.0
Primary school	79	39.7
High school or equivalent	86	43.2
Bachelor degree or equivalent	30	15.1
Higher than bachelor degree	2	1.0
Income (Baht/month)		
<5,000	20	10.1
5,000-10,000	86	43.2
10,001-20,000	39	19.6
20,001-30,000	28	14.1
30,001-40,000	8	4.0
40,000-50,000	11	5.5
>50,000	7	3.5

2. The Study Variables

The family functioning scores ranged from 2 to 3.86 with a mean of 3.15 (*SD* = .35). The coping scores ranged from 1 to 5 with a mean of 3.64 (*SD* = .80). The symptom distress scores ranged from 0 to 2.83 with a mean of 1.04 (*SD* = .64). The self-care behavior scores ranged from 30 to 75 with a mean of 59.41 (*SD* = 10.55). The trait anxiety scores ranged from 20 to 60 with a mean of 30.23 (*SD* = 6.77). The state anxiety scores ranged from 19 to 57 with a mean of 28.38 (*SD* = 3.82). The functional status scores ranged from 20 to 100 with a mean of 76.53 (*SD* = 17.82). The HRQOL scores ranged from 28.26 to100 with a mean of 70.79 (*SD* = 15.24). All of the variables were normally distributed indicating that the assumption of normality was met. Therefore, all of them were included in the data analysis process (Table 5).

Table 5

Possible score, actual score, mean (M), standard deviation (SD) of study variables (N = 199)

Variable	Possible score	Actual score	*M*	*SD*
1. Family functioning	1-4	2-3.86	3.15	0.35
2. Coping	1-5	1-5	3.64	0.80
3. Symptom distress	0-4	0-2.83	1.04	0.64
4. Self-care behavior	0-100	30-75	59.41	10.55
5. Trait anxiety	20-60	20-48	30.23	6.77
6. State anxiety	19-57	19-39	28.38	3.82
7. Functional status	0-100	20-100	76.53	17.82
8. Health-related quality of life	0-100	28.26-100	70.79	15.24

3. The Results of Path Analysis

Before performing the path analysis, the statistical assumptions were examined. All assumptions were met, except for the univariate normal distribution of two variables, state anxiety (Skewness value = 3.76, Kurtosis value = 2.42) and family functioning (Skewness value = -3.74, Kurtosis value = 2.21). Six outliers from on the state anxiety scores (4 cases) and family functioning scores (2 cases) were deleted and discarded; resulting in normal distribution of these two set data. The multivariate outliers were also checked via the Mahalanobis distance, and no multivariate outliers were present as well. The plotting of the Mahalanobis distance against the chi-square test resulted in a straight line. Therefore, the data showed both a univariate and multivariate normal distribution. The correlation matrix was used to determine multicollinearity. The results showed that no multicollinearity was detected among the independent variables. Moreover, bivariate scatterplots were used to determine linearity, and the results showed that the relationship between each dependent and independent variable was adequately linear. Homoscedasticity was examined by scatterplots, and the results indicated that the variance of error of the independent variables was constant (Appendix E).

The estimation method used in this study was Maximum Likelihood by means of AMOS program version 23. In the model, HRQOL, trait anxiety, state anxiety and functional status were endogenous variables. On the other hand, four variables—family functioning, coping, symptoms, and self-care behavior were exogenous variables. Then the research hypotheses were examined, and the results are presented in Tables 6 and Figure 5.

Research hypothesis 1

Research hypothesis 1 stated that the initial model would fit the data.

The goodness of fit measures of the hypothesized model

The hypothesized model was tested and the results revealed that the absolute fit indices and incremental fit indices had a lower than acceptable value (χ^2 = 104.11, df = 18, p = .00, χ^2/df = 5.78, GFI = .89, $AGFI$=.78, NFI = .58, TLI = .39, CFI = .61, $RMSEA$ = .16, $SRMR$ = .133) identifying that the hypothesized model did not fit well with the empirical data (Table 6). Besides, in the hypothesized model, family functioning, coping, symptom distress, self-care behavior, and state anxiety did not have a significant direct effect on HRQOL (β = -.03, -.09, -.10, 07 respectively; p > .05). Coping did not have a direct effect on trait anxiety (β = -.11, p > .05). However, trait anxiety and functional status had a significant direct effect on HRQOL (β = -.34, .36, respectively; p < .001). Symptom distress had a significant direct effect on functional status (β = -.18, p < .05). Trait anxiety had a significant direct effect on state anxiety (β = .44, p < .001).

Even though the results from the hypothesized model reported four significant paths, it showed that the fit indices had lower than adequate values. Consequently, the hypothesized model could not interpret the next hypotheses. Then, the hypothesized model was modified based on modification indices as well as theoretical and statistical support.

The goodness of fit measures of the modified model

As the hypothesized model did not fit the data, it was then re-specified, resulting in the modified model. The direct path from state anxiety to functional status, the direct path from coping to state anxiety, and the correlation paths between exogenous variables were added. In addition, the direct path from family functioning to HRQOL and the direct path from self-care behavior to HRQOL were dropped to improve the fit and parsimony of the model since family functioning and self-care behavior did not significantly affect HRQOL. Furthermore, family functioning and self-care behavior did not directly affect other endogenous variables. After adding paths as well as trimming family functioning and self-care behavior, the modified model was examined to determine whether the model fitted, and the results showed that the modified model fitted well ($\chi 2$ = 8.7, *df* = 4, *p* = .068, $\chi 2/df$ = 2.18, *GFI* = .99, *AGFI* = .93, *NFI* = .95, *TLI* = .90, *CFI* = .97, *RMSEA* = .077, *SRMR* = .047). The model was interpreted, and the hypotheses testing results based on the modified model (Table 6 and Figure 5) were as follows.

Research hypothesis 2

The second hypothesis examined the direct and positive effect of family functioning on HRQOL in children with cancer. In the modified model, the path from family functioning to HRQOL was dropped. Consequently, the second research hypothesis was not supported.

Table 6

Comparison of model fit statistics of the hypothesized model and the modified model

Statistical test	Hypothesized model	Modified model	Criteria of goodness of fit values
Chi-square (χ^2)	104.11, *df* = 18 *p* = .00	8.725, *df* = 4 *p* = .07	close to zero, p > .05 (Ullman, 2007)
Relative Chi-square	5.78	2.18	≤ 3 (Munro, 2005)
GFI	0.89	.99	> .90 (Norris, 2013b; Hair et al., 2010)
AGFI	.78	.93	> .90 (Ullman, 2007)
SRMR	.133	.047	< .05 (Hooper et al., 2008; Norris, 2013b)
RMSEA	.155	.077	< .08 (Hair et al., 2010; Hooper et al., 2008)
NFI	.58	.95	≥ .95 (Hair et al., 2010)
TLI	.39	.90	≥ .95(Hair et al., 2010)
CFI	.61	.97	≥ .95 (Ullman, 2007; Norris, 2013b)
AIC	140.11	42.72	Small value, greater parsimony (Tabachnick & Fidell, 2007)

Note. *GFI* = Goodness-of-fit index, *AGFI* = Adjusted goodness of fit, *SRMR* = Standardized root mean square residual, *RMSEA* = Root mean square error of approximation, *NFI* = Normed fit index, *TLI* = Tucker-Lewis index, *CFI* = Comparative fit index, *AIC* = Akaike information criterion

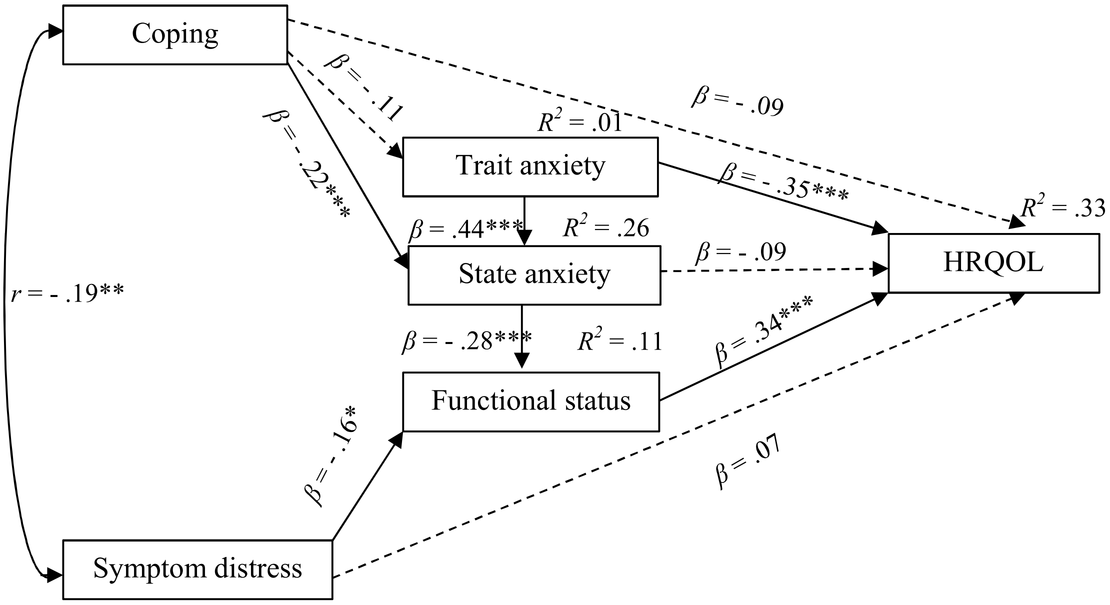

Figure 5. A modified causal model of health-related quality of life in Thai children with cancer

Note **p* < .05, ***p* < .01, ****p* <.001, Model fit indices: $\chi^2 = 8.725$, $df = 4$, $p = .068$, $\chi^2/df = 2.18$, *GFI* = .99, *AGFI*=.93, *NFI* = .95, *TLI* = .90, *CFI* = .97, *RMSEA* = .077, *SRMR* = .047

Research hypothesis 3

The third hypothesis examined the direct effect of coping on HRQOL and its indirect effect on HRQOL via trait and state anxiety. The path analysis results showed that coping did not directly affect HRQOL ($\beta = -.09$, $p > .05$). The indirect effect of coping on HRQOL through trait and state anxiety were not significant ($\beta = .04, .02$, respectively; $p > .05$). Therefore, coping did not have a significant total effect on HRQOL ($\beta = -.00$, $p > .05$) (Table 7). Hence, the third hypothesis was not supported.

Table 7

The direct effects, indirect effects, and total effects of the modified model

Outcomes/Paths	Modified model				
	R^2	DE	IE	IE (Total)	TE
HRQOL	.33.				
C → HRQOL		-.09		.09**	-.00
C → TA → HRQOL			.04		
C → SA → HRQOL			.02		
C → TA → SA → HRQOL			.00		
C → SA → FS → HRQOL			.03*		
TA → HRQOL		-.35***		-.08*	-.43*
TA → SA → HRQOL			-.04		
TA → SA → FS → HRQOL			-.04*		
SA → HRQOL		-.09		-.10*	-.19*
SA → FS → HRQOL			-.10*		
SD → HRQOL		-.07		-.05*	-.12*
SD → FS → HRQOL			-.05*		
FS → HRQOL		.34***	-	-	-
Trait anxiety	.01				
C → TA		-.11	-	-	-
State anxiety	.26				
C → SA		-.22***	-	-.05	-.27**
C → TA → SA			-.05		
TA → SA		.44***	-	-	-
Functional status	.11			-	-
C → FS		-	-	.08**	-
C → SA → FS		-	.06**	-	-
C → TA → SA → FS		-	.02	-	-
SD → FS		-.16*	-	-	-
TA → SA → FS		-	-.12**	-	-
SA → FS		-.28***	-	-	-

Note. *p <.05, **p <.01, ***p <.001

DE = Direct effect, IE = Indirect effect, TE = Total effect, Coping, TA = Trait anxiety, SA = State anxiety, FF = Family functioning, SD = Symptom distress , FS = Functional status, HRQOL = Health-related quality of life

Research hypothesis 4

The fourth hypothesis tested the direct and negative effect of symptom distress on HRQOL and its indirect and negative effect on HRQOL via the functional status in children with cancer. The results indicated that symptom distress did not have a significant direct effect on HRQOL ($\beta = -.07$, $p > .05$). Also, the indirect effect of symptom distress on HRQOL through functional status was significant ($\beta = -.05$, $p < .05$). Symptom distress had a significant negative total effect on HRQOL ($\beta = -0.12$, $p < .05$) (Table 7). Therefore, the fourth hypothesis was partially supported.

Research hypothesis 5

The fifth hypothesis examined the direct and negative effect of trait anxiety on HRQOL and its indirect effect on HRQOL via state anxiety in children with cancer. The results affirmed that trait anxiety had a significant direct and negative effect on HRQOL ($\beta = -.35$, $p < .001$). The results also showed that trait anxiety did not have a significant indirect affect HRQOL via state anxiety ($\beta = -.04$, $p > .05$). However, trait anxiety had a significant negative total effect on HRQOL ($\beta = -.43$, $p < .05$) (Table 7). Consequently, the fifth hypothesis was partially supported.

Research hypothesis 6

The sixth hypothesis maintained that state anxiety had a direct and negative effect on HRQOL in children with cancer. The results, however, failed to confirm this ($\beta = -.09$, $p > .05$) (Table 7). Therefore, the sixth hypothesis was not supported.

Research hypothesis 7

The seventh hypothesis examined the direct and positive effect of functional status on HRQOL in children with cancer. The results indicated that functional status had a significant direct and positive effect on HRQOL ($\beta = .34$, $p < .001$) (Figure 5 and Table 7). Therefore, the seventh hypothesis was supported.

Research hypothesis 8

The eighth hypothesis examined the direct and positive effect of self-care behavior on HRQOL in children with cancer. The findings suggested that self-care behavior did not directly affect HRQOL ($p > .05$). In the modified model, the path self-care behavior to HRQOL was dropped to improve fit. Consequently, the eight research hypothesis was not supported (Figure 5).

Research hypothesis 9

The ninth hypothesis examined the direct and negative effect of coping on trait anxiety in children with cancer. The results found no significant direct effect of coping on trait anxiety ($\beta = -.11$, $p > .05$). As a result, the ninth hypothesis was not supported.

Research hypothesis 10

The tenth hypothesis examined the direct and positive effect of trait anxiety on state anxiety. It was found that trait anxiety had a significant direct effect on state anxiety ($\beta = .44$, $p < .001$) (Figure 5 and Table 7). As a consequence, the tenth hypothesis was strongly supported.

Research hypothesis 11

The eleventh hypothesis tested the direct and negative effect of symptom distress on the functional status of children with cancer. The results showed that symptom distress had a significantly negative effect on functional status (β = -.16, $p < .05$) (Figure 5 and Table 7). As a result, the eleventh hypothesis was supported.

The additional finding

In the modified model, the paths from state anxiety to functional status and from coping to state anxiety were added and also the correlation between coping and symptom distress based on the previous research study. The modified model (Figure 5 and Table 7) provided additional significant findings as follows.

1. Coping had a significant positive indirect effect on HRQOL via both state anxiety and functional status (β =.03, p <.05).
2. State anxiety had a significant negative indirect affected on HRQOL via functional status (β = -.10, $p < .05$).
3. Coping had a significant negative direct effect on state anxiety (β = -.22, $p < .001$).
4. State anxiety had a significant negative direct effect on functional status (β = -.28, $p < .001$).
5. Trait anxiety had a significant negative indirect effect on functional status via state anxiety (β = -.12, $p < .01$).
6. Coping significantly and negatively correlated with symptom distress (r = -.19, $p < .01$).

Discussion

The discussion section is composed of two parts: demographic data and results of research hypotheses are as follows.

1. Demographic data

One hundred and ninety-nine children with cancer and their caregivers from three regions of Thailand participated in this study. Approximately two thirds of the children with cancer were male (64.8%). Their ages ranged from 9 to18 years, and the mean age was 11.93 years (*SD* ± 2.23). Most of them were school-age children (9-12 years) (64.8%). The finding of this study regarding the incidence of cancer was consistent with the national incidence rate reported by Imsamran and colleagues (2015). They found that the incidence of cancer in male children aged between 0 and 14 years was higher than that among female children. The incidence rate in male children aged below 4 years, 5-9 years, and 10-14 years was 21.7, 16.6, and 10.2 per 100,000 population, respectively. On the other hand, among female children in the same ranges of age it was 14.1, 10.5, and 9.4 per 100,000 population, respectively (Imsamran et al., 2015). Our findings concurred with the previous reports of a low cancer incidence in children of an older age as well. Most of our children had attended school at a primary level (64.8%) (grades 4-6, 44.2%; grades 1-3, 20.6%). School grade level in this study was related with the children's range of age.

Two-fifths of our participants were diagnosed with leukemia (40.7%), followed by brain tumor (16.1%), lymphoma (12.6%) and osteosarcoma (12.6%). The types of cancer in this study were similar to the childhood cancer types classified by the International Classification of Childhood Cancer. Furthermore, our findings were in line with those of previous reviews from Thailand in 2003-2005 (Wiangnon et al., 2011). The most common cancer in children under 15 years of age was leukemia and followed by lymphoma and neoplasms of the central nervous system (CNS) (Wiangnon et al., 2011).

Regarding illness duration, most children (70.9 %) were in the first year of diagnosis, and the remaining ones were in their second years of diagnosis (29.1%). Illness duration in this study was related to the inclusion criteria of the study since the overall HRQOL was reported lower than that of general children among newly-diagnosed cancer patients (Landolt et al., 2006), and those undergoing therapy (Landolt et al., 2006; Wu et al., 2007). Concerning received treatment, nearly two-thirds of the children received chemotherapy (63.3%), followed by chemotherapy with surgery (21.2%). Treatment was related to the type for cancer. In this study, leukemia had the highest incidence. Based on the 2016 Thai national protocol for the treatment of childhood cancer, chemotherapy was the most commonly used therapy to treat leukemia and lymphoma (The Thai Pediatric Oncology Group, The Thai Society of Hematology, and National Health Security Office, 2016). Besides, chemotherapy combined with other treatments was regularly used to treat different kinds of cancer (The Thai Pediatric Oncology Group, The Thai Society of Hematology, & National Health Security Office, 2016).

2. Results of research hypotheses

2.1 Model fit

The first hypothesis stated that the model would fit the empirical data. In this study, the hypothesized model was developed based on Wilson and Cleary's health-related quality of life conceptual model (WCM) as revised by Ferrans et al. (2005) and evidence from previous research regarding the factors that are associated with QOL in children with cancer. Four concepts, including those of the revised WCM—characteristics of the environment, symptoms, and functional status—were included in this study. Family functioning represented characteristics of the environment, and symptom distress and trait and state anxiety represented symptoms. Coping and self-care behavior were included based on previous evidence. The directions of the paths were also based on previous evidence.

In this study, the fit indices used to determine the overall model fit consisted of three types: absolute fit indices, incremental fit indices, and parsimonious fit indices (Hair et al., 2010). The criteria for the absolute fit indices were a non-significant Chi-square (χ^2) result (Ullman, 2007), and if the relative Chi-square score was less than or equal to 3 (Norris, 2013b). The goodness-of-fit index (*GFI*) had to be equal to or more than .90 (Norris, 2013b; Hair et al., 2010), and the adjusted goodness-of-fit index (*AGFI*) needed to be equal to or more than .90 (Ullman, 2007). The root mean square error of approximation (*RMSEA*) needed to be less than .08 (Hair et al., 2010) and standardized root mean square residual (*SRMR*) was less than .05 (Hooper et al., 2008).

The criteria for incremental fit indices involved comparative fit indices (*CFI*) equal to or more than .95 (Ullman, 2007; Norris, 2013b) and a normed fit index (*NFI*) and Tuker-Lewis index (*TLI*) values equal to or more than .95 (Hair et al., 2010). In addition, the Akaike Information Criterion (*AIC*) was employed to indicate a good fitting and parsimonious model (Hooper et al., 2008).

The results of the present study reported that the fit measures, namely the absolute fit indices and the incremental fit indices, did not present within acceptable values (χ^2 = 104.11, df = 18, *p* = .00, χ^2/df= 5.78, *GFI*=.89, *AGFI*=.78, *NFI* = .58, *TLI* = .39, *CFI* = .61, *RMSEA* = .16, *SRMR*=.13) (Table 6). As mentioned earlier, the hypothesized model was developed based on the revised WCM by Ferrans et al.'s (2005) as well as previous evidence. However, only the association between self-care behavior and HRQOL was examined in Thai children with cancer. As it regards the other variables, most of the evidence came from western countries. No study has ever examined either the relationship or the prediction of the other variables in Thai children with cancer. From this reason, the differences of context might have influenced this study's model. For example, the differences in culture and stressor characteristics could influence coping between Thai and American children. According to McCarty et al. (1999), Thai children utilize more secondary control than Americans children when coping with separation. Therefore, the hypothesized model did not fit well.

According to Ullman (2007), the model could be revised based on substantive reasoning when an unacceptable model fit was found. Besides, the highest modification index (*M.I.*) should be selected. Based on the highest value of the modification index obtained from the computer program, it was suggested to add a path from self-care behavior to trait anxiety (*M.I.* = 18.156). However, this path was omitted since no evidence supported the prediction of self-care behavior on trait anxiety. Next, a path from state anxiety to functional status was added based on the second largest value of the modification index (*M.I. = 16.29*5) and the revised WCM by Ferrans et al. (2005). In the revised WCM, symptoms had an indirect effect on the overall QOL via the functional status and general health perception and directly affected functional status as well (Ferrans et al., 2005). The model fit after this modification changed minimally ($\chi2$ = 86.98, *df* = 17, *p* = .00, $\chi2/df$ = 5.12, *GFI* =.91, *AGFI* =.81, *NFI* = .65, *TLI* = .47, *CFI* = .68, *RMSEA* = .14, *SRMR* =.12).

Afterward, a path from coping to state anxiety was added to improve the fit based on the modification index (*M.I.* = 11.946). Besides, a previous study has reported that secondary-control coping influences anxiety and depression in American children with cancer negatively (Compas et al., 2014). After adding these paths, the modified model remained outside of the acceptable values (χ^2 = 74.52, *df* = 16, *p* = .00, χ^2/df = 4.66, *GFI* =.92, *AGFI* =.83, *NFI* = .70, *TLI* = .53, *CFI* = .73, *RMSEA* = .14, *SRMR* =.11). The path from symptom distress to trait anxiety was suggested from the modification index (*M.I.* = 4.85). However, this suggestion was omitted since no evidence supported the prediction of symptom distress on trait anxiety. Then The correlations among four exogenous variables—family functioning, coping, symptoms, and self-care behavior were added based on earlier research evidence. The association between symptom distress and coping was examined in adults with advance-stage cancer that were undergoing chemotherapy, and the results found that symptom distress positively influenced avoidant coping (Sumpio, Jeon, Northouse, & Knobf, 2017). A study on patients with type-2 diabetes revealed that diabetes distress negatively and indirectly affected self-care behavior via self-efficacy (Devarajooh & Chinna, 2017). These results were used to support the relationship between symptom distress and self-care behavior. Moreover, Preechawong et al.'s study (2007) reported that family functioning significantly and positively influenced resourceful coping in Thai adolescents with asthma. In addition, the association between coping and self-care behavior was also observed in adults with diabetes (Samuel-Hodge, Watkins, Rowell, & Hooten, 2008).

However, the modified model still did not reach the acceptable values (χ^2 = 41.35, df = 10, p = .00, χ^2/df = 4.14, GFI = .96, $AGFI$ = .84, NFI = .83, TLI = .60, CFI = .86, $RMSEA$ = .13, $SRMR$ = .08). After checking the direction of each variable based on the theoretical reasoning, the path from family functioning to HRQOL did not show a true direction. The results indicated a negative relationship between these two variables, which was inconsistent with previous evidence. For example, Barakat and colleagues' study showed that dysfunction in role had a negative influence on the psychological domain of quality of life (β = -0.32, $p < .01$) and a negative influence on the physical domain of quality of life (β = -0.21, $p < .10$) in American adolescents with cancer (Barakat et al., 2010). Moreover, in Chinese elderly, family functioning did not significantly influence QOL (Lu, Yuan, Lin, Zhou, & Pan, 2017). According to Lu et al. (2017), family functioning did not have a significant effect on the QOL (β = .10, $p > .05$) of Chinese elderly. Therefore, family functioning was dropped. Then the fit of the model was tested again. The results presented that the model still did not fit with the empirical data (χ^2 = 39.87, df = 7, p = .00, χ^2/df = 5.67, GFI = .95, $AGFI$ = .80, NFI = .83, TLI = .53, CFI = .84, $RMSEA$ = .15, $SRMR$ = .08).

The variable, self-care behavior, was also dropped due to non-significant effect on HRQOL. This finding was incongruent with that of Punthmatharith et al. (2013) who found significant positive relationship (β = .32, $p < .01$). Nevertheless, in American and Canadian female adolescents with type-1 diabetes, a non-significant association between self-care behavior and HRQOL has been reported. Adherence to the diabetes self-care such as insulin injection, diet control, exercise, and glucose testing did not have a significant correlation with the overall QOL of American and Canadian female adolescents with type-1 diabetes (r = -.09, -.25, .00, -.19, respectively; $p > .05$). Likewise, the same study reported a non-significant correlation in male adolescents with type-1 DM, except for insulin injection (Di Battista, Hart, Greco, & Gloizer, 2009). After modification by dropping self-care behavior, the modified model not only fitted better, but also was parsimonious (Table 6).

Based on the modification of the above model, the modified model explained a higher amount of variance on HRQOL (R^2 = 33) than the initial hypothesized model (R^2 = 31). The whole model accounted for 33% of the explained variance for HRQOL. This study provided new evidence regarding the influencing factors on the HRQOL among children and adolescents with cancer. The findings from the modified model showed new associations between coping and state anxiety; state anxiety and functional status. In addition, the correlation between coping and symptom distress was revealed. This model provided new evidence especially concerning Thai children with cancer.

However, further examination of 67% of the unexplained variance for HRQOL is needed. Based on Ferrans et al.'s conceptual model of HRQOL, the overall quality of life is influenced by several variables that were not included in the present model such as characteristics of the individual, biological function, and general health perceptions. In addition, based on previous evidence, several other factors are associated with HRQOL; they include both non-modifiable such as age (Dijk et al., 2007; Wu et al., 2007), gender (Wu et al., 2007), type of cancer (Pek et al., 2010, and treatment (Reimers et al., 2009; Wu et al., 2007); and modifiable factors such as the number of symptoms, symptom severity (Baggott et al., 2011), depression (Chung et al., 2012; Kanellopoulos et al., 2013), and fatigue (Dod et al., 2001). However, only some modifiable factors were selected for testing in this study. After performing additional regression analysis, the results revealed that diagnosis and caregiver education could predict HRQOL ($\beta = .126, p < .05; \beta = -.151, p < .01$, respectively). From the additional findings, a causal model explaining HRQOL of children with cancer should include both non-modifiable factor and modifiable factor. This may provide better understanding of this phenomenon.

Noticeably, the participants of this study were composed of children and adolescents with wide range of age that might have been the different in developmental stage. This might contribute to the non-significant direct path of family functioning, coping, state anxiety, symptom distress, and self-care behavior to HRQOL. The other reasons were due to instrument issue. The Chulalongkorn Family Inventory (CFI) used to assess family functioning from the perception of caregivers, not the children, whereas the HRQOL was used to ask children directly. The perceptions of caregiver and children probably were different. This might affect the relationship between the two.

2.2 The direct effect of family functioning on HRQOL

The second hypothesis stated that family functioning had a direct effect on HRQOL. In this study, the path from family function to HRQOL was dropped since the results showed that family functioning did not directly affect HRQOL significantly ($p > .05$) and the path did not show a true direction as well. The results indicated a negative relationship between these two variables, which was inconsistent with previous evidence. For example, Barakat et al. (2010) presented that dysfunction in role had a negative effect on the psychological domain of quality of life (β = -.32, p < .01) and a negative effect on the physical domain of quality of life (β = -.21, p < .10) in American adolescents with cancer (Barakat et al., 2010). This is probably due to different perception. In Barakat et al.'s study, family functioning was answered by adolescents whereas in this study it was answered by caregivers. The incongruent data between parent and child report family functioning might be occurring. Bihul, Wamboldt, Gavin, and Wamboldt (2002) found the low correlation between school-aged children and mother reported family functioning by using Family Assessment Device (FAD). This might affect the non-significant finding.

Moreover, family functioning did not significant affect quality of life in Chinese elderly (Lu, Yuan, Lin, Zhou, & Pan, 2017). According to Lu et al. (2017), family functioning did not have a significant effect on the QOL of Chinese elderly (β = .10, p > .05). The reasons for the non-significant result might be from some factors relating to family functioning. The previous study reported that the higher level of education and income positively correlated with family functioning. In contrast, in the present study, 83.9% of caregivers had low education (43.2% high school and 39.7% primary school) and 53.3% had low income. This might result in a moderate level family functioning in this study.

Besides, in this study, family functioning represented the characteristics of environment which was one component of the revised WCM by Ferrans (2005). In the revised WCM, characteristics of environment are categorized as either social environment or physical environment. For the social environment, it covered influence of family, friends, and health care providers. The physical environment was considered as a setting (home, neighborhood, and workplace). In this study, only family functioning was included in the model. Additionally, in the present study, approximately two-thirds of participants were school-age children and one-thirds of participants were adolescents. The developmental stage of these groups might be different from that of younger children, as they might give importance to friends more than parents. Therefore, peer relationships might be another factor influencing to HRQOL. According to Lezhnieva, Fredriksen, and Bekkhus (2018), peer relationships including reciprocal friendship and popularity had a positive association with children's QOL children aged between 11-12 years old ($\beta = .25$, *95% CI*: .17-.31 ;$\beta = .18$, *95% CI*: .12-.27, respectively).

2.3 The direct effect of coping on HRQOL and the indirect effect of coping on HRQOL via trait anxiety and state anxiety

The third hypothesis stated that coping had a direct and positive effect on HRQOL in children with cancer, and an indirect and negative effect via trait anxiety and state anxiety. In this study, coping was added to the model based on the previous evidence. The results showed that coping did not directly affect HRQOL significantly ($\beta = -.09$, $p > .05$). This was unexpected because the findings of this study were inconsistent with those of the previous studies. For example, in American adolescents with cancer 6 months after the completion of treatment, coping behaviors with humor was a positive predictor on the psychosocial HRQOL after the completion of treatment ($b = 2.06$, $p < .05$) (Ruccione et al., 2013).

However, both significant and non-significant effects were reported in Maurice-Stam et al.'s study (2007). They found that the predictive control strategy (being optimistic about the course of the disease) of disease-related cognitive coping had a positive influence on physical and psychological domains, and the total score of quality of daily functioning, which can indicate the HRQOL in surviving Dutch children with cancer two months after the end of a successful treatment (β = .33, β = .39, β = .35, respectively; p < .05) (Maurice-Stam et al., 2007). On the other hand, the same study found that the predictive control strategy did not significantly influence some domains of HRQOL like positive emotions and negative emotions (β = .07 and β = .26, respectively; p > .05). Similarly, vicarious control strategies (attributing power to medical care-givers and treatment) also did not significantly influence positive emotions and negative emotions (β = -.19 and β = -.24, respectively; p > .05). The HRQOL domains of motor functioning and autonomy were not significantly affected by the interpretative control strategy (β = -.17 and β = -.21, respectively; p > .05). Actually, the association between coping and HRQOL depends on strategies how children with cancer used to cope. In this study, children were asked to identify the strategies they used to cope with their illness, and their coping ability after applying the strategies was examined. Hence, coping ability was examined in the model.

The possible reasons for the non-significant results might be found in Aldridge and Roesch's study (2007). The meta-analysis showed that time since diagnosis related to coping-adjustment in children with cancer. Coping-adjustment negatively correlated with short time (6-12 months) after diagnosis with cancer, whereas coping-adjustment had a positive correlation with the long term after diagnosis 1-5 year. As the time from diagnosis increased, the positive approach was found (Aldridge & Roesch, 2007). In this study, the cancer duration of children was 9.17 months and the mean coping score was presented at a moderate level (*M* = 3.64, *SD* = 0.8). In contrast, HRQOL score was reported at a high level (*M* = 70.79, *SD* = 0.8). Therefore, coping might be unnecessary in this group. Similarly, in Taiwanese pediatric cancer patients, no significant psychosocial changes since diagnosis were reported such as changes in their academic performance, friendships, character, temper and mood. Therefore, significant changes in their psychosocial adjustment did not perceive by them (Chao, Chen, Wang, Wu, & Yeh, 2003).

Regarding the indirect effect of coping via trait anxiety and state anxiety on HRQOL, this hypothesis was not supported. The results from the modified model showed that there was no significant indirect effect of coping via either trait anxiety or state anxiety on HRQOL ($\beta = .04$ and $\beta = .02$, respectively; $p > .05$) (Table 7). A possible reason for the non-significant mediating effect of trait and state anxiety on the relationship between coping and HRQOL in this study is that trait anxiety is identified as the stable tendency to attend to and negative emotional report (Gidron, 2013). It occurs in general like a personality trait (Spielberger & Reheiser, 2004). Therefore, coping ability cannot influence trait anxiety. On the other hand, state anxiety refers to the level of an uncomfortable feeling or worry when they confronted with specific situations (Spielberger & Reheiser, 2004) such as treatment and/or surgery. Therefore, coping was able to directly affect state anxiety ($\beta = -.22$, $p < .001$) in this study.

However, factors such as knowledge, experience, etc. can reduce state anxiety. A previous study found that providing knowledge or information can reduce state anxiety before surgery both in children (Pungsawang, 2002) and adults (Rittithrum & Chinnoros, 2012). Moreover, state anxiety is a non-permanent feeling depending on situations, and it also involves the trait anxiety of the individual (Spielberger & Reheiser, 2004). In this study, although the participants were children with cancer undergoing therapy, most of them had experiences related to treatments they received. Besides, the level of state anxiety among our participants did not present at a high level (*M* = 28.38). Consequently, the results of the modified model showed non-significant direct effects of state anxiety on HRQOL ($\beta = -.09$, $p > .05$).

2.4 The direct effect of symptom distress on HRQOL and indirect effect on HRQOL via functional status

The fourth hypothesis addressed a direct and negative effect of symptom distress on HRQOL and an indirect and negative effect on HRQOL via functional status in children with cancer. This hypothesis was partially supported. The path analysis results from the modified model showed that the direct effect of symptom distress on HRQOL was not significant ($\beta = -.07$, $p > .05$). The non-significant direct effect of symptom distress on HRQOL probably due to nearly half (40.7%) of children with cancer have been diagnosed with leukemia and came to the hospital for chemotherapy and no severe side effects occurring. Moreover, they did not have symptom distress at a high level. Thus, symptom distress in this study did not predict HRQOL.

In addition, it could be explained by the revised WCM. In this study, symptom distress represented symptoms in the revised WCM. According to Ferrans et al. (2005), in the conceptual model of HRQOL, symptoms had an indirect effect on the overall QOL via functional status and general health perception, but it had no direct effect on HRQOL. However, based on evidence from previous research, higher symptom distress scores correlated with a poorer overall HRQOL and individual domains of HRQOL like physical functioning, emotional functioning, social functioning, and school functioning in American children and adolescents with cancer

(r = -.64, -.59, -.53, -.47, and -.36, respectively; $p < .01$) (Baggott et al., 2011). Moreover, some domains of QOL such as physical functioning, emotional functioning, and school functioning can be influenced by symptom distress (b = -1.4, -0.6, and -0.7 respectively; $p < 0.05$) (Hinds et al., 2009). Yet, the results from the modified model were inconsistent with those of previous studies. However, the results of this study were supported by the revised WCM by Ferrans et al. (2005). In their model, symptom did not have a direct effect on HRQOL, but symptoms had an indirect effect on the overall QOL via the functional status and general health perception.

2.5 The direct effect of trait anxiety on HRQOL and indirect effect on HRQOL via state anxiety

The fifth hypothesis addressed the direct and negative effect of trait anxiety on HRQOL and the indirect and negative effect on HRQOL via state anxiety in children with cancer. This hypothesis was partly supported by the direct and negative effect trait anxiety on HRQOL. The findings from the modified model demonstrated a significant effect by trait anxiety on HRQOL (β = -.35, $p < .001$). These results were in line with those of previous studies in Japanese children with cancer. Japanese children with brain tumors perceived that HRQOL was affected by their trait anxiety (β = -.43, $p < .05$) (Sato et al., 2013). For the indirect effect of trait anxiety on HRQOL through state anxiety, although trait anxiety significantly and directly affected state-anxiety (β = .44, $p < .001$), no significant effect by state anxiety on HRQOL (β = -.09, $p > .05$) was detected. Therefore, the indirect effect of trait anxiety on HRQOL through state anxiety was non-significant (β = -.12, $p > .05$).

These unexpected results were inconsistent with those found among Japanese children with brain tumors (Sato et al., 2013) and American children with cancer (Fortier et al., 2013). In Japanese children with brain tumors, state anxiety negatively correlated with HRQOL ($r = -.27$, $p < .05$), and in American children with cancer, child state anxiety was a negative predictor for HRQOL while receiving treatment for cancer ($\beta = -0.29$, $p = 0.01$) (Fortier et al., 2013). Possible reasons for the non-significant direct effect of state anxiety on HRQOL have been presented previously. State anxiety refers to the level of an uncomfortable feeling when faced with threats (Spielberger & Reheiser, 2004) such as treatment or surgery. Factors such as, knowledge, experience, etc. can reduce state anxiety. A previous study found that giving knowledge or information before surgery can reduce state anxiety in both children (Pungsawang, 2002) and adults (Rittithrum & Chinnoros, 2012). Moreover, state anxiety is a non-permanent feeling depending on situations and also the trait anxiety of an individual (Spielberger & Reheiser, 2004). These reasons could offer an explanation why the results from the modified model showed trait anxiety had a non-significant indirect effect on HRQOL via state anxiety.

2.6 The direct effect of state anxiety on HRQOL

The sixth hypothesis addressed whether or not state anxiety had a direct and negative effect on HRQOL in children with cancer. The results from the modified model suggested that state anxiety did not affect HRQOL directly ($\beta = -.09$, $p > .05$). This finding was inconsistent with those of Fortier et al.'s study (2013). They reported that child state anxiety was a negative predictor for HRQOL in American children with cancer who were receiving treatment for cancer ($\beta = -.29$, $p = .01$). Furthermore, in Japanese children with brain tumors, it was discovered that state anxiety correlated negatively with HRQOL ($r = -.27$, $p < .05$) (Sato et al., 2013).

The reasons for the non-significant effect of state anxiety on HRQOL are similar to the previous mentioned in section 2.3. As mentioned earlier, state anxiety is an unstable emotion depending on several factors. Therefore, this kind of anxiety does not directly influence HRQOL. However, our findings showed that state anxiety had an indirect effect on HRQOL via functional status ($\beta = -.10$, $p < .05$). This concurred with the revised WCM proposed by Ferrans et al. (2005), which maintains that state anxiety is a psychological symptom that represent the model's symptoms domain. According to Ferrans et al. (2005), symptoms indirectly influence the overall QOL via functional status and general health perception.

2.7 The direct effect of functional status on HRQOL

The seventh hypothesis stated that functional status had a direct and positive effect on HRQOL in children with cancer. The findings supported the hypothesis ($\beta = .34$, $p < .001$). The same was found in American children following myelosuppressive chemotherapy and Swiss children newly diagnosed with cancer. Baggott et al. (2011) discovered that functional status significantly correlated with HRQOL in American children following myelosuppressive chemotherapy ($r = .63$, $p < .001$). Similarly, in Swiss children newly diagnosis with cancer, low functional status negatively correlated with some domains of HRQOL, e.g., motor functioning at 6 weeks and 1 year after diagnosis ($r = -.49$, and $-.36$, respectively; $p < .05$) and negative emotions at 1 year after diagnosis ($r = -.30$, $p < .05$) (Landolt et al., 2006).

2.8 The effect of self-care behavior on HRQOL

The eighth hypothesis stated that self-care behavior had a direct and positive effect on HRQOL in children with cancer. The results failed to support this hypothesis. The findings suggested that self-care behavior did not directly affect HRQOL ($p > .05$) and this path was dropped in the modified model. This was incongruent with the findings of the previous study. According to Punthmatharith et al. (2013), self-care behavior positively influenced the quality of life in Thai children with cancer ($\beta = .32, p < .01$). Even though the previous study indicated a significant relationship between self-care behavior and QOL in Thai children with cancer, only the association between this pair of variables was tested. Moreover, in other populations, a non-significant association between self-care behavior and HRQOL has been reported in American and Canadian female adolescents with type-1 diabetes. According to Di Battista, Hart, Greco and Gloizer (2009), self-care behavior regarding adherence to insulin injection, diet control, exercise, and glucose testing did not have a significant correlation with the overall QOL ($r = -.09, -.25, .00, -.19$, respectively; $p > .05$). They also reported a non-significant correlation in male adolescents, except in adherence to insulin injection.

Generally, parents dominate their children self-care behaviors directly and indirectly. The quality of parental involvement is very important to promote self-care behavior. As reported in adolescents with type I DM, critical parenting has been related to poor adherence and metabolic control (Jaser & Grey, 2010). With this reason a moderate level of family functioning found in this study might contribute to children’s self-care behavior, and to the HRQOL.

An additional reason for the non-significant result was from typical children's behavior. Several factors could influence self-care behavior in children such as child's age and gender. Besides, girls reported self-care behavior better than boys in school-age children ($t = 4.32$, $p < .001$) (Phuong Minh, 2014). Most participants in this study were male (64.8%). In addition, the participants in this study had a wide range of age (9-18 years old). Self-care ability was different since it depends on developmental status of children. Besides, the results from the previous study reported that the child's age significantly correlated with self-care behavior ($r = .65$, $p < .001$) (Phuong Minh, 2014). Consequently, the non-significant result might be affected from these reasons.

In addition, self-care behavior was assessed by the self-care behavior questionnaire based on the prior study. The existing literature on children with cancer was used to develop this instrument (Punthmatharith et al., 2008). Although the reliability was tested and presented an acceptable value, its construct validity was not tested using exploratory factor analysis and confirmatory factor analysis.

2.9 The direct effect of coping on trait anxiety

The ninth hypothesis addressed whether or not coping has a direct and negative effect on trait anxiety in children with cancer. This hypothesis was not supported by the results of this study since a non-significance relationship between coping and trait anxiety was observed ($\beta = -.11$, $p > .05$). Our finding was inconsistent with those of the previous study. Maurice-Stam et al. (2009) found that disease-related cognitive coping significantly predicted lower levels of trait anxiety in Dutch children with cancer ($\beta = -.18$, $p < .05$). The possible reasons for the non-significance of this relationship in this study are similar to the previously mentioned in section 2.3.

Since trait anxiety occurs in general like a personality trait (Spielberger & Reheiser, 2004); therefore, coping could not affect trait anxiety.

2.10 The direct effect of trait anxiety on state anxiety

The tenth hypothesis stated that trait anxiety would have a direct and positive effect on state anxiety in children with cancer. It was supported by the results of this study, which demonstrated a significant direct effect ($\beta = .44$, $p < .001$). According to Spielberger and Reheiser (2004), state anxiety is a non-permanent feeling that involves the trait anxiety of an individual. Besides, Li and Lopez's (2005) study identified that in stressful conditions, the trait anxiety of children was found to be a positive predictor of their state anxiety ($\beta = .57$, $p = .01$). This study provides new knowledge regarding prediction between trait anxiety and state anxiety in Thai children with cancer.

2.11 The effect of symptom distress on functional status

The eleventh hypothesis stated that symptom distress would have a direct and negative effect on functional status in children with cancer. The path analysis results indicated that symptom distress had a significantly direct effect on functional status ($\beta = -.16$, $p < .05$) in the modified model. This finding concurred with the revised WCM by Ferrans (2005), which maintains that the characteristics of the individual and the environment as well as symptoms had a direct effect on functional status. Additionally, this result was probably comparable with those reported by the previous studies. According to Dodd et al. (2001), symptoms such as fatigue and pain were negatively related to functional status in American adolescents and adults with cancer at the end of the third cycle of chemotherapy ($r = -.41$ and $-.42$, respectively; $p < .05$). Moreover, in adult breast cancer patients, those with high severity levels of all four symptoms—pain, sleep disturbance, fatigue, and depression—had a poorer functional status and QOL than other subgroups ($p < .001$) (Dodd, Cho, Cooper, & Miaskowski, 2010).

2.12 The additional finding

2.12.1 The indirect effect of coping on HRQOL via state anxiety and functional status

In the modified model, coping had a significant positive indirect effect on HRQOL via both state anxiety and functional status ($\beta = .03$, $p < .05$). In this study, state anxiety was evaluated as a psychological symptom. Based on the revised WCM by Ferrans et al. (2005), symptoms had no direct effect on HRQOL, whereas they had an indirect effect via functional status. Similarly, in this study, state anxiety and functional status were mediators between coping and HRQOL. In addition, even though no previous study has examined the association between state anxiety and functional status in children with cancer, the results were probably comparable with those of the study in children and adolescents with chronic pain. That study reported that anxiety positively correlated with functional disability ($r = .25$, $p < .01$) (Simons, Sieberg, & Claar, 2012). Similarly, in American adolescents with asthma, a high anxiety score was negatively correlated with asthma-related functioning (activities) ($r = -.28$, $p < .01$) (McCauley, Katon, Russo, Richardson, & Lozano, 2007). Therefore, this study stated that coping did not influence HRQOL directly; coping could reduce state anxiety and also indirectly promote better functional status and HRQOL in Thai children with cancer.

2.12.2 The indirect effect of state anxiety on HRQOL via functional status

Although state anxiety did not have a direct effect on HRQOL, state anxiety had a significant negative indirect effect on HRQOL via functional status (β = -.10, p < .05). The reason for the non-significant effect of state anxiety on HRQOL was probably from the level of state anxiety. As previously mentioned in section 2.3, state anxiety refers to the level of an uncomfortable feeling or worry when persons are confronted with specific situations (Spielberger & Reheiser, 2004. However, some factors can reduce state anxiety (Pungsawang, 2002; Rittithrum & Chinnoros, 2012). Moreover, state anxiety is a non-permanent feeling depending on situations, and it also involves the trait anxiety of the individual (Spielberger & Reheiser, 2004). In this study, the participants had experiences related to treatments they received. Besides, the level of state anxiety among our participants did not present both trait anxiety and state anxiety at a high level. Consequently, the results of the modified model showed non-significant direct effects of state anxiety on HRQOL (β = -.09, p > .05).

2.12.3 The direct effect of coping on state anxiety

The path analysis results of the modified model identified coping had a negative direct effect on HRQOL (β = -.22, p < .001). This was probably comparable with the findings reported by Compas et al. (2014) who found that secondary control coping influenced anxiety and depression in American children with cancer negatively (β = -.37, p < .001). Moreover, Frank, Blount, and Brown (1997) reported that avoidance coping could predict levels of anxiety (β = .29,

$p < .01$) in children with cancer of various ethnic backgrounds—African American, Caucasian, Hispanic, Indian, and Vietnamese.

2.12.4 The direct effect of state anxiety on functional status

It was shown that state anxiety had a direct and negative effect on functional status ($\beta = -.28$, $p < .001$). This result was consistent with the revised WCM by Ferrans et al. (2005) since state anxiety is a psychological symptom. Based on the revised WCM, the characteristics of the individual and the environment in addition to symptoms have a direct effect on functional status. Granted that no previous study has examined the association between state anxiety and functional status in children with cancer, the result was probably comparable with those found in children and adolescents with chronic pain (Simons et al., 2012) and in American adolescents with asthma (McCauley et al., 2007).

2.12.5 The indirect effect of trait anxiety on functional status via state anxiety

The additional results showed that trait anxiety had a significant negative indirect effect on functional status via state anxiety ($\beta = -.12$, $p < .01$). As presented previously, state anxiety is a non-permanent feeling that involves the trait anxiety of an individual (Spielberger & Reheiser, 2004). Besides, in stressful conditions, the trait anxiety of children was found to be a positive predictor of their state anxiety ($\beta = .57$, $p = .01$) (Li & Lopez, 2005). This result could be explained by the revised WCM. State anxiety is a psychological symptom that represents symptoms experienced by the patient. According to Ferrans et al. (2005), symptoms indirectly influence the overall QOL via functional status and general health perception.

Similarly, the results of this study showed that trait anxiety had an indirect effect on HRQOL through state anxiety and functional status.

2.12.6 The correlation between coping and symptom distress

In the additional finding, coping negatively correlated with symptom distress ($r = -.19$, $p < .01$). Again, no other study has examined the relationship between coping and symptom distress in children with cancer undergoing therapy. Nevertheless, in childhood cancer survival, the predictive control strategies (being optimistic) of coping positively influenced psychological distress ($\beta = .26$, $p < .001$) (Wenninger et al., 2013). Besides, in adults with advanced-stage cancer undergoing chemotherapy, symptom distress was positively related to avoidant coping ($r = .30$, $p < .01$). Moreover, symptom distress positively influenced avoidant coping ($\beta = .18$, $p < .05$) as well (Sumpio, Jeon, Northouse, & Knobf, 2017). Again, the results of this study provided evidence to support the correlation between coping and symptom distress in children with cancer.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

This chapter provides information regarding conclusions drawn from the study results, their contributions to the nursing science, strengths and limitations of the study, and recommendations for nursing practice, nursing education as well as future research.

Conclusions of Study Results

This study aimed to develop and test a causal relationship of predicting factors on HRQOL in Thai children with cancer. The hypothesized model was developed based on the previous evidence and the revised WCM by Ferrans et al. (2005). The influencing factors were selected based on statistical support where the magnitude of the predictors had to be at a moderate to high level and relevant in the Thai context. Seven independent variables—family functioning, coping, trait anxiety, state anxiety, symptom distress, functional status, and self-care behavior—were examined in the HRQOL model.

The participants in this study consisted of 199 children with cancer aged 9-18 years and their caregivers, who were either hospitalized or followed up at the outpatient clinics of eight tertiary-care hospitals in three parts of Thailand. Purposive sampling was used to recruit the participants. The instruments used to collect data in this study were a set of questionnaires that were composed of 8 parts. There were the demographic data questionnaire, the Thai Pediatric Quality of Life Inventory version 4.0, the Thai version of Coping of Disease Inventory, the revised Thai versions of

State-Trait Anxiety Inventory for Children, the self-care behavior questionnaire, the Chulalongkorn Family Inventory, the Memorial Symptom Assessment Scale 10–18, and the Play-Performance Scale for Children. Two research instruments developed in English—the Memorial Symptom Assessment Scale 10–18 and the Play-Performance Scale—were translated from English to Thai by three experts using the back translation technique. In the final step, the similarity of the meaning of the original version and the back translation version was checked by a native English speaker. The reliability of the instruments was tested using Cronbach's Alpha and the test-retest technique. The Cronbach's Alpha coefficients of the Thai Pediatric Quality of Life Inventory version 4.0, the Thai version of Coping of Disease Inventory, the revised Thai version of State-Trait Anxiety Inventory for Children (Form C-1), the revised Thai version of State-Trait Anxiety Inventory for Children (Form C-2), the self-care behavior questionnaire, the Chulalongkorn Family Inventory, and the Memorial Symptom Assessment Scale 10–18 (distress dimension) were .93, .88, .88, .89, .82, .89, and .91 respectively. Besides, the intraclass correlation coefficient of the Play-Performance Scale for Children was .93. The results of the reliability test presented that all instruments had acceptable value of reliability.

In this study, a hypothesized model was tested. The results presented that the goodness of fit measures of the hypothesized model did not meet the criteria. Then, a hypothesized model was modified. The modification indices of computer program and theoretical evidence were used to guide in this process. The results showed that the goodness of fit of the modified model was met. The modified model result revealed that five independent variables (coping, symptom distress, trait anxiety, state anxiety, and functional status) significantly accounted for 33% of the variance of

HRQOL. The Chi-square (χ^2) test score was not significant 8.73 (p =.068), the relative Chi-square (2.18) was less than 3, *GFI* (.99) was more than .90, *AGFI* (.93) was more than .90, *SRMR* (.047) was less than .05, *RMSEA* (.077) was less than 0.08, *NFI* (.95) was more than .95, *TLI* (.90) was more than .90, and *CFI* (.97) was more than .95.

Most of the hypotheses tested were partially supported. The findings from the modified model demonstrated that trait anxiety and functional status had a significant direct effect on HRQOL (β = -.35, .34, respectively; p < .001). Besides trait anxiety had a significant indirect negative effect on HRQOL (β = -.08, p < .05) via state anxiety and functional status. It had a significant total effect on HRQOL (β = -.43, p < .05). Coping, symptom distress, and state anxiety had no direct effect on HRQOL (β = -.09, .07, -.09, respectively; p > .05). However, coping significantly indirect affected HRQOL via state anxiety and functional status (β = .03, p < .05). Both symptom distress and state anxiety had a significant indirect effect on HRQOL through functional status (β = -.05, β = -.10, respectively, p < .05). Coping did not significantly affect trait anxiety, but it significantly affected state anxiety (β = -.11, p > .05; β = -.22, p < .001, respectively). Symptom distress and state anxiety had a significant negative direct effect on functional status (β = -.16, p < .05; β = -.28, p < .001, respectively). Trait anxiety had significant positive direct effect on state anxiety (β = .44, p < .001). Besides, coping was significantly and negatively correlated with symptom distress (r = -.19, p=.05).

Contribution of the Study Results to Nursing Science

The study results provided new empirical knowledge and could be used as evidence to develop nursing knowledge in the future. In this study, a model was developed based on the revised WCM by Ferran et al. (2005) and combining two concepts from the previous studies. In addition, only the variables with evidence regarding children with cancer were selected from the revised WCM. The results of this study demonstrated that our modified model of HRQOL fit the empirical data. Therefore, this HRQOL conceptual model together with another concept, specially coping could explain HRQOL in Thai children with cancer. Therefore, this study succeeded in providing new knowledge for Thai children with cancer and beyond.

Besides, the predictive factors that affect HRQOL in Thai children with cancer were explained, and they can be used as basic knowledge to promote HRQOL among this group of patients. The results showed that trait anxiety and functional status significantly and directly predicted HRQOL. Trait anxiety also influenced state anxiety. Functional status mediated between state anxiety and symptom distress and HRQOL. However, the direct effect of coping, state anxiety, and symptom distress on HRQOL resulted insignificant. Therefore, future studies are needed to further examine their significance on HRQOL.

Strengths and Limitations of the Study

Strengths of the study

1. This is the first study to test a model that based on the revised WCM by Ferrans et al. (2005) and evidences from the previous studies in children with cancer. The results of this study demonstrated that the revised modified model fit the empirical data. Therefore, the findings of this study can be utilized in children with cancer.

2. In this study, four concepts from the HRQOL conceptual model were added to test in Thai children with cancer that were undergoing therapy. Therefore, the findings of this study can offer support for the conceptual model of HRQOL in Thai children with cancer.

Limitations of the study

1. This study did not include children and adolescents with cancer from central part of Thailand. Therefore, the results of this study might not be generalized to children of the central region.

2. The Children currently studied at schools and those who were on study leave for more than one month were included in this study. The measurement bias in the school functioning domain of the HRQOL (Thai PedsQL 4.0) might exist.

3. In this study, family functioning was collected from the caregivers' perception. Hence, this might not truly reflect what children perceived.

4. Some demographic data such as religions and the number of siblings in the family may also contribute to perceiving HRQOL of children with cancer. These were not yet explored in this study.

Recommendations for Nursing Practice, Nursing Education and Future Research

The results of this study provided an empirical model regarding the influencing factors of HRQOL among Thai children with cancer. Some recommendations for nursing practice, nursing research and future research are as follows.

Recommendations for nursing practice

Based on the results of this study, trait anxiety had a significant direct effect and an indirect effect on HRQOL through state anxiety and functional status. Although trait anxiety is personality trait, nurses should pay attention to assess trait anxiety in children with cancer during cancer therapy before performing nursing intervention. Symptom distress and state anxiety had a direct and negative effect on functional status. Also, both variables had an indirect effect on HRQOL via functional status. It is advisable for nurses to develop interventions to enhance functional status and HRQOL by reducing symptom distress and state anxiety. Functional status indicated by play performance positively influenced HRQOL in this study. Thus, nurses may develop interventions using play to enhance HRQOL in Thai children with cancer.

Recommendations for nursing education

According to the results of this study, several factors impact HRQOL in children with cancer. They had either direct or indirect effects on HRQOL. Nursing educators should address both their direct and mediating effects on HRQOL in order to follow a more holistic approach when it comes to HRQOL. In addition, the development of programs that integrate mediating effects should be encouraged in order to promote HRQOL in Thai children with cancer.

Recommendations for future research

In light of this study's findings, a few recommendations for future research can be made.

1. Multi-group structural equation models should be analyzed to clarify and confirm any causal relationships among these seven variables in different types of cancer, e.g., hematologic malignancies and solid tumors, or compare between different sexes. In addition, seven domains of family functioning and six domains of coping should be included in the model to identify causal relationships each domain and HRQOL.

2. Experimental research, either quasi-experimental or randomized controlled trial studies are needed to test the effects of coping promotion and state anxiety reduction on functional status and HRQOL or the effect of play on HRQOL.

3. Children with cancer and caregivers from other regions of Thailand should be included in future research. Besides, proportion sampling should be conducted in future research in order to avoid selection bias and achieve an accurate representation of the population. That way, the results would have better generalizability.

4. This study had 67% of the unexplained variance for HRQOL. The non-modifiable (e.g. age, gender, type of cancer, or treatment) and modifiable factors (e.g. self-esteem, depression, the severity of symptom, and the number of symptom) should be tested in future models.

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Appendices

Appendix A

Research Instruments

A Causal Model of Health-Related Quality of Life in Thai Children with Cancer

The questionnaires in this study composed of 8 parts as follows.

1. Demographic Data Questionnaire
2. The Thai Pediatric Quality of Life Inventory version 4.0
3. Thai version of Coping of Disease Inventory
4. The revised Thai versions of State-Trait Anxiety Inventory for Children
5. Self-care Behavior Questionnaire
6. Chulalongkorn Family Inventory
7. The Memorial Symptom Assessment Scale 10–18
8. The Play-Performance Scale for Children

Demographic data questionnaire

Direction: Please make a mark √ in the appropriate box or fill in the blank regarding the personal characteristic of children with cancer (Question No. 1-3) and the personal characteristic of caregivers (Question No. 4-5). Question No. 6-8 for researcher

Personal characteristic of children with cancer

1. Gender

( ) 1. Female ( ) 2. Male

2. Age ………….. years ……….. months (Birth date ………………………)

3. Education level (Specify) …………………

Personal characteristic of caregivers

4. Education level

( ) 1. Elementary ( ) 2. High school or equivalent

( ) 3. Bachelor degree or equivalent ( ) 4. Higher than bachelor degree

( ) 5. Others (Specify) ………………………………

5. Family income / month (Specify) ………………………

Question No. 6-8 for researcher

6. Diagnosis

( ) 1. Leukemia ( ) 2. Brain tumor/cancer

( ) 3. Retinoblastoma ( ) 4. Lymphoma

( ) 5. Osteosarcoma ( ) 6. Neuroblastoma

( ) 7. Histiocytoses ( ) 8. Wilm’s tumor

( ) 9. Others (Specify) …………………

7. Illness duration ………years ………………months…….days

8. Treatments (can select more than choice)

( ) 1. Chemotherapy (at least 1 cycle)

( ) 2. Surgery

( ) 3. Radiation

( ) 4. Others (Specify) …………………

The Thai version of Pediatric Quality of Life Inventory version 4.0

Age 8-12 years old

Direction: On the following page is a list of things that might be a problem for you. Please tell us how much of a problem each one has been for you during the past ONE month by circling

0 if it is never a problem
1 if it is almost never a problem
2 if it is sometimes a problem
3 if it is often a problem
4 if it is almost always a problem

There are no right or wrong answers.

If you do not understand a question, please ask for help.

In the past ONE month, how much of a problem has this been for you …

ABOUT MY HEALTH AND ACTIVITIES (problems with…)	Never	Almost Never	Sometimes	Often	Almost Always
1. It is hard for me to walk more than one block	0	1	2	3	4
2. It is hard for me to run	0	1	2	3	4
3. ……………….……………………………….……					
4. …………………………….………………					
5. ……………………….………………………					
6. ……….…………………………………….					
7. ………………………………………..……					
8. …………………………………….………					
ABOUT MY FEELINGS (problems with…)	Never	Almost Never	Sometimes	Often	Almost Always
1. …………………………………….…..…					
2. ………………………………………………..					
3. ……………….……………………..…					
4. ……………………………………..……					
5. ……………………………………..……					
HOW I GET ALONG WITH OTHERS (problems with…)	Never	Almost Never	Sometimes	Often	Almost Always
1. ………………………………………..……					
2.……………………………………….………..					
3. …………………………………….…………					
4.…………………………………….…………..					
5. ………………………………………………..					
ABOUT SCHOOL (problems with…)	Never	Almost Never	Sometimes	Often	Almost Always
1. ……………………………..……………..					
2. ……………………………..…………					
3. ……………………………..………..					
4. ……………………………….…………….					
5. ……………………………….……………..					

The Thai version of Pediatric Quality of Life Inventory version 4.0

Age 13-18 years old

Direction: On the following page is a list of things that might be a problem for you. Please tell us how much of a problem each one has been for you during the past ONE month by circling

0 if it is never a problem
1 if it is almost never a problem
2 if it is sometimes a problem
3 if it is often a problem
4 if it is almost always a problem

There are no right or wrong answers.

If you do not understand a question, please ask for help.

In the past ONE month, how much of a problem has this been for you …

ABOUT MY HEALTH AND ACTIVITIES (problems with…)	Never	Almost Never	Sometimes	Often	Almost Always
1. It is hard for me to walk more than 100 meters	0	1	2	3	4
2. It is hard for me to run	0	1	2	3	4
3. ………………………………………..					
4. ………………………………………..					
5. ………………………………………..					
6. ……………………………………….					
7. ………………………………………					
8. ………………………………………..					
ABOUT MY FEELINGS (problems with…)	Never	Almost Never	Sometimes	Often	Almost Always
1. ………………………………………….					
2. …………………………………………					
3. ………………………………………….					
4. ………………………………………….					
5. ………………………………………….					
HOW I GET ALONG WITH OTHERS (problems with…)	Never	Almost Never	Sometimes	Often	Almost Always
1. ……………………………………………….					
2. ………………………………………………					
3. ………………………………………………					
4. ………………………………………………					
5. ………………………………………………					
ABOUT SCHOOL (problems with…)	Never	Almost Never	Sometimes	Often	Almost Always
1. ……………………………………………..					
2. …………………………………………….					
3. …………………………………………….					
4. ……………………………………………					
5. ……………………………………………					

Thai version of Coping of Disease Inventory

Direction: Think of situations, when you have been bothered or stressed because of your illness. Below you find a list of things how you may deal with illness in these situations. Please read the following sentence and make a mark (√), how often you usually do the things or have this kind of thoughts related to your illness.

Coping strategy	**Never** **(1)**	**Seldom** **(2)**	**quite often** **(3)**	**very often** **(4)**	**Always** **(5)**
Avoidance					
1. I try to forget my illness					
2. I pretend to be all right					
3. I try to ignore my illness					
:					
:					
:					
:					
27………………………………					
28. Overall, how well do you think you cope with your illness?	not well at all (1)	not well (2)	moderate (3)	well (4)	very well (5)

The revised Thai versions of State-Trait Anxiety Inventory for Children

Form C-1: State anxiety

DIRECTIONS: DIRECTIONS: A number of statements which boys and girls use to describe themselves are given below. Read each statement carefully and decide how you feel right now. Then put an X in the box in front of the word or phrase which best describes how you feel. There are noright or wrong answers. Don't spend too much time on any one statement. Remember, find the word or phrase which best describes how you feel right now, at this very moment.

1. I feel ☐ very calm ☐ calm ☐ not calm
2. I feel ☐ very upset ☐ upset ☐ not upset
3. I feel ☐ ……………. ☐ …………….. ☐ ………………….
4. I feel ☐ ……………. ☐ ……………. ☐ …………………
5. I feel ☐ …………… ☐ …………….. ☐ ………………….
6. I feel ☐ …………… ☐ …………… ☐ …………………
7. I feel ☐ …………… ☐ …………… ☐ ……...……...…
8. I feel ☐ …………… ☐ …………… ☐ …………………
9. I feel ☐ ……………. ☐ …………… ☐ …………………
10. I feel ☐ ……………..… ☐ …………… ☐ …………………
11. I feel ☐ ……………..… ☐ ……………. ☐ ……….………..
12. I feel ☐ …………….. ☐ ……………. ☐ …………………
13. I feel ☐ …………….. ☐ ……………. ☐ ………………..
14. I feel ☐ …………….. ☐ …………….. ☐ ………………..
15. I feel ☐ …………….. ☐ ……………. ☐ ……………….
16. I feel ☐ ……………… ☐ …………….. ☐ ………………..
17. I feel ☐ ……………….. ☐ …………….. ☐ …………………
18. I feel ☐ ………………. ☐ …………….. ☐ ………………..
19. I feel ☐ ……………….. ☐ ……………. ☐ …………………..

The revised Thai versions of State-Trait Anxiety Inventory for Children

Form C-2: Trait anxiety

<u>DIRECTIONS</u>: A number of statements which boys and girls use to describe themselves are given below. Read each statement carefully and decide if it is hardly-ever, or sometimes, or often true for you. Then for each statement, put an X in the box in front of the word that seems to describe you best. There are no right or wrong answers. Don't spend too much time on any one statement. Remember, choose the word which seems to describe how you usually feel.

1.	I worry about making mistakes	☐ hardly-ever	☐ sometimes	☐ often
2.	I feel like crying	☐ hardly-ever	☐ sometimes	☐ often
3.	……………………..	☐	☐	☐ …………………
4.	……………………..	☐	☐	☐ …………………
5.	…………………….	☐	☐	☐ ....
6.		☐	☐	☐
7.		☐	☐	☐
8.		☐	☐	☐
9.		☐	☐	☐
10.		☐	☐	☐
11.		☐	☐	☐
12.		☐	☐	☐
13.		☐	☐	☐
14.		☐	☐	☐
15.		☐	☐	☐
16.		☐	☐	☐
:		☐	☐	☐
:		☐	☐	☐
:		☐	☐	☐
20.		☐	☐	☐

Self-care behavior questionnaire

Direction: Please make a mark (✓) in the appropriate box regarding the self-care behavior of children with cancer (25 items)

There are 4 choices available

0 = never
1 = sometimes
2 = often
3 = always

Self-care behavior of children with cancer	always	often	sometimes	never
1. I take a shower at least twice a day.				
2. I brush my teeth at least 2 times a day when without bleeding problem.				
3. I washed my hands before eating.				
4. ……………………………………………				
5. ……………………………………………				
6. …………………………………………..				
7. ………………………………………….				
:				
:				
:				
:				
:				
25. …………………………………………………..				

Chulalongkorn Family Inventory

<u>Direction</u>: Please make a mark (✓) in the appropriate box regarding the family functioning of children with cancer (36 items)

There are 4 choices available

1 = not match
2 = slightly match
3 = moderately match
4 = strongly match

Item	not match	slightly match	moderately match	strongly match
Problem solving				
1. Our family helps to solve problems that happen within our family.				
2……………………………………………….				
3………………………………………………..				
4………………………………………………..				
:				
:				
:				
:				
:				
:				
:				
:				
36……………………………………………				

Memorial Symptom Assessment Scale

INSTRUCTIONS: We have listed 30 symptoms below, Read each one carefully. If you have had the symptom during this past week, let we know how OFTEN you had it, how SEVERE it was usually and how much It DISTRISSED OR BOTHERED you by circling the appropriate number. If you DID NOT HAVE the symptom, make an "X" in the box marked "DID NOT HAVE"

DURING THE PAST WEEK Did you have any of the Following symptoms?	DID NOT HAVE	IF YES, How much did It DISTRISSED or BOTHER you?				
		Not at all	A little bit	Somewhat	Quite a bit	Very much
1. Difficulty concentrating or Paying attention		0	1	2	3	4
2. Pain		0	1	2	3	4
3. Lack of energy		0	1	2	3	4
4………….………………						
5…………………………..						
6……………………….….						
7…………………………						
8…………………………						
9…………………………						
10……………………….						
11……………………….						
:						
:						
:						
:						
30. Changes in skin		0	1	2	3	4

Play Performance Scale for Children

INSTRUCTIONS: On this form are a series of descriptions. Each description has a number beside it. Think about your child's play and activity over the past week. Think about both good days and bad days. Average out this period. Now read the descriptions and pick the one that best describes your child's play during the past week.

Circle the number beside that one description.

100	fully active, normal
90	minor restrictions in physically strenuous activity
80	active, but tires more quickly
70	both greater restriction of, and less time spent in, active play
60	up and around, but minimal active play; keeps busy with
50	gets dressed, but lies around much of the day; no active play
40	mostly in bed; participates in quiet activities
30	in bed; needs assistance even for quiet play
20	often sleeping; play entirely limited to very passive activities
10	no play: does not get out of bed
0	unresponsive

Appendix B

The Permission of Research Instruments

คณะพยาบาลศาสตร์
เลขรับ 1802
วันที่ ๒๒ ก.ค. 58
เวลา 11.๒๐

ที่ ศธ ๖๓๙๓(๒๓)/ ๒๗๔๖

บัณฑิตวิทยาลัย มหาวิทยาลัยเชียงใหม่
๒๓๙ ถนนห้วยแก้ว ตำบลสุเทพ
อำเภอเมืองเชียงใหม่ ๕๐๒๐๐

๑๐ กรกฎาคม ๒๕๕๘

เรื่อง อนุญาตให้ใช้เครื่องมือวิจัย

เรียน คณบดีคณะพยาบาลศาสตร์ มหาวิทยาลัยสงขลานครินทร์

อ้างถึง หนังสือที่ ศธ ๐๕๒๑.๑.๐๕/๑๘๑๕ ลงวันที่ ๑๘ มิถุนายน ๒๕๕๘

ตามที่ คณะพยาบาลศาสตร์ มหาวิทยาลัยสงขลานครินทร์ มีความประสงค์จะขออนุญาตให้นางปราณี คำจันทร์ นักศึกษาหลักสูตรปรัชญาดุษฎีบัณฑิต สาขาการพยาบาล นำเครื่องมือวิจัยในวิทยานิพนธ์ของ **นางสาวบุษยารัตน์ ศิลปวิทยาทร** ไปใช้ในงานวิจัยนั้น

บัณฑิตวิทยาลัย มหาวิทยาลัยเชียงใหม่ พิจารณาแล้วไม่ขัดข้อง และยินดีอนุญาตให้นำเครื่องมือดังกล่าวไปใช้ประโยชน์ในการศึกษาวิจัยได้

จึงเรียนมาเพื่อโปรดทราบ

ขอแสดงความนับถือ

(รองศาสตราจารย์ ดร.ทิพาพร วงศ์หงษ์กุล)
รองคณบดี ปฏิบัติการแทน
คณบดีบัณฑิตวิทยาลัย

งานบริการการศึกษา
โทร. ๐-๕๓๙๔-๒๔๑๐
โทรสาร. ๐-๕๓๙๔-๒๔๓๕

ส่ง บัณฑิตศึกษา

คณะพยาบาลศาสตร์
เลขรับ 2940
วันที่ 01/09/๕๘
เวลา 15.00 น.

ที่ ศธ 0512.11/ 1010

คณะพยาบาลศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
อาคารบรมราชชนนีศรีศตพรรษ ชั้น 11
ถนนพระราม 1 แขวงวังใหม่ เขตปทุมวัน
กรุงเทพฯ 10330

10 กรกฎาคม 2558

เรื่อง อนุญาตให้ใช้เครื่องมือวิจัย

เรียน คณบดีคณะพยาบาลศาสตร์ มหาวิทยาลัยสงขลานครินทร์

อ้างถึง หนังสือ คณะพยาบาลศาสตร์ มหาวิทยาลัยสงขลานครินทร์ ที่ ศธ 0521.1.05/1817 ลงวันที่ 18 มิถุนายน 2558 เรื่อง ขออนุญาตใช้เครื่องมือวิจัย

ตามหนังสือที่อ้างถึง แจ้งว่า นางปราณี คำจันทร์ รหัสนักศึกษา 5510430004 นักศึกษาหลักสูตรปรัชญาดุษฎีบัณฑิต สาขาการพยาบาล (หลักสูตรนานาชาติ) คณะพยาบาลศาสตร์ มหาวิทยาลัยสงขลานครินทร์ มีความประสงค์ที่จะทำวิจัย เรื่อง "A Causal Model Heath-Related Quality of Life in Children With Cancer" มีความประสงค์ขออนุญาตใช้เครื่องมือวิจัย เรื่อง "The Revise Thai Version of the State-Trait Anxiety Inventory for Children" ของ รองศาสตราจารย์ ดร. วราภรณ์ ชัยวัฒน์ นั้น คณะพยาบาลศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย ยินดีและอนุญาตให้ใช้เครื่องมือวิจัยดังกล่าวได้ โดยขอให้ผู้ใช้แจ้งผลการวิจัยและข้อเสนอแนะในการปรับปรุงเครื่องมือให้คณะพยาบาลศาสตร์ทราบด้วย

จึงเรียนมาเพื่อโปรดทราบ

ขอแสดงความนับถือ

(ผู้ช่วยศาสตราจารย์ ดร. สุวิณี วิวัฒน์วานิช)
รองคณบดี
รักษาการแทนคณบดีคณะพยาบาลศาสตร์

ฝ่ายวิชาการ
โทร. 0-2218-1129 โทรสาร. 0-2218-1130

คณะพยาบาลศาสตร์
เลขรับ 2776
วันที่ 04/09/58
เวลา 14.50 น.

ที่ ศธ ๐๕๑๒.๑๗/๐๑๐๘๒

คณะแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
ถนนราชดำริ เขตปทุมวัน กรุงเทพฯ ๑๐๓๓๐

๑ กันยายน ๒๕๕๘

เรื่อง การขออนุญาตใช้เครื่องมือวิจัย

เรียน คณบดีคณะพยาบาลศาสตร์ มหาวิทยาลัยสงขลานครินทร์

อ้างถึง หนังสือคณะพยาบาลศาสตร์ มหาวิทยาลัยสงขลานครินทร์ ที่ ศธ ๐๕๒๑.๑.๐๕/๑๘๑๖
ลงวันที่ ๑๘ มิถุนายน ๒๕๕๘

ตามหนังสือที่อ้างถึง ได้แจ้งความประสงค์ขออนุญาตใช้เครื่องมือวิจัย "Chulalongkorn Family Inventory" ของ **ศาสตราจารย์แพทย์หญิงอุมาพร ตรังคสมบัติ** เพื่อทำวิจัย เรื่อง "A Causal Model 'Health-Related Quality of Life in Children with Cancer" ของ นางปราณี คำจันทร์ นักศึกษาหลักสูตรปรัชญาดุษฎีบัณฑิต สาขาการพยาบาล (หลักสูตรนานาชาติ) ดังรายละเอียดทราบแล้วนั้น

คณะแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย ยินดีให้ใช้เครื่องมือวิจัยเพื่อประกอบการทำวิจัยเรื่องดังกล่าวข้างต้น

จึงเรียนมาเพื่อโปรดทราบ

ขอแสดงความนับถือ

(รองศาสตราจารย์นายแพทย์เกรียงศักดิ์ ประสพสันติ)
รองคณบดีฝ่ายบริหาร
ปฏิบัติการแทนคณบดี

ฝ่ายบริหาร คณะแพทยศาสตร์
โทร. ๐-๒๒๕๖-๔๕๖๓
โทรสาร. ๐-๒๒๕๒-๔๙๖๓

ส่ง บัณฑิตศึกษา

บันทึกข้อความ

ส่วนราชการ กลุ่มงานวิจัยและบัณฑิตศึกษา คณะพยาบาลศาสตร์ โทร. ๖๔๕๗
ที่ มอ ๖๐๖.๒/๔๔๓ **วันที่ ๒๙** มิถุนายน ๒๕๕๘
เรื่อง ขออนุญาตใช้เครื่องมือวิจัย

เรียน รองศาสตราจารย์ ดร.บุษกร พันธ์เมธาฤทธิ์

ด้วย นางปราณี คำจันทร์ รหัสนักศึกษา ๕๕๑๐๔๓๐๐๐๔ นักศึกษาหลักสูตรปรัชญาดุษฎีบัณฑิต สาขาการพยาบาล (หลักสูตรนานาชาติ) คณะพยาบาลศาสตร์ มหาวิทยาลัยสงขลานครินทร์ มีความประสงค์ที่จะทำวิจัยเรื่อง "A Causal Model Heath-Related Quality of Life in Children with Cancer." โดยมี รศ.ดร.บุษกร พันธ์เมธาฤทธิ์ เป็นอาจารย์ที่ปรึกษาวิทยานิพนธ์ มีความประสงค์ขออนุญาตใช้เครื่องมือวิจัยของท่าน คือ "แบบสอบถามพฤติกรรมในการดูแลตนเองของผู้ป่วยเด็กโรคมะเร็ง" เพื่อประกอบการทำวิทยานิพนธ์

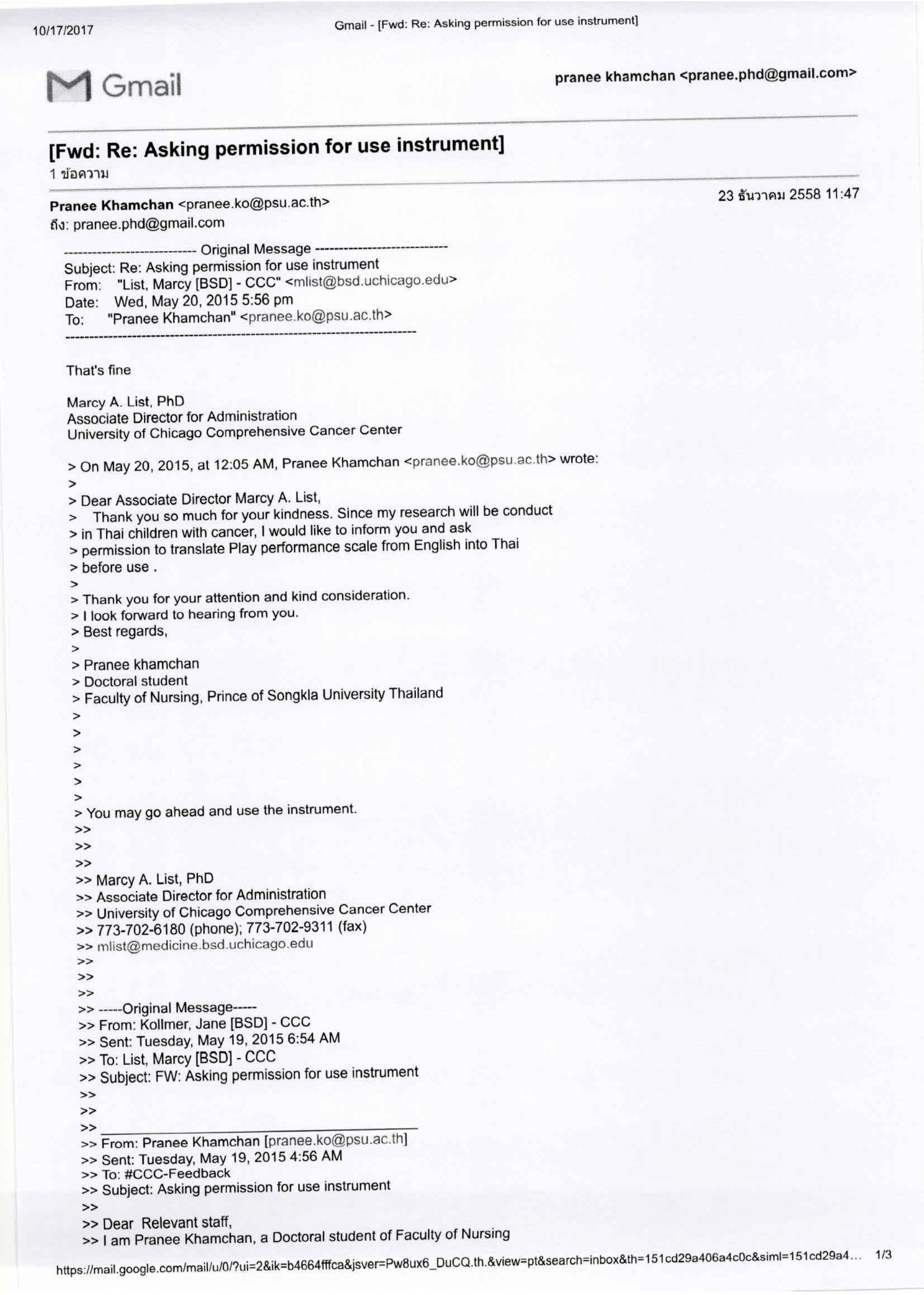
คณะพยาบาลศาสตร์ มหาวิทยาลัยสงขลานครินทร์ จึงใคร่ขอความอนุเคราะห์ให้ นางปราณี คำจันทร์ ใช้เครื่องมือวิจัยข้างต้นเพื่อประกอบการทำวิจัยต่อไป

จึงเรียนมาเพื่อโปรดพิจารณาอนุญาตด้วย จะเป็นพระคุณยิ่ง

(ผู้ช่วยศาสตราจารย์ ดร. อุมาพร ปุญญโสพรรณ)
รองคณบดีฝ่ายวิจัยและบัณฑิตศึกษา ปฏิบัติราชการแทน
คณบดีคณะพยาบาลศาสตร์

ไม่ขัดข้อง

9 กค 58



Gmail

pranee khamchan <pranee.phd@gmail.com>

[Fwd: Re: Asking permission for use instrument]

1 ข้อความ

Pranee Khamchan <pranee.ko@psu.ac.th>
ถึง: pranee.phd@gmail.com

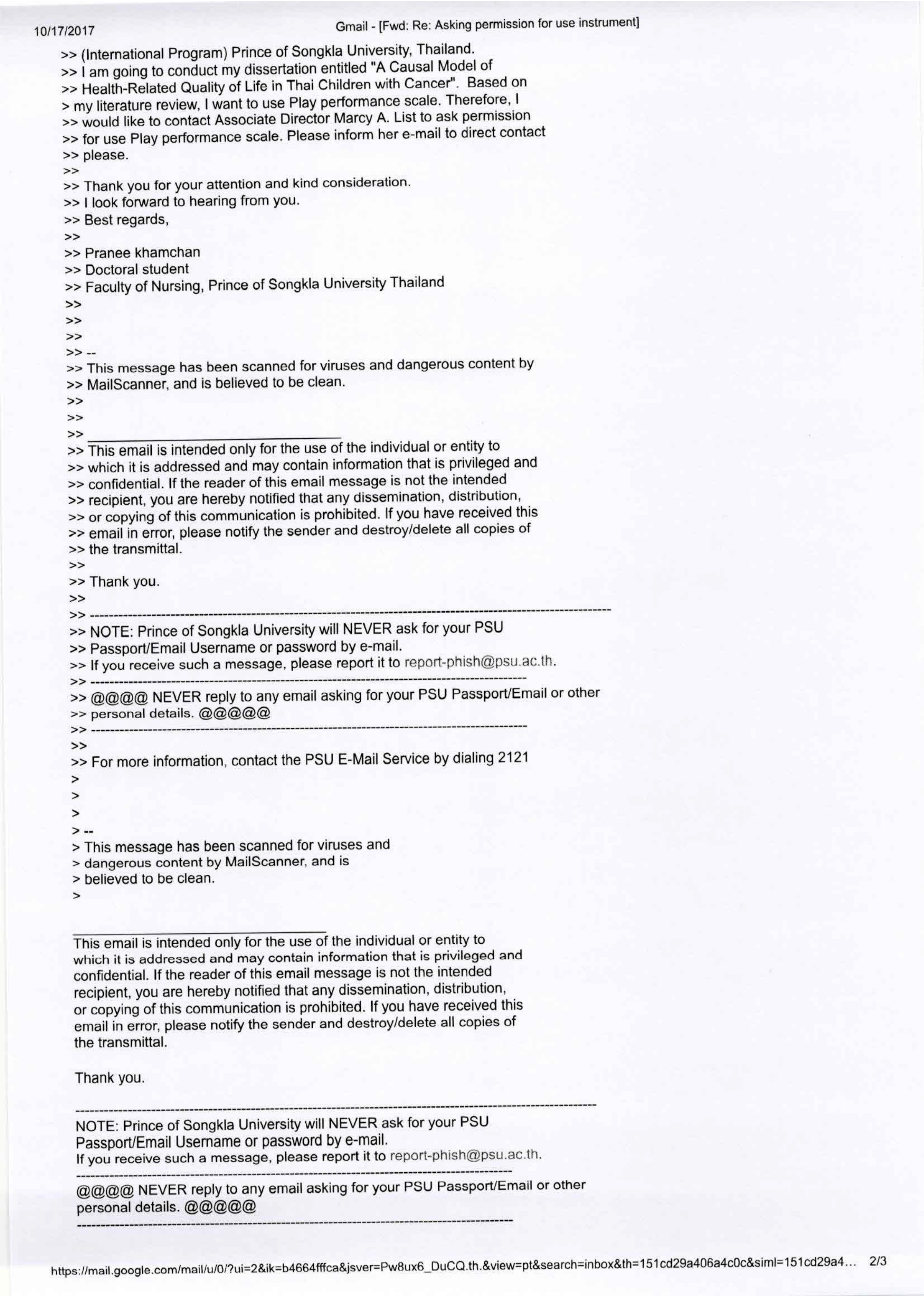
23 ธันวาคม 2558 11:47

---------------------------- Original Message ----------------------------
Subject: Re: Asking permission for use instrument
From: "List, Marcy [BSD] - CCC" <mlist@bsd.uchicago.edu>
Date: Wed, May 20, 2015 5:56 pm
To: "Pranee Khamchan" <pranee.ko@psu.ac.th>

That's fine

Marcy A. List, PhD
Associate Director for Administration
University of Chicago Comprehensive Cancer Center

> On May 20, 2015, at 12:05 AM, Pranee Khamchan <pranee.ko@psu.ac.th> wrote:
>
> Dear Associate Director Marcy A. List,
> Thank you so much for your kindness. Since my research will be conduct
> in Thai children with cancer, I would like to inform you and ask
> permission to translate Play performance scale from English into Thai
> before use .
>
> Thank you for your attention and kind consideration.
> I look forward to hearing from you.
> Best regards,
>
> Pranee khamchan
> Doctoral student
> Faculty of Nursing, Prince of Songkla University Thailand
>
>
>
>
>
>
> You may go ahead and use the instrument.
>>
>>
>>
>> Marcy A. List, PhD
>> Associate Director for Administration
>> University of Chicago Comprehensive Cancer Center
>> 773-702-6180 (phone); 773-702-9311 (fax)
>> mlist@medicine.bsd.uchicago.edu
>>
>>
>>
>> -----Original Message-----
>> From: Kollmer, Jane [BSD] - CCC
>> Sent: Tuesday, May 19, 2015 6:54 AM
>> To: List, Marcy [BSD] - CCC
>> Subject: FW: Asking permission for use instrument
>>
>>
>> ________________________________
>> From: Pranee Khamchan [pranee.ko@psu.ac.th]
>> Sent: Tuesday, May 19, 2015 4:56 AM
>> To: #CCC-Feedback
>> Subject: Asking permission for use instrument
>>
>> Dear Relevant staff,
>> I am Pranee Khamchan, a Doctoral student of Faculty of Nursing



>> (International Program) Prince of Songkla University, Thailand.
>> I am going to conduct my dissertation entitled "A Causal Model of
>> Health-Related Quality of Life in Thai Children with Cancer". Based on
> my literature review, I want to use Play performance scale. Therefore, I
>> would like to contact Associate Director Marcy A. List to ask permission
>> for use Play performance scale. Please inform her e-mail to direct contact
>> please.
>>
>> Thank you for your attention and kind consideration.
>> I look forward to hearing from you.
>> Best regards,
>>
>> Pranee khamchan
>> Doctoral student
>> Faculty of Nursing, Prince of Songkla University Thailand
>>
>>
>>
>> --
>> This message has been scanned for viruses and dangerous content by
>> MailScanner, and is believed to be clean.
>>
>>
>> ________________________________

>> This email is intended only for the use of the individual or entity to
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>> the transmittal.
>>
>> Thank you.
>>
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>> NOTE: Prince of Songkla University will NEVER ask for your PSU
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>> If you receive such a message, please report it to report-phish@psu.ac.th.
>> --
>> @@@@ NEVER reply to any email asking for your PSU Passport/Email or other
>> personal details. @@@@@
>> --
>>
>> For more information, contact the PSU E-Mail Service by dialing 2121

>
>
>
> --
> This message has been scanned for viruses and
> dangerous content by MailScanner, and is
> believed to be clean.
>

____
This email is intended only for the use of the individual or entity to
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recipient, you are hereby notified that any dissemination, distribution,
or copying of this communication is prohibited. If you have received this
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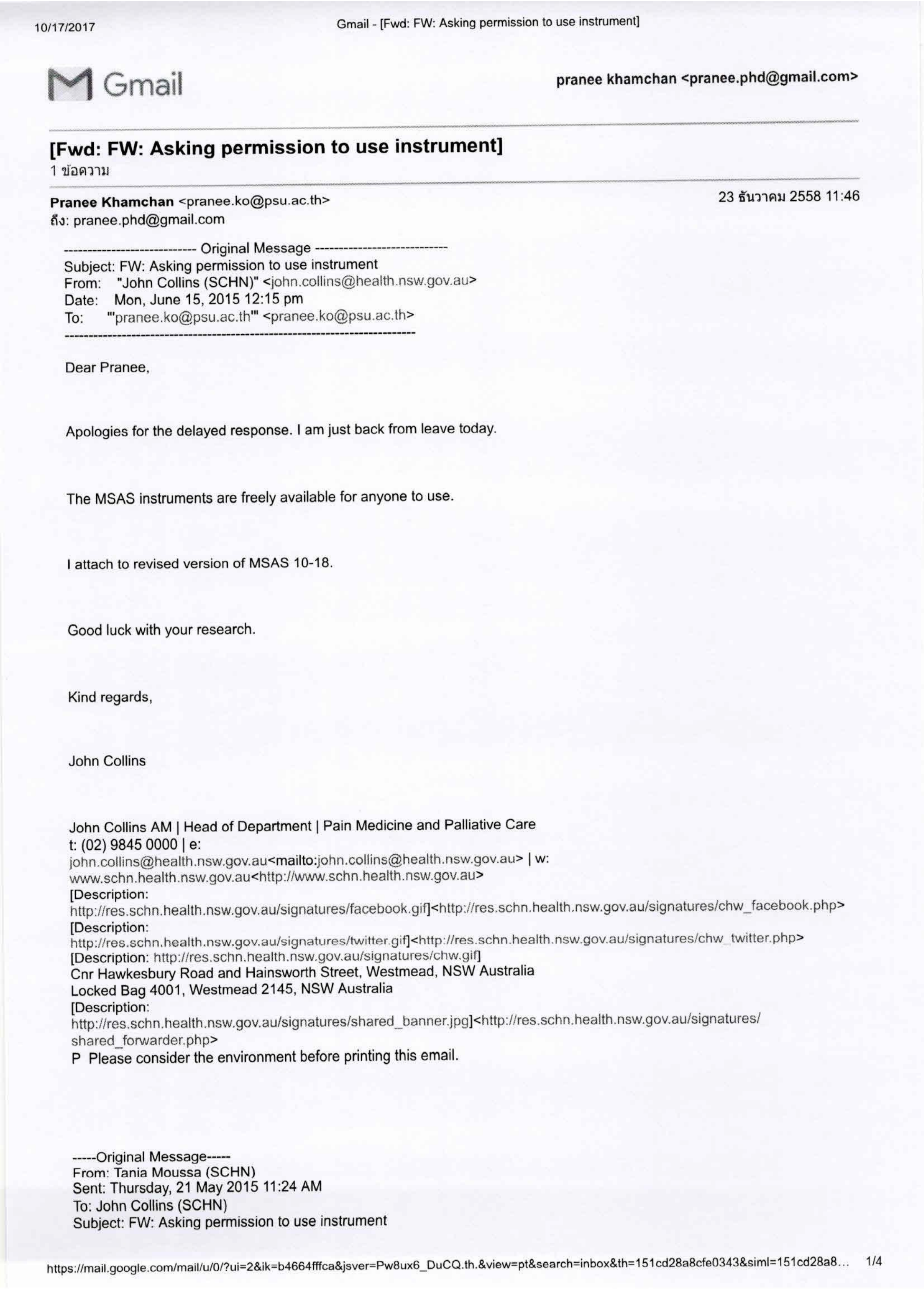
the transmittal.

Thank you.

NOTE: Prince of Songkla University will NEVER ask for your PSU
Passport/Email Username or password by e-mail.
If you receive such a message, please report it to report-phish@psu.ac.th.

@@@@ NEVER reply to any email asking for your PSU Passport/Email or other
personal details. @@@@@



10/17/2017 Gmail - [Fwd: FW: Asking permission to use instrument]

Gmail

pranee khamchan <pranee.phd@gmail.com>

[Fwd: FW: Asking permission to use instrument]

1 ข้อความ

Pranee Khamchan <pranee.ko@psu.ac.th> 23 ธันวาคม 2558 11:46

ถึง: pranee.phd@gmail.com

---------------------------- Original Message ----------------------------
Subject: FW: Asking permission to use instrument
From: "John Collins (SCHN)" <john.collins@health.nsw.gov.au>
Date: Mon, June 15, 2015 12:15 pm
To: "'pranee.ko@psu.ac.th'" <pranee.ko@psu.ac.th>

Dear Pranee,

Apologies for the delayed response. I am just back from leave today.

The MSAS instruments are freely available for anyone to use.

I attach to revised version of MSAS 10-18.

Good luck with your research.

Kind regards,

John Collins

John Collins AM | Head of Department | Pain Medicine and Palliative Care
t: (02) 9845 0000 | e:
john.collins@health.nsw.gov.au<mailto:john.collins@health.nsw.gov.au> | w:
www.schn.health.nsw.gov.au<http://www.schn.health.nsw.gov.au>
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[Description: http://res.schn.health.nsw.gov.au/signatures/chw.gif]
Cnr Hawkesbury Road and Hainsworth Street, Westmead, NSW Australia
Locked Bag 4001, Westmead 2145, NSW Australia
[Description:
http://res.schn.health.nsw.gov.au/signatures/shared_banner.jpg]<http://res.schn.health.nsw.gov.au/signatures/shared_forwarder.php>
P Please consider the environment before printing this email.

-----Original Message-----
From: Tania Moussa (SCHN)
Sent: Thursday, 21 May 2015 11:24 AM
To: John Collins (SCHN)
Subject: FW: Asking permission to use instrument

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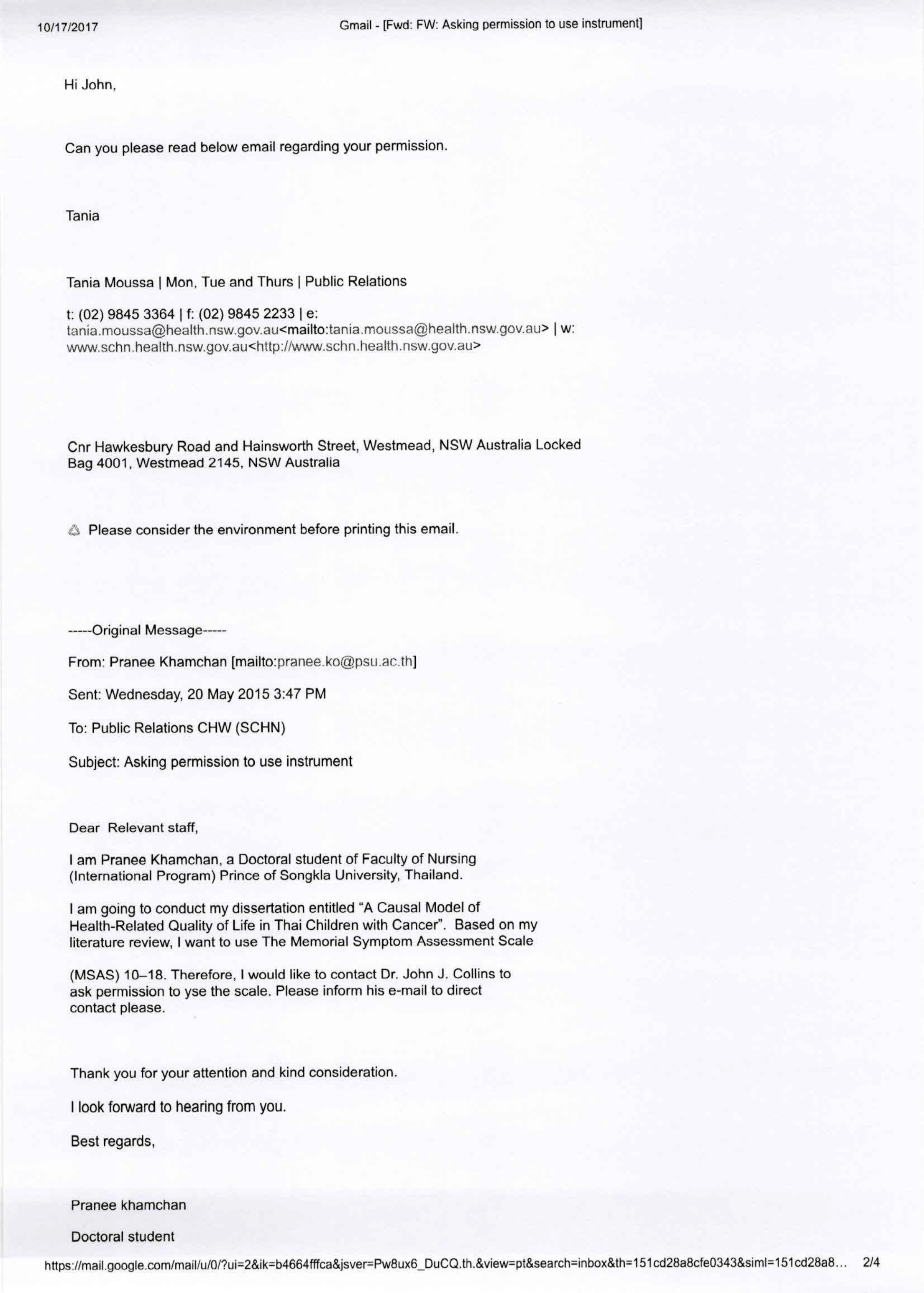

10/17/2017 Gmail - [Fwd: FW: Asking permission to use instrument]

Hi John,

Can you please read below email regarding your permission.

Tania

Tania Moussa | Mon, Tue and Thurs | Public Relations

t: (02) 9845 3364 | f: (02) 9845 2233 | e: tania.moussa@health.nsw.gov.au<mailto:tania.moussa@health.nsw.gov.au> | w: www.schn.health.nsw.gov.au<http://www.schn.health.nsw.gov.au>

Cnr Hawkesbury Road and Hainsworth Street, Westmead, NSW Australia Locked Bag 4001, Westmead 2145, NSW Australia

♲ Please consider the environment before printing this email.

-----Original Message-----

From: Pranee Khamchan [mailto:pranee.ko@psu.ac.th]

Sent: Wednesday, 20 May 2015 3:47 PM

To: Public Relations CHW (SCHN)

Subject: Asking permission to use instrument

Dear Relevant staff,

I am Pranee Khamchan, a Doctoral student of Faculty of Nursing (International Program) Prince of Songkla University, Thailand.

I am going to conduct my dissertation entitled “A Causal Model of Health-Related Quality of Life in Thai Children with Cancer”. Based on my literature review, I want to use The Memorial Symptom Assessment Scale

(MSAS) 10–18. Therefore, I would like to contact Dr. John J. Collins to ask permission to yse the scale. Please inform his e-mail to direct contact please.

Thank you for your attention and kind consideration.

I look forward to hearing from you.

Best regards,

Pranee khamchan

Doctoral student

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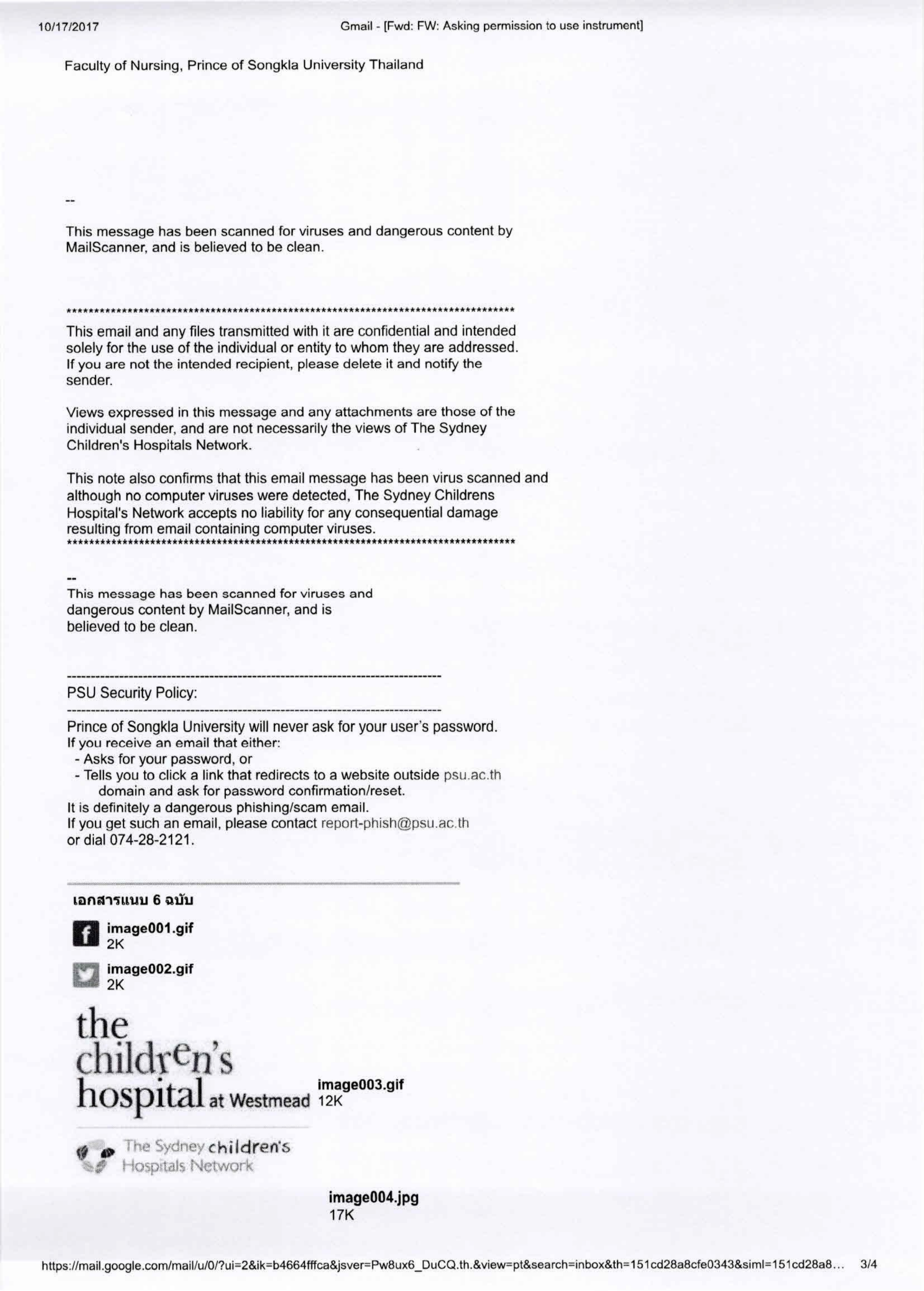

Faculty of Nursing, Prince of Songkla University Thailand

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This message has been scanned for viruses and dangerous content by MailScanner, and is believed to be clean.

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This message has been scanned for viruses and dangerous content by MailScanner, and is believed to be clean.

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the children's hospital at Westmead

image003.gif
12K

The Sydney children's Hospitals Network

image004.jpg
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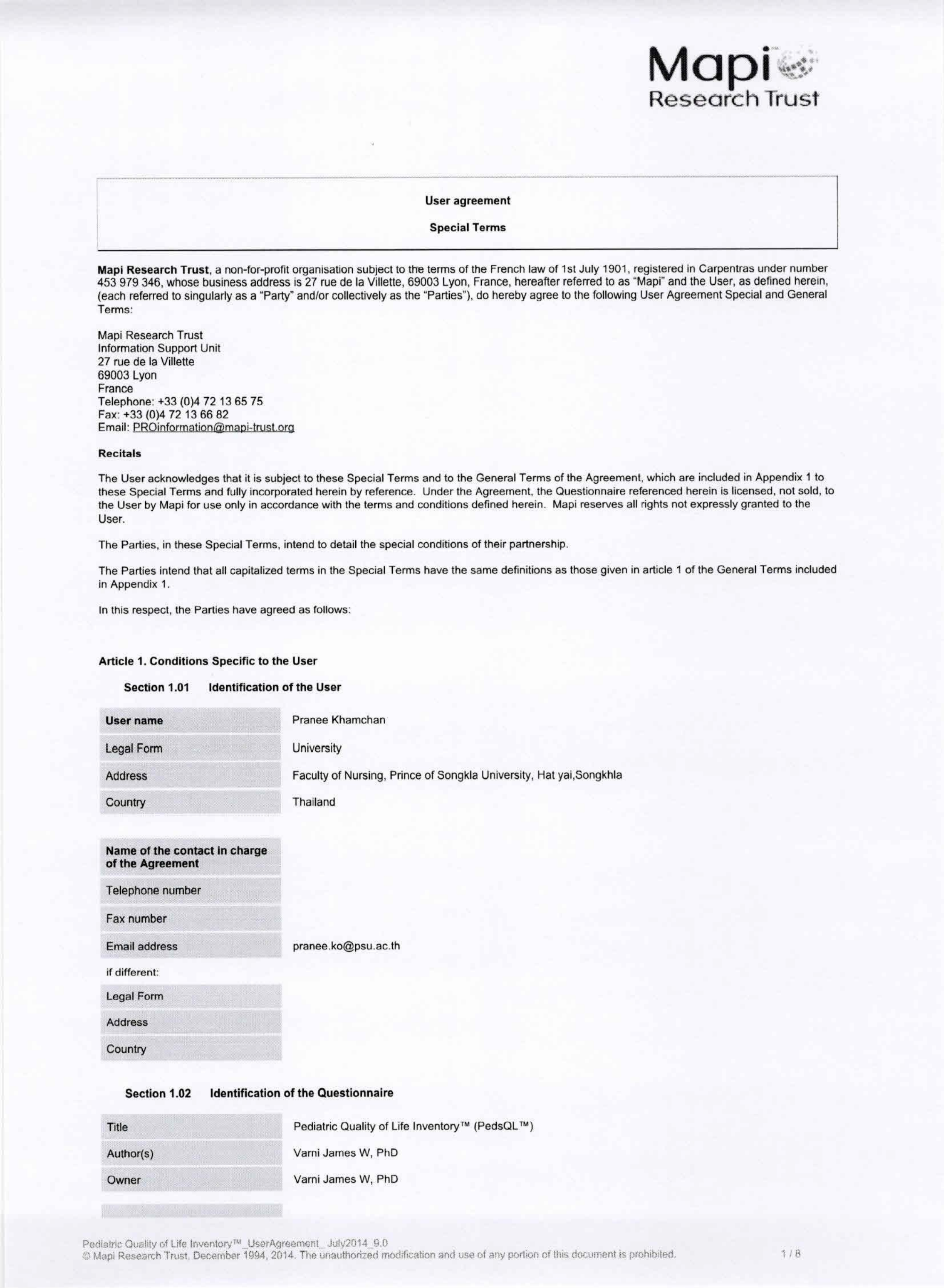


Mapi Research Trust

User agreement

Special Terms

Mapi Research Trust, a non-for-profit organisation subject to the terms of the French law of 1st July 1901, registered in Carpentras under number 453 979 346, whose business address is 27 rue de la Villette, 69003 Lyon, France, hereafter referred to as "Mapi" and the User, as defined herein, (each referred to singularly as a "Party" and/or collectively as the "Parties"), do hereby agree to the following User Agreement Special and General Terms:

Mapi Research Trust
Information Support Unit
27 rue de la Villette
69003 Lyon
France
Telephone: +33 (0)4 72 13 65 75
Fax: +33 (0)4 72 13 66 82
Email: PROinformation@mapi-trust.org

Recitals

The User acknowledges that it is subject to these Special Terms and to the General Terms of the Agreement, which are included in Appendix 1 to these Special Terms and fully incorporated herein by reference. Under the Agreement, the Questionnaire referenced herein is licensed, not sold, to the User by Mapi for use only in accordance with the terms and conditions defined herein. Mapi reserves all rights not expressly granted to the User.

The Parties, in these Special Terms, intend to detail the special conditions of their partnership.

The Parties intend that all capitalized terms in the Special Terms have the same definitions as those given in article 1 of the General Terms included in Appendix 1.

In this respect, the Parties have agreed as follows:

Article 1. Conditions Specific to the User

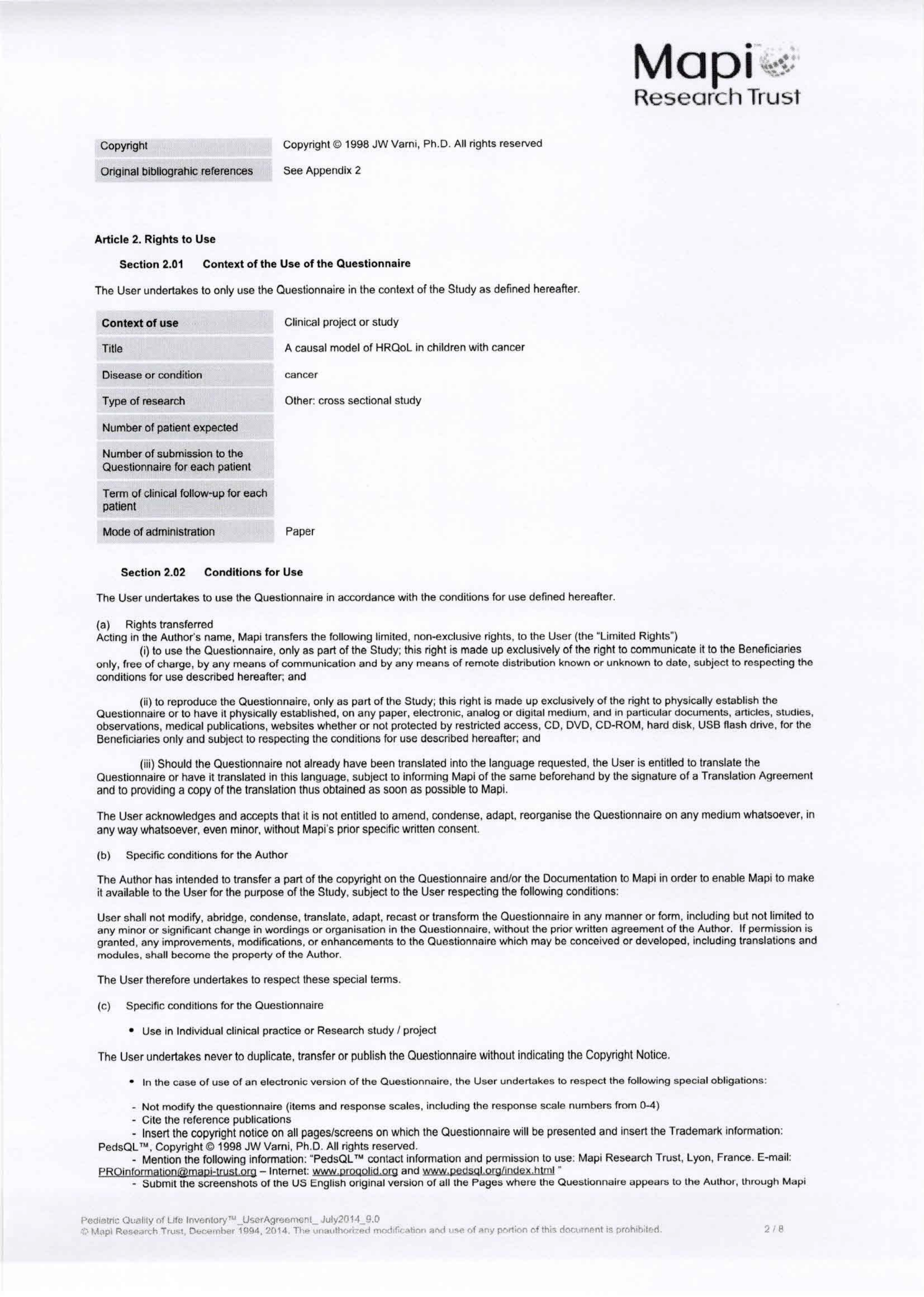
Section 1.01 Identification of the User

User name	Pranee Khamchan
Legal Form	University
Address	Faculty of Nursing, Prince of Songkla University, Hat yai,Songkhla
Country	Thailand

Name of the contact in charge of the Agreement	
Telephone number	
Fax number	
Email address	pranee.ko@psu.ac.th
if different:	
Legal Form	
Address	
Country	

Section 1.02 Identification of the Questionnaire

Title	Pediatric Quality of Life Inventory™ (PedsQL™)
Author(s)	Varni James W, PhD
Owner	Varni James W, PhD



Mapi
Research Trust

Copyright	Copyright © 1998 JW Varni, Ph.D. All rights reserved
Original bibliograhic references	See Appendix 2

Article 2. Rights to Use

Section 2.01 Context of the Use of the Questionnaire

The User undertakes to only use the Questionnaire in the context of the Study as defined hereafter.

Context of use	Clinical project or study
Title	A causal model of HRQoL in children with cancer
Disease or condition	cancer
Type of research	Other: cross sectional study
Number of patient expected	
Number of submission to the Questionnaire for each patient	
Term of clinical follow-up for each patient	
Mode of administration	Paper

Section 2.02 Conditions for Use

The User undertakes to use the Questionnaire in accordance with the conditions for use defined hereafter.

(a) Rights transferred
Acting in the Author's name, Mapi transfers the following limited, non-exclusive rights, to the User (the "Limited Rights")

(i) to use the Questionnaire, only as part of the Study; this right is made up exclusively of the right to communicate it to the Beneficiaries only, free of charge, by any means of communication and by any means of remote distribution known or unknown to date, subject to respecting the conditions for use described hereafter; and

(ii) to reproduce the Questionnaire, only as part of the Study; this right is made up exclusively of the right to physically establish the Questionnaire or to have it physically established, on any paper, electronic, analog or digital medium, and in particular documents, articles, studies, observations, medical publications, websites whether or not protected by restricted access, CD, DVD, CD-ROM, hard disk, USB flash drive, for the Beneficiaries only and subject to respecting the conditions for use described hereafter; and

(iii) Should the Questionnaire not already have been translated into the language requested, the User is entitled to translate the Questionnaire or have it translated in this language, subject to informing Mapi of the same beforehand by the signature of a Translation Agreement and to providing a copy of the translation thus obtained as soon as possible to Mapi.

The User acknowledges and accepts that it is not entitled to amend, condense, adapt, reorganise the Questionnaire on any medium whatsoever, in any way whatsoever, even minor, without Mapi's prior specific written consent.

(b) Specific conditions for the Author

The Author has intended to transfer a part of the copyright on the Questionnaire and/or the Documentation to Mapi in order to enable Mapi to make it available to the User for the purpose of the Study, subject to the User respecting the following conditions:

User shall not modify, abridge, condense, translate, adapt, recast or transform the Questionnaire in any manner or form, including but not limited to any minor or significant change in wordings or organisation in the Questionnaire, without the prior written agreement of the Author. If permission is granted, any improvements, modifications, or enhancements to the Questionnaire which may be conceived or developed, including translations and modules, shall become the property of the Author.

The User therefore undertakes to respect these special terms.

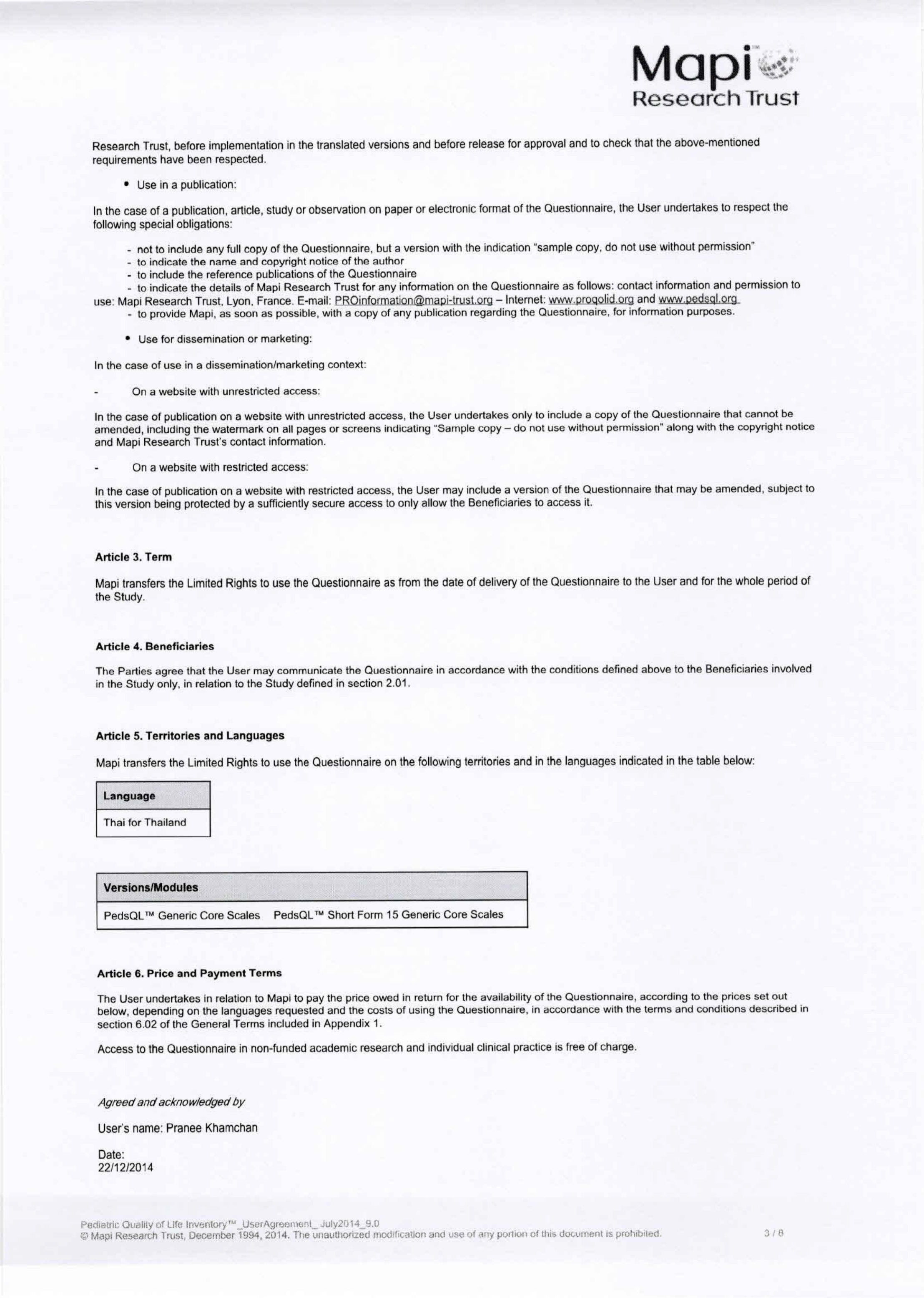
(c) Specific conditions for the Questionnaire

- Use in Individual clinical practice or Research study / project

The User undertakes never to duplicate, transfer or publish the Questionnaire without indicating the Copyright Notice.

- In the case of use of an electronic version of the Questionnaire, the User undertakes to respect the following special obligations:

- Not modify the questionnaire (items and response scales, including the response scale numbers from 0-4)
- Cite the reference publications
- Insert the copyright notice on all pages/screens on which the Questionnaire will be presented and insert the Trademark information: PedsQL™, Copyright © 1998 JW Varni, Ph.D. All rights reserved.
- Mention the following information: "PedsQL™ contact information and permission to use: Mapi Research Trust, Lyon, France. E-mail: PROinformation@mapi-trust.org – Internet: www.proqolid.org and www.pedsql.org/index.html "
- Submit the screenshots of the US English original version of all the Pages where the Questionnaire appears to the Author, through Mapi



Research Trust, before implementation in the translated versions and before release for approval and to check that the above-mentioned requirements have been respected.

- Use in a publication:

In the case of a publication, article, study or observation on paper or electronic format of the Questionnaire, the User undertakes to respect the following special obligations:

- not to include any full copy of the Questionnaire, but a version with the indication "sample copy, do not use without permission"
- to indicate the name and copyright notice of the author
- to include the reference publications of the Questionnaire
- to indicate the details of Mapi Research Trust for any information on the Questionnaire as follows: contact information and permission to use: Mapi Research Trust, Lyon, France. E-mail: PROinformation@mapi-trust.org – Internet: www.proqolid.org and www.pedsql.org
- to provide Mapi, as soon as possible, with a copy of any publication regarding the Questionnaire, for information purposes.

- Use for dissemination or marketing:

In the case of use in a dissemination/marketing context:

- On a website with unrestricted access:

In the case of publication on a website with unrestricted access, the User undertakes only to include a copy of the Questionnaire that cannot be amended, including the watermark on all pages or screens indicating "Sample copy – do not use without permission" along with the copyright notice and Mapi Research Trust's contact information.

- On a website with restricted access:

In the case of publication on a website with restricted access, the User may include a version of the Questionnaire that may be amended, subject to this version being protected by a sufficiently secure access to only allow the Beneficiaries to access it.

Article 3. Term

Mapi transfers the Limited Rights to use the Questionnaire as from the date of delivery of the Questionnaire to the User and for the whole period of the Study.

Article 4. Beneficiaries

The Parties agree that the User may communicate the Questionnaire in accordance with the conditions defined above to the Beneficiaries involved in the Study only, in relation to the Study defined in section 2.01.

Article 5. Territories and Languages

Mapi transfers the Limited Rights to use the Questionnaire on the following territories and in the languages indicated in the table below:

Language
Thai for Thailand

Versions/Modules
PedsQL™ Generic Core Scales PedsQL™ Short Form 15 Generic Core Scales

Article 6. Price and Payment Terms

The User undertakes in relation to Mapi to pay the price owed in return for the availability of the Questionnaire, according to the prices set out below, depending on the languages requested and the costs of using the Questionnaire, in accordance with the terms and conditions described in section 6.02 of the General Terms included in Appendix 1.

Access to the Questionnaire in non-funded academic research and individual clinical practice is free of charge.

Agreed and acknowledged by

User's name: Pranee Khamchan

Date:
22/12/2014

Appendix C

Informed Consent Form

My name is Pranee Khamchan, PhD. student, Faculty of Nursing, Prince of Songkla University, Thailand. I am conducting a research study entitled "A Causal Model of Health-Related Quality of Life in Children with Cancer". My research is under supervision of Assoc. Prof. Dr. Busakorn Punthmatharith, Asst. Prof. Dr. Wongchan Petpichetchian, Asst. Prof. Thirachit Chotsampancharoen, MD. The findings of this study will provide information for nurses to develop effective interventions to enhance HRQOL in children with cancer. This study has been approved by the Institutional Review Board of Faculty of Nursing, Prince of Songkla University, and permitted by ethical committee of hospital. If you and your child decide to participate in this study, you will be to ask to fill three questionnaires including 1) Demographic data questionnaire, 2) Chulalongkorn Family Inventory, and 3) The Play Performance Scale for Children. Your child will be asked to fill out five questionnaires including 1) The Pediatric Quality of Life Inventory Version 4.0, 2) Thai version of Coping of Disease Inventory, 3) The revised Thai versions of State-Trait Anxiety Inventory for Children, 4) Self-care behavior questionnaire, 5) The memorial symptom assessment scale 10–18, It will take about 60-90 minutes for answer all of the questionnaires. You and your child will be received 100 baths for commission fee. The risks from participating in this study are time-consuming for measurement procedure and feeling of fatigue to answer the questionnaires. You and your child can take a rest or make a decision to continue answer the questionnaires more than one time. You and your child will be informed regarding the scheduling measurement and time planning. All information in this study will remain confidential and anonymous, and will only be accessible to the researcher, research advisors, and research committee of this study. You name and your child's name or any identifying information will not be used. You and your child have the right to withdraw from participation in this study at any time, and there are no influences on your chid receiving service or any medical treatment after withdrawing from the study. If you and your child have any questions or cannot participate in this study, I can directly contact the researcher (Pranee Khamchan) by phone number 0812777077 or Assoc. Prof. Dr. Busakorn Punthmatharith by phone number 074286561. After I and my child agree to participate in this program, I will be asked to sign my name on consent form.

Thank you for your kind cooperation
Pranee Khamchan
Researcher

I am (name)........................ (surname)…………………..…….and my child (name).......................... (surname)……………. …. understand the information and willing to participate in a research study.

Signature of Patient……...………………...…………….Date……………………..……

(In child who over 12 years of age)

Signature of Legal Guardian……………………………. Date:……….……………

Signature of Person Obtaining Consent………………… Date:……….……………

Assent form

My name is Pranee Khamchan. I am a doctoral student at the Faculty of Nursing, Prince of songkla University. I am conducting a research study on "**A causal model of health-related quality of life in children with cancer**". The findings of this study will provide information for nurses to develop effective interventions to enhance HRQOL for you and your friends in the future. So I would like you to complete the five questionnaires. It will take about 60-90 minutes for answer all of the questionnaires. You and your caregiver will be received 100 baths for commission fee. If you feel fatigue or bore to answer the questionnaires you can take a rest.

You are voluntary to participate in this study. Your name will remain confidential and anonymous. You have the right to withdraw from participation in this study at any time without any effects to you or blame.

………………………………………..………..……………………………

I understand the information and willing to participate in a research study

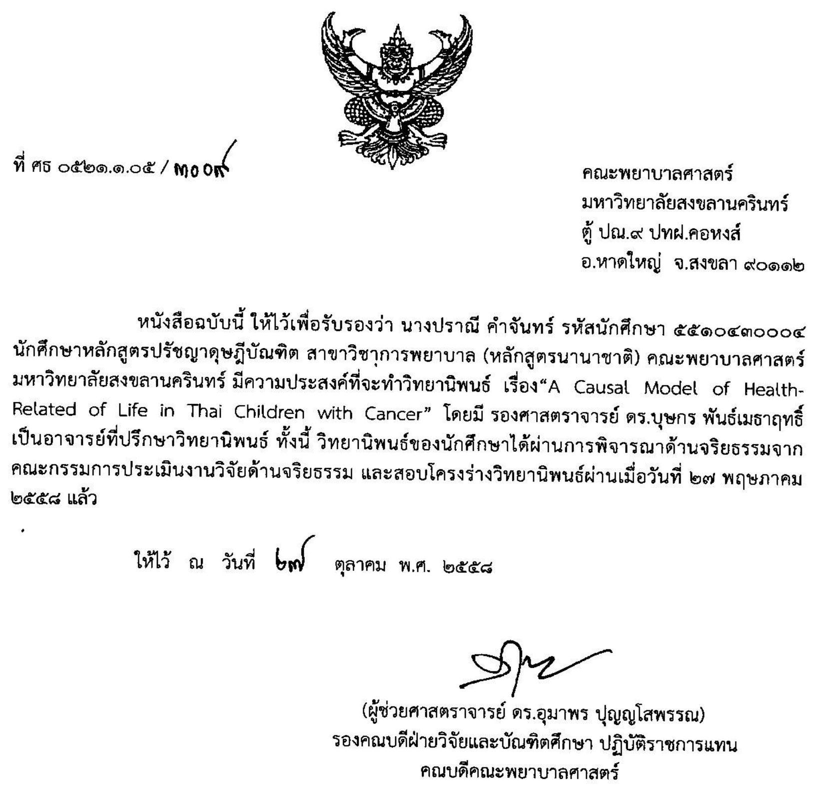
Signature of Patient……...………………..…………….Date…………………..……

(In child 9 - 12 years of age)

Signature of Person Obtaining Consent………………… Date:……….……………

Appendix D

Approving of Institutional Review Board



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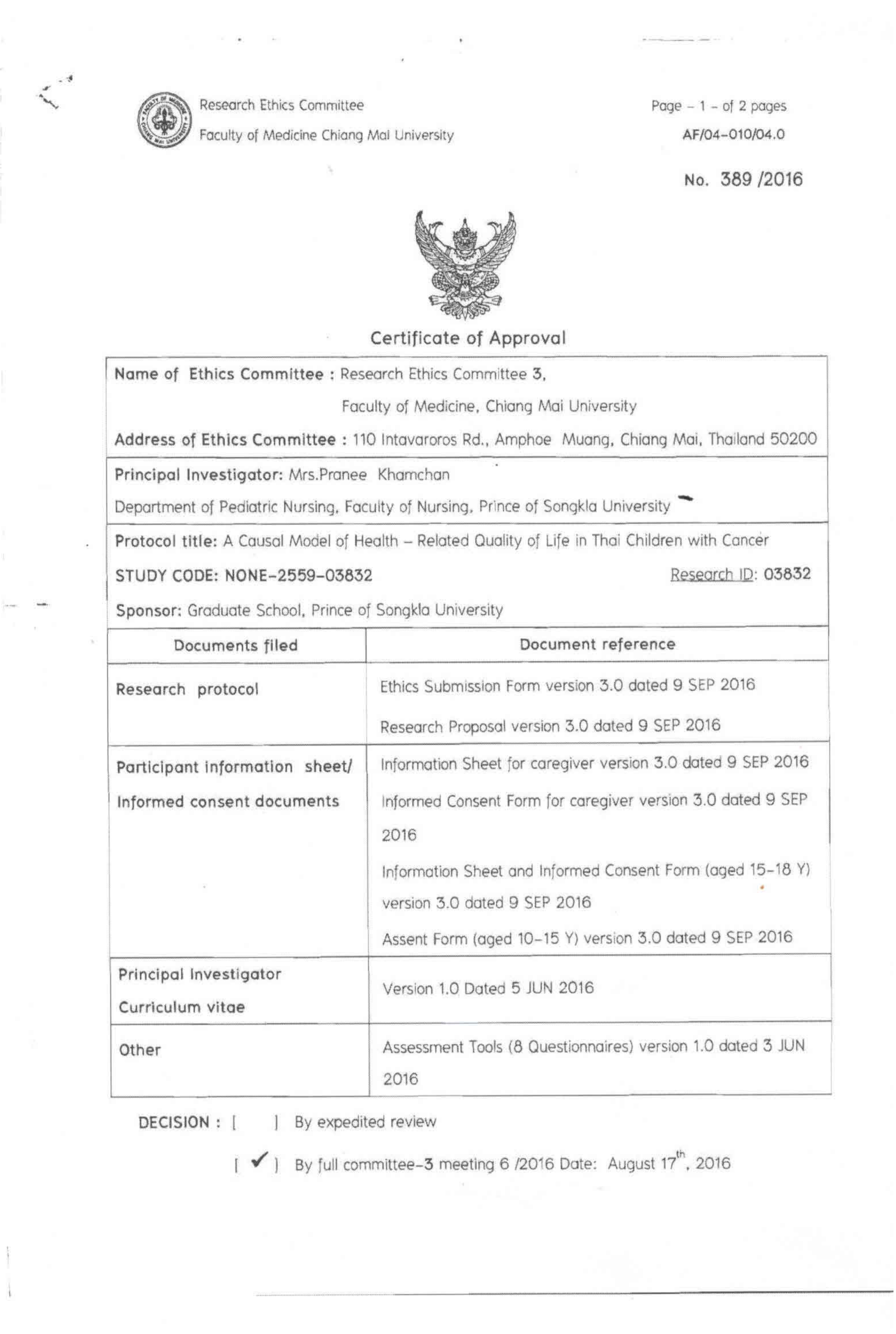
คณะพยาบาลศาสตร์
มหาวิทยาลัยสงขลานครินทร์
ตู้ ปณ.๙ ปทฝ.คอหงส์
อ.หาดใหญ่ จ.สงขลา ๙๐๑๑๒

หนังสือฉบับนี้ ให้ไว้เพื่อรับรองว่า นางปราณี คำจันทร์ รหัสนักศึกษา ๕๕๑๐๔๓๐๐๐๔ นักศึกษาหลักสูตรปรัชญาดุษฎีบัณฑิต สาขาวิชาการพยาบาล (หลักสูตรนานาชาติ) คณะพยาบาลศาสตร์ มหาวิทยาลัยสงขลานครินทร์ มีความประสงค์ที่จะทำวิทยานิพนธ์ เรื่อง“A Causal Model of Health-Related of Life in Thai Children with Cancer” โดยมี รองศาสตราจารย์ ดร.บุษกร พันธ์เมธาฤทธิ์ เป็นอาจารย์ที่ปรึกษาวิทยานิพนธ์ ทั้งนี้ วิทยานิพนธ์ของนักศึกษาได้ผ่านการพิจารณาด้านจริยธรรมจากคณะกรรมการประเมินงานวิจัยด้านจริยธรรม และสอบโครงร่างวิทยานิพนธ์ผ่านเมื่อวันที่ ๒๗ พฤษภาคม ๒๕๕๘ แล้ว

ให้ไว้ ณ วันที่ ๒๗ ตุลาคม พ.ศ. ๒๕๕๘

(ผู้ช่วยศาสตราจารย์ ดร.อุมาพร ปุญญโสพรรณ)
รองคณบดีฝ่ายวิจัยและบัณฑิตศึกษา ปฏิบัติราชการแทน
คณบดีคณะพยาบาลศาสตร์



Research Ethics Committee
Faculty of Medicine Chiang Mai University

Page – 1 – of 2 pages
AF/04-010/04.0

No. 389 /2016

Certificate of Approval

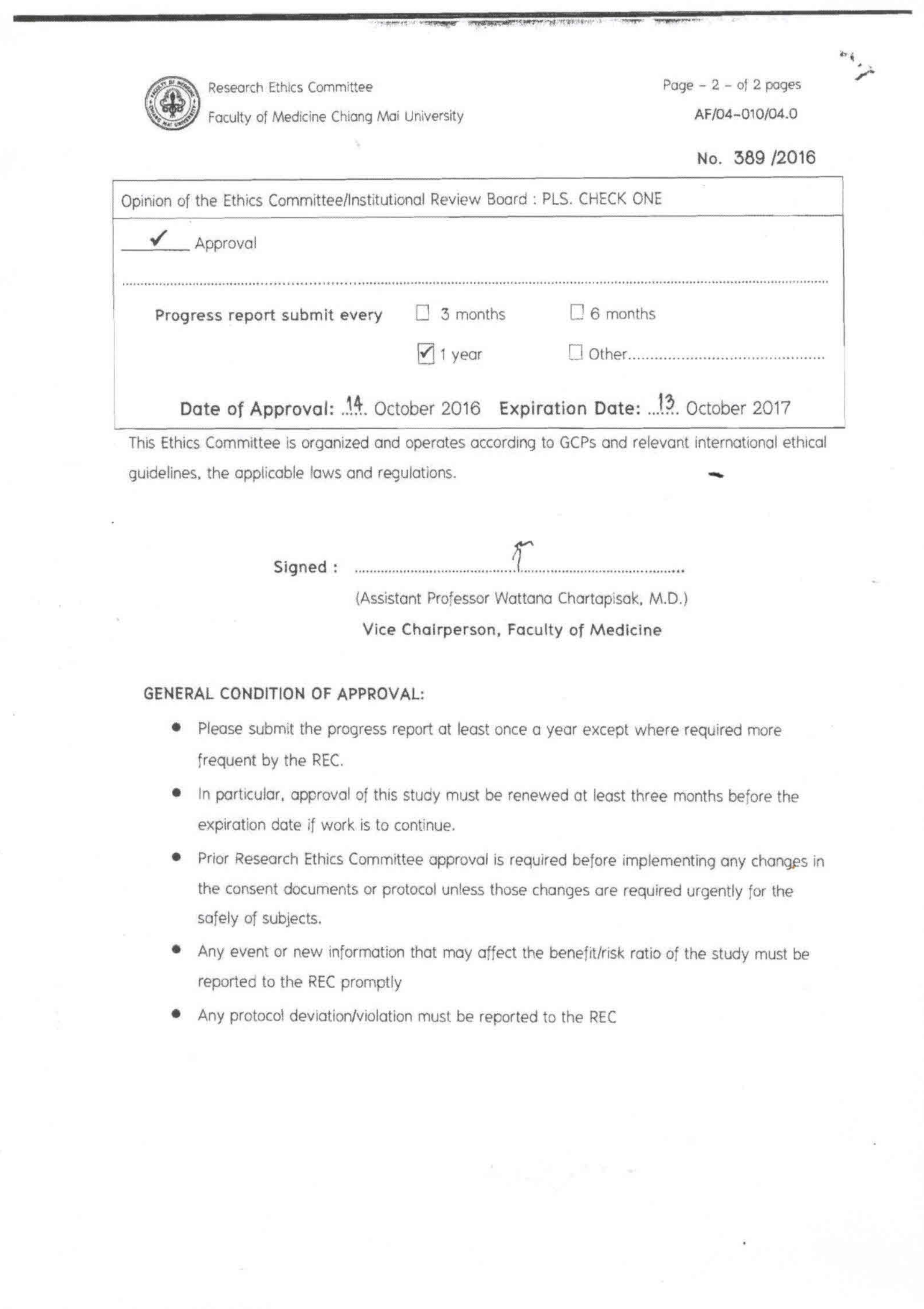
Name of Ethics Committee : Research Ethics Committee 3,
Faculty of Medicine, Chiang Mai University
Address of Ethics Committee : 110 Intavaroros Rd., Amphoe Muang, Chiang Mai, Thailand 50200

Principal Investigator: Mrs.Pranee Khamchan
Department of Pediatric Nursing, Faculty of Nursing, Prince of Songkla University

Protocol title: A Causal Model of Health – Related Quality of Life in Thai Children with Cancer
STUDY CODE: NONE-2559-03832 Research ID: 03832
Sponsor: Graduate School, Prince of Songkla University

Documents filed	Document reference
Research protocol	Ethics Submission Form version 3.0 dated 9 SEP 2016 Research Proposal version 3.0 dated 9 SEP 2016
Participant information sheet/ Informed consent documents	Information Sheet for caregiver version 3.0 dated 9 SEP 2016 Informed Consent Form for caregiver version 3.0 dated 9 SEP 2016 Information Sheet and Informed Consent Form (aged 15-18 Y) version 3.0 dated 9 SEP 2016 Assent Form (aged 10-15 Y) version 3.0 dated 9 SEP 2016
Principal Investigator Curriculum vitae	Version 1.0 Dated 5 JUN 2016
Other	Assessment Tools (8 Questionnaires) version 1.0 dated 3 JUN 2016

DECISION : [ ] By expedited review
[✓] By full committee-3 meeting 6 /2016 Date: August 17th, 2016



Research Ethics Committee
Faculty of Medicine Chiang Mai University

Page - 2 - of 2 pages
AF/04-010/04.0

No. 389 /2016

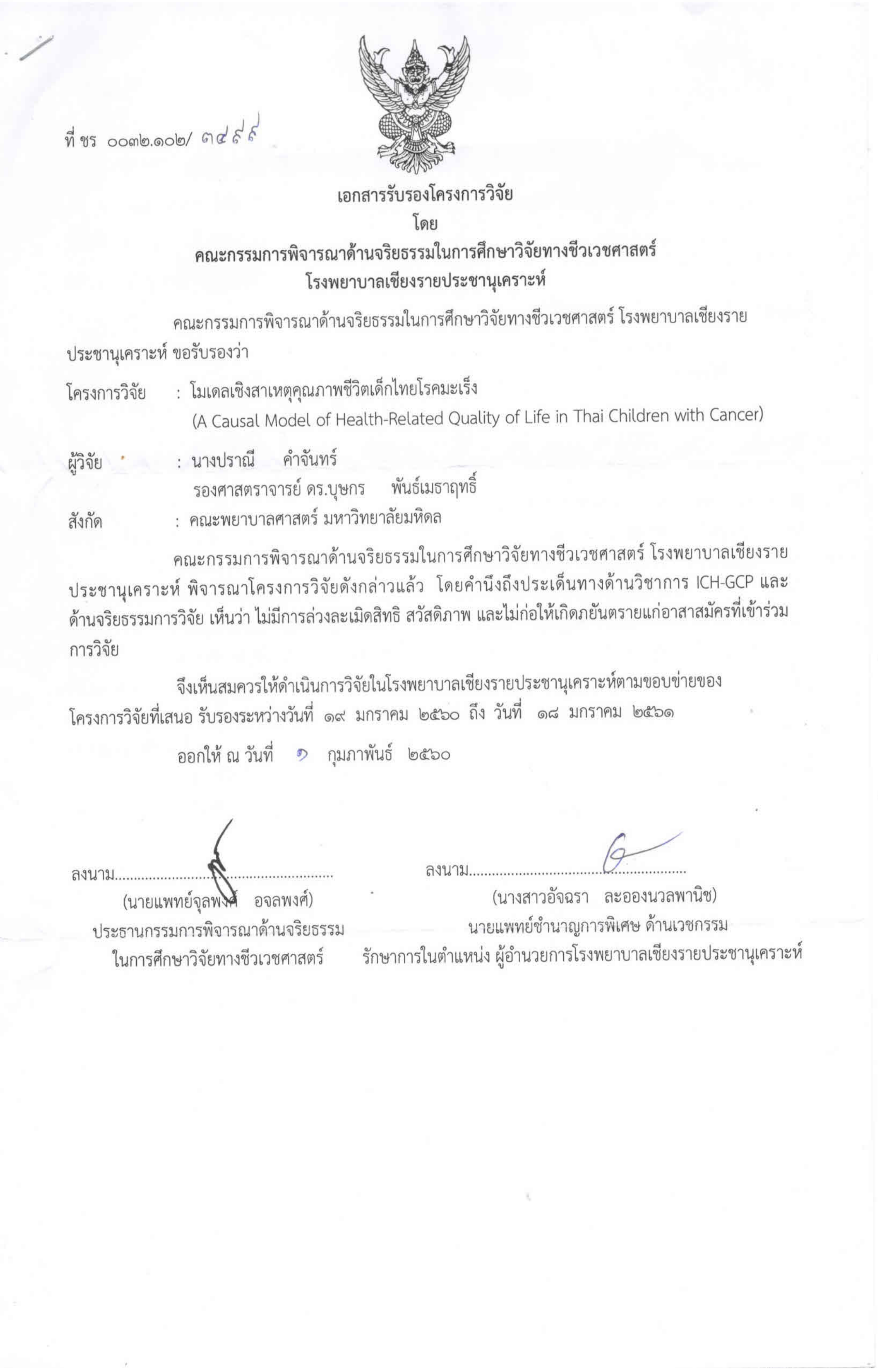
Opinion of the Ethics Committee/Institutional Review Board : PLS. CHECK ONE
_✓_ Approval
Progress report submit every ☐ 3 months ☐ 6 months ☑ 1 year ☐ Other...
Date of Approval: ..14.. October 2016 **Expiration Date:** ..13.. October 2017

This Ethics Committee is organized and operates according to GCPs and relevant international ethical guidelines, the applicable laws and regulations.

Signed : ....
(Assistant Professor Wattana Chartapisak, M.D.)
Vice Chairperson, Faculty of Medicine

GENERAL CONDITION OF APPROVAL:

- Please submit the progress report at least once a year except where required more frequent by the REC.
- In particular, approval of this study must be renewed at least three months before the expiration date if work is to continue.
- Prior Research Ethics Committee approval is required before implementing any changes in the consent documents or protocol unless those changes are required urgently for the safely of subjects.
- Any event or new information that may affect the benefit/risk ratio of the study must be reported to the REC promptly
- Any protocol deviation/violation must be reported to the REC



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เอกสารรับรองโครงการวิจัย
โดย
คณะกรรมการพิจารณาด้านจริยธรรมในการศึกษาวิจัยทางชีวเวชศาสตร์
โรงพยาบาลเชียงรายประชานุเคราะห์

คณะกรรมการพิจารณาด้านจริยธรรมในการศึกษาวิจัยทางชีวเวชศาสตร์ โรงพยาบาลเชียงรายประชานุเคราะห์ ขอรับรองว่า

โครงการวิจัย : โมเดลเชิงสาเหตุคุณภาพชีวิตเด็กไทยโรคมะเร็ง
(A Causal Model of Health-Related Quality of Life in Thai Children with Cancer)

ผู้วิจัย : นางปราณี คำจันทร์
รองศาสตราจารย์ ดร.บุษกร พันธ์เมธาฤทธิ์

สังกัด : คณะพยาบาลศาสตร์ มหาวิทยาลัยมหิดล

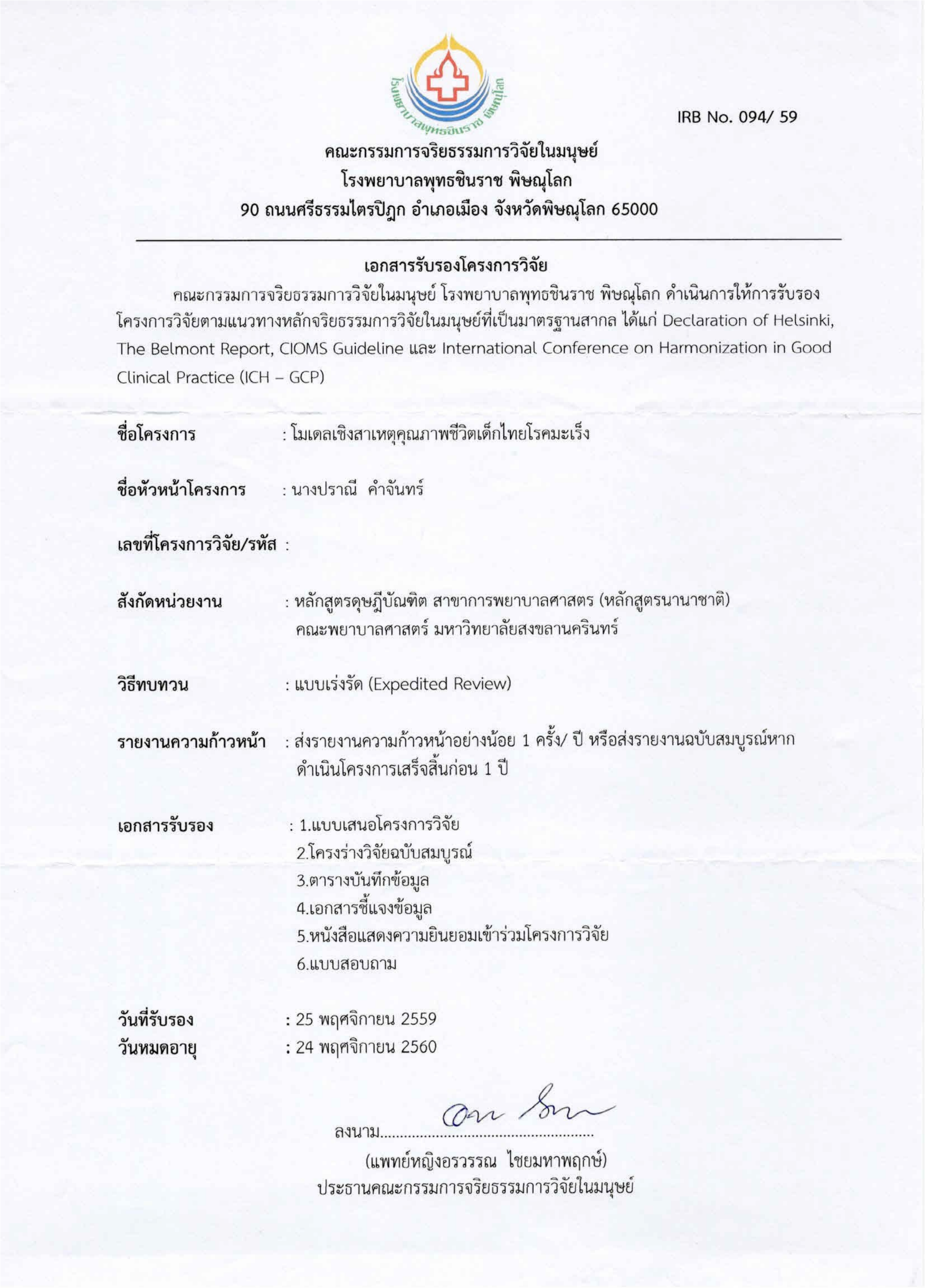
คณะกรรมการพิจารณาด้านจริยธรรมในการศึกษาวิจัยทางชีวเวชศาสตร์ โรงพยาบาลเชียงรายประชานุเคราะห์ พิจารณาโครงการวิจัยดังกล่าวแล้ว โดยคำนึงถึงประเด็นทางด้านวิชาการ ICH-GCP และด้านจริยธรรมการวิจัย เห็นว่า ไม่มีการล่วงละเมิดสิทธิ สวัสดิภาพ และไม่ก่อให้เกิดภยันตรายแก่อาสาสมัครที่เข้าร่วมการวิจัย

จึงเห็นสมควรให้ดำเนินการวิจัยในโรงพยาบาลเชียงรายประชานุเคราะห์ตามขอบข่ายของโครงการวิจัยที่เสนอ รับรองระหว่างวันที่ ๑๙ มกราคม ๒๕๖๐ ถึง วันที่ ๑๘ มกราคม ๒๕๖๑

ออกให้ ณ วันที่ ๑ กุมภาพันธ์ ๒๕๖๐

ลงนาม..
(นายแพทย์จุลพงศ์ อจลพงศ์)
ประธานกรรมการพิจารณาด้านจริยธรรม
ในการศึกษาวิจัยทางชีวเวชศาสตร์

ลงนาม..
(นางสาวอัจฉรา ละอองนวลพานิช)
นายแพทย์ชำนาญการพิเศษ ด้านเวชกรรม
รักษาการในตำแหน่ง ผู้อำนวยการโรงพยาบาลเชียงรายประชานุเคราะห์



IRB No. 094/ 59

คณะกรรมการจริยธรรมการวิจัยในมนุษย์
โรงพยาบาลพุทธชินราช พิษณุโลก
90 ถนนศรีธรรมไตรปิฎก อำเภอเมือง จังหวัดพิษณุโลก 65000

เอกสารรับรองโครงการวิจัย

คณะกรรมการจริยธรรมการวิจัยในมนุษย์ โรงพยาบาลพุทธชินราช พิษณุโลก ดำเนินการให้การรับรองโครงการวิจัยตามแนวทางหลักจริยธรรมการวิจัยในมนุษย์ที่เป็นมาตรฐานสากล ได้แก่ Declaration of Helsinki, The Belmont Report, CIOMS Guideline และ International Conference on Harmonization in Good Clinical Practice (ICH – GCP)

ชื่อโครงการ : โมเดลเชิงสาเหตุคุณภาพชีวิตเด็กไทยโรคมะเร็ง

ชื่อหัวหน้าโครงการ : นางปราณี คำจันทร์

เลขที่โครงการวิจัย/รหัส :

สังกัดหน่วยงาน : หลักสูตรดุษฎีบัณฑิต สาขาการพยาบาลศาสตร (หลักสูตรนานาชาติ)
คณะพยาบาลศาสตร์ มหาวิทยาลัยสงขลานครินทร์

วิธีทบทวน : แบบเร่งรัด (Expedited Review)

รายงานความก้าวหน้า : ส่งรายงานความก้าวหน้าอย่างน้อย 1 ครั้ง/ ปี หรือส่งรายงานฉบับสมบูรณ์หากดำเนินโครงการเสร็จสิ้นก่อน 1 ปี

เอกสารรับรอง : 1.แบบเสนอโครงการวิจัย
2.โครงร่างวิจัยฉบับสมบูรณ์
3.ตารางบันทึกข้อมูล
4.เอกสารชี้แจงข้อมูล
5.หนังสือแสดงความยินยอมเข้าร่วมโครงการวิจัย
6.แบบสอบถาม

วันที่รับรอง : 25 พฤศจิกายน 2559
วันหมดอายุ : 24 พฤศจิกายน 2560

ลงนาม...
(แพทย์หญิงอรวรรณ ไชยมหาพฤกษ์)
ประธานคณะกรรมการจริยธรรมการวิจัยในมนุษย์

มหาวิทยาลัยขอนแก่น
หนังสือฉบับนี้ให้ไว้เพื่อแสดงว่า

โครงการวิจัยเรื่อง: โมเดลเชิงสาเหตุคุณภาพชีวิตเด็กไทยโรคมะเร็ง
A Causal Model of Health – Related Quality of Life in Thai Children with Cancer

ผู้วิจัย: นางปราณี คำจันทร์
คณะพยาบาลศาสตร์ มหาวิทยาลัยสงขลานครินทร์

สำหรับเอกสาร:

1. แบบเสนอเพื่อขอรับการพิจารณาด้านจริยธรรมของการวิจัยในมนุษย์ เวอร์ชั่น 1.1 ฉบับวันที่ 20 พฤษภาคม พ.ศ. 2559
2. โครงการวิจัยฉบับสมบูรณ์ เวอร์ชั่น 1.1 ฉบับวันที่ 20 พฤษภาคม พ.ศ. 2559
3. แบบคำชี้แจงอาสาสมัคร (สำหรับผู้ปกครอง) เวอร์ชั่น 1.1 ฉบับวันที่ 20 พฤษภาคม พ.ศ. 2559
4. แบบคำชี้แจงอาสาสมัคร (สำหรับเด็กอายุ 13ปีขึ้นไป-18ปี) เวอร์ชั่น 1.1 ฉบับวันที่ 20 พฤษภาคม พ.ศ. 2559
5. แบบยินยอมอาสาสมัคร (สำหรับผู้ปกครองเด็กอายุ 10-13 ปี) เวอร์ชั่น 1.1 ฉบับวันที่ 20 พฤษภาคม พ.ศ. 2559
6. แบบยินยอมอาสาสมัคร (สำหรับเด็กอายุ 13ปีขึ้นไป-18ปี และผู้ปกครอง) เวอร์ชั่น 1.1 ฉบับวันที่ 20 พฤษภาคม พ.ศ. 2559
7. แบบยินยอมอาสาสมัคร (สำหรับเด็กอายุ 10- 13 ปี) เวอร์ชั่น 1.1 ฉบับวันที่ 20 พฤษภาคม พ.ศ. 2559
8. แบบบันทึกข้อมูล เวอร์ชั่น 1.0 ฉบับวันที่ 10 มีนาคม พ.ศ. 2559
9. ประวัติผู้วิจัย

ได้ผ่านการรับรองจากคณะกรรมการจริยธรรมการวิจัยในมนุษย์มหาวิทยาลัยขอนแก่น โดยยึดหลักเกณฑ์ตามคำประกาศเฮลซิงกิ (Declaration of Helsinki) และแนวทางการปฏิบัติการวิจัยทางคลินิกที่ดี (ICH GCP) โดยขอให้รายงานความก้าวหน้าของโครงการวิจัยทุก 12 เดือน

ให้ไว้ ณ วันที่ 1 มิถุนายน พ.ศ. 2559

(ศาสตราจารย์นายแพทย์พลศักดิ์ จีระวิพูลวรรณ)
ประธานคณะกรรมการจริยธรรมการวิจัยในมนุษย์ประจำสาขาวิชาคณะที่ 1 มหาวิทยาลัยขอนแก่น

ลำดับที่ : 4.2.03: 17/2559
เลขที่ : HE591152

วันหมดอายุ: 3 พฤษภาคม พ.ศ. 2560

สำนักงานคณะกรรมการจริยธรรมการวิจัยในมนุษย์ มหาวิทยาลัยขอนแก่น
อาคารเวชวิชชาการ ชั้น 3 ห้อง 5317 คณะแพทยศาสตร์ มหาวิทยาลัยขอนแก่น 40002
โทร. 089-7141913, 67133, 67134

Institutional Review Board Number; IRB00001189
Federal Wide Assurance; FWA00003418

Khon Kaen Hospital
Institute Review Board in Human Research

F/17-03/02.0

เอกสารรับรองจริยธรรมการวิจัยในมนุษย์ โรงพยาบาลขอนแก่น

ชื่อคณะกรรมการ: คณะกรรมการจริยธรรมการวิจัยในมนุษย์ โรงพยาบาลขอนแก่น
ที่อยู่คณะกรรมการ: 54, 56 ถนนศรีจันทร์ ตำบลในเมือง อำเภอเมือง จังหวัดขอนแก่น 40000

ชื่อผู้วิจัยหลัก: นางปราณี คำจันทร์

หน่วยงาน : คณะพยาบาลศาสตร์ มหาวิทยาลัยสงขลานครินทร์

ชื่อเรื่อง: โมเดลเชิงสาเหตุคุณภาพชีวิตเด็กไทยโรคมะเร็ง
"A Causal Model of Health-Related Quality of Life in Thai Children with Cancer"

รหัสโครงการวิจัย: KE60010

สถานที่ทำวิจัย: หอผู้ป่วยเคมีบำบัดเด็ก กลุ่มงานภารกิจด้านการพยาบาล โรงพยาบาลขอนแก่น

รายการเอกสาร	**การอ้างอิง**
แบบเสนอเพื่อขอรับการพิจารณาจริยธรรมการวิจัยในมนุษย์	เวอร์ชั่น 1.0 วันที่ 9 กันยายน 2559
โครงร่างการวิจัยฉบับภาษาอังกฤษ	เวอร์ชั่น 1.0 วันที่ 9 กันยายน 2559
แบบบันทึกข้อมูล	เวอร์ชั่น 1.0 วันที่ 9 กันยายน 2559
แบบคำชี้แจงอาสาสมัคร	เวอร์ชั่น 1.0 วันที่ 9 กันยายน 2559
แบบยินยอมอาสาสมัคร	เวอร์ชั่น 1.0 วันที่ 9 กันยายน 2559
ประวัติความรู้ความชำนาญของนักวิจัย	ฉบับวันที่ 9 กันยายน 2559

การพิจารณา: [√] แบบเร็ว [ ] แบบปกติ

เสนอรายงานความก้าวหน้า: ทุกๆ ☐ 3 เดือน ☐ 6 เดือน ☑ 12 เดือน

วันที่เริ่มอนุมัติ: 11 พฤศจิกายน 2559 **วันหมดอายุ:** 10 พฤศจิกายน 2560

ได้ผ่านการพิจารณาด้านจริยธรรมการวิจัยในมนุษย์จากคณะกรรมการจริยธรรมวิจัยในมนุษย์ โรงพยาบาลขอนแก่น โดยอ้างปฏิญญาเฮลซิงกิแล้ว และเห็นว่าผู้วิจัยต้องดำเนินการตามโครงการวิจัยที่ได้กำหนดไว้ หากจะมีการปรับเปลี่ยนหรือแก้ไขใด ๆ ควรผ่านความเห็นชอบหรือแจ้งต่อคณะกรรมการจริยธรรมวิจัยในมนุษย์ โรงพยาบาลขอนแก่นก่อน

(นางอุษณีย์ สังคมกำแหง)
นายแพทย์เชี่ยวชาญ
ประธานคณะกรรมการจริยธรรมการวิจัยในมนุษย์ โรงพยาบาลขอนแก่น

AF/03-05/01.1

คณะแพทยศาสตร์ มหาวิทยาลัยสงขลานครินทร์

หนังสือฉบับนี้ให้ไว้เพื่อแสดงว่า

รหัสโครงการ: REC: 58-339-19-9
ชื่อโครงการ (ภาษาไทย): โมเดลเชิงสาเหตุคุณภาพชีวิตเด็กไทยโรคมะเร็ง
A Causal Model of Health-Related Quality of Life in Children with Cancer
ผู้วิจัยหลัก: นางปราณี คำจันทร์ **สังกัด:** สาขาการพยาบาล (นานาชาติ) คณะพยาบาลศาสตร์
มหาวิทยาลัยสงขลานครินทร์

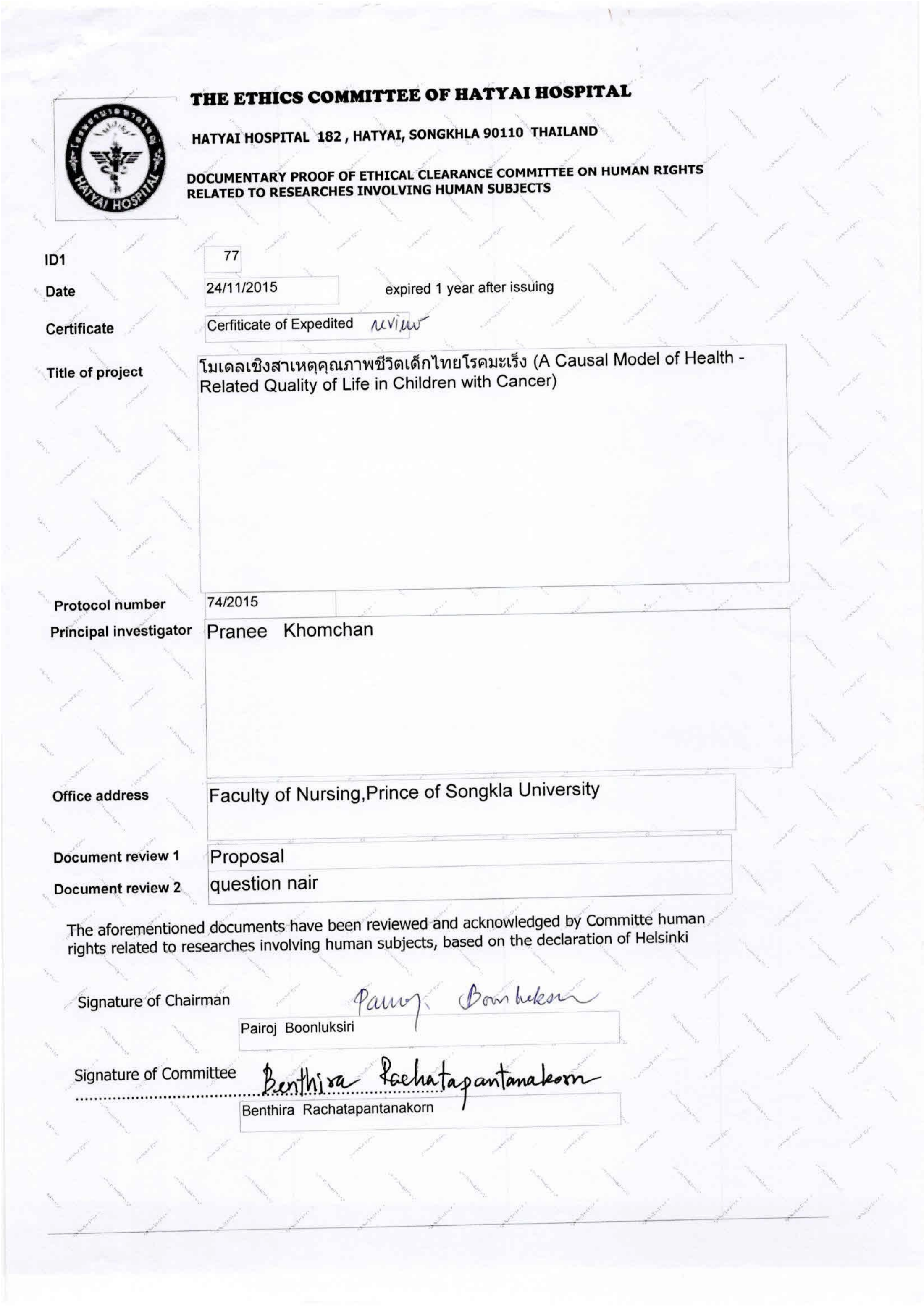
เอกสารที่รับรอง:
1. แบบเสนอเพื่อขอรับการพิจารณาจริยธรรมการวิจัยในมนุษย์ เวอร์ชั่น 2.0 ฉบับวันที่ 23 กุมภาพันธ์ 2559
2. โครงการวิจัยฉบับสมบูรณ์ เวอร์ชั่น 2.0 ฉบับวันที่ 23 กุมภาพันธ์ 2559
3. เอกสารชี้แจงอาสาสมัคร เวอร์ชั่น 2.0 ฉบับวันที่ 23 กุมภาพันธ์ 2559
4. เอกสารแสดงเจตนายินยอมของอาสาสมัคร เวอร์ชั่น 2.0 ฉบับวันที่ 23 กุมภาพันธ์ 2559
5. แบบบันทึกข้อมูล
6. ประวัติผู้วิจัย

ได้ผ่านการรับรองจากคณะกรรมการจริยธรรมการวิจัยในมนุษย์คณะแพทยศาสตร์ มหาวิทยาลัยสงขลานครินทร์ (ในการประชุมคณะกรรมการ วันที่ 4 ธันวาคม 2558 วาระที่ 4.2.02) โดยยึดหลักเกณฑ์ตามประกาศ เฮลซิงกิ (Declaration of Helsinki) และแนวทางการปฏิบัติการวิจัยทางคลินิกที่ดี (The International Conference on Harmonization in Good Clinical Practice หรือ ICH-GCP) โดยขอให้รายงานความก้าวหน้าของโครงการวิจัยทุก 12 เดือน

ลงชื่อ...
(รองศาสตราจารย์นายแพทย์บุญสิน ตั้งตระกูลวนิช)
ประธานคณะกรรมการพิจารณาจริยธรรมการวิจัยในมนุษย์

วันที่รับรอง: 8 มีนาคม 2559
วันหมดอายุ: 7 มีนาคม 2560

สำนักงานจริยธรรมการวิจัยในมนุษย์
คณะแพทยศาสตร์ มหาวิทยาลัยสงขลานครินทร์
15 ถ.กาญจนวานิช อ.หาดใหญ่ จ.สงขลา
90110 โทรศัพท์ 0-7445-1149, 0-7445-1157
โทรสาร 0-7421-2900



THE ETHICS COMMITTEE OF HATYAI HOSPITAL

HATYAI HOSPITAL 182 , HATYAI, SONGKHLA 90110 THAILAND

DOCUMENTARY PROOF OF ETHICAL CLEARANCE COMMITTEE ON HUMAN RIGHTS RELATED TO RESEARCHES INVOLVING HUMAN SUBJECTS

ID1 77

Date 24/11/2015 expired 1 year after issuing

Certificate Cerfiticate of Expedited review

Title of project โมเดลเชิงสาเหตุคุณภาพชีวิตเด็กไทยโรคมะเร็ง (A Causal Model of Health - Related Quality of Life in Children with Cancer)

Protocol number 74/2015

Principal investigator Pranee Khomchan

Office address Faculty of Nursing,Prince of Songkla University

Document review 1 Proposal

Document review 2 question nair

The aforementioned documents have been reviewed and acknowledged by Committe human rights related to researches involving human subjects, based on the declaration of Helsinki

Signature of Chairman Pairoj. Boonluksiri

Pairoj Boonluksiri

Signature of Committee Benthira Rachatapantanakorn

Benthira Rachatapantanakorn

เอกสารรับรองจริยธรรมทางการวิจัย

เอกสารฉบับนี้ เพื่อแสดงว่า โครงการวิจัย
เรื่อง โมเดลเชิงสาเหตุคุณภาพชีวิตเด็กไทยโรคมะเร็ง

ผู้วิจัย คือ นางปราณี คำจันทร์
หน่วยงาน คณะพยาบาลศาสตร์ มหาวิทยาลัยสงขลานครินทร์
ได้ผ่านการพิจารณาจากคณะกรรมการจริยธรรมการวิจัยในมนุษย์ โรงพยาบาลสุราษฎร์ธานีแล้ว และเห็นว่าผู้วิจัยต้องดำเนินการตามโครงการวิจัยที่ได้กำหนดไว้แล้ว หากมีการปรับเปลี่ยนหรือแก้ไขใด ๆ ควรผ่านความเห็นชอบหรือแจ้งต่อคณะกรรมการจริยธรรมทางการวิจัยอีกครั้ง

ออกให้ ณ วันที่ ๓๐ เดือน มกราคม พ.ศ. ๒๕๖๐

ลงชื่อ
(นายดามพ์ มุกด์มณี)
นายแพทย์ ระดับชำนาญการ
ประธานคณะกรรมการจริยธรรมการวิจัยในมนุษย์

ลำดับที่ ๒/๒๕๖๐

คณะกรรมการจริยธรรมการวิจัยในมนุษย์ โรงพยาบาลสุราษฎร์ธานี ถ.ศรีวิชัย อ.เมือง จ.สุราษฎร์ธานี ๘๔๐๐๐
โทร. (๐๗๗) ๙๑๕๖๐๐ ต่อ ๑๔๐๐, โทรสาร (๐๗๗) ๙๑๕๖๔๒

Appendix E

Assumptions of Path Analysis Test Results

The assumptions of univariate and multivariate normal distribution, univariate outliers, linearity, homoscedasticity, multicollinearity and autocorrelation were presented as follows.

1. The assumptions of univariate normal distribution

The univariate normality was tested by using skewness and kurtosis. These parameters could be converted to a z-score by divided with standard error. The acceptable value for normal distribution of z-score was between ± 3.29. Two variables including family functioning and state anxiety had z-score of skewness -3.74 and 3.76, respectively after univariate normal distribution testing with *N* =205. Therefore, the results showed not normality. The data showed normal distribution after omitting 5 outliers.

Table 8

Skewness value and kurtosis value N = 205 *and N* =199

Variable	Skewness Value *(N =205)*	Skewness Value *(N =199)*	Kurtosis Value *(N =205)*	Kurtosis Value *(N =199)*
1. Family functioning	-3.74	-2.44	2.21	0.81
2. Coping	0.15	0.15	-0.72	-0.70
3. Symptom distress	1.16	1.25	-1.72	-1.66
4. Self-care behavior	-2.23	-2.25	-1.37	-1.34
5. Trait-anxiety	2.85	2.24	-0.89	-1.93
6. State-anxiety	3.76	2.08	2.45	1.25
7. Functional status	-3.03	-2.92	-0.44	-0.51
8. Health-related quality of life	-2.75	-2.87	-1.34	-1.34

2. The assumptions of multivariate normal distribution

The plotting of Mahalanobis distance against chi-square presented in a straight line. As a result, the data showed multivariate normal distribution both *N* = 205 and *N* = 199.

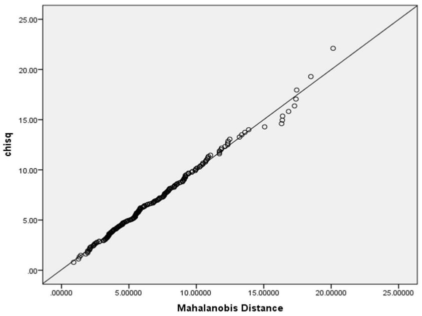


Figure 6. The plotting of Mahalanobis distance against chi-square *N* = 205

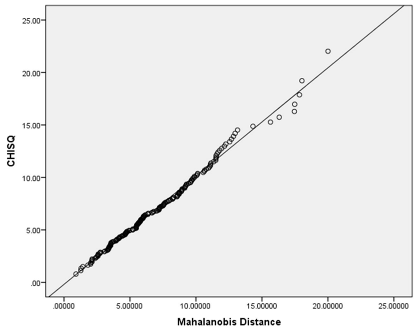


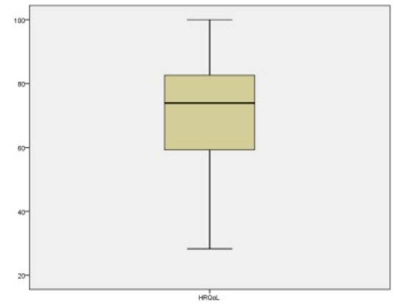
Figure 7. The plotting of Mahalanobis distance against chi-square *N* = 199

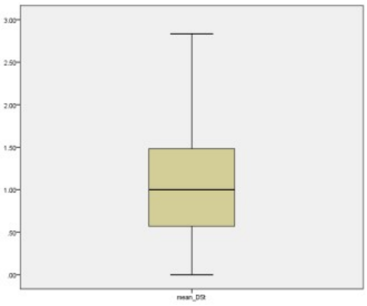
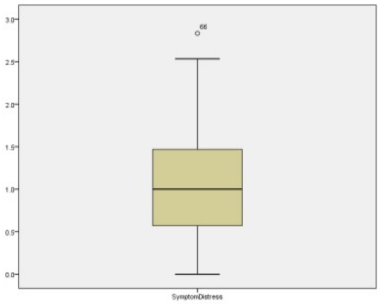
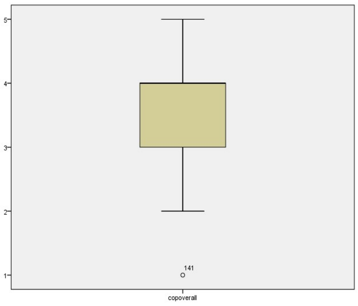
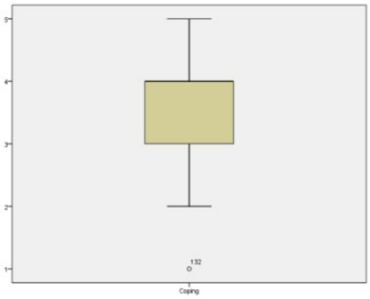
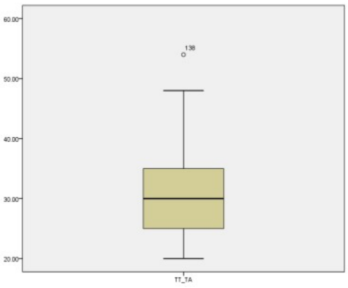
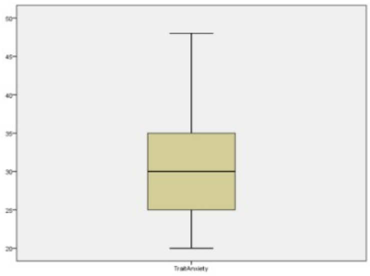
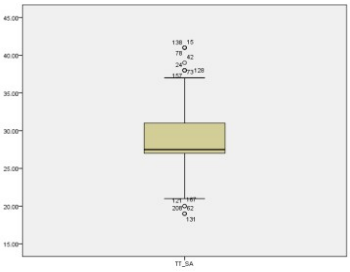
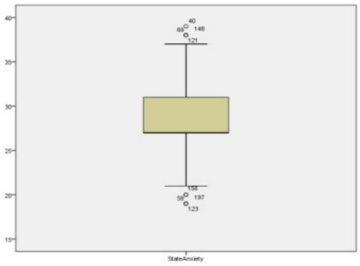
2. Univariate outlier test results

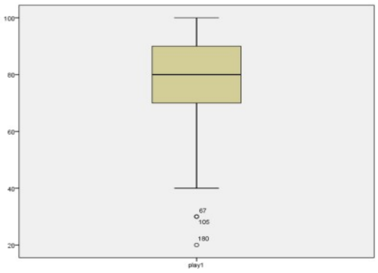
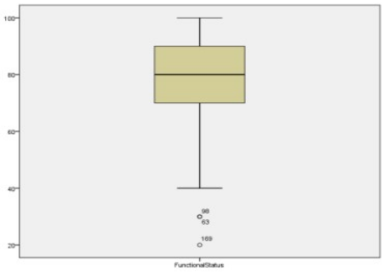
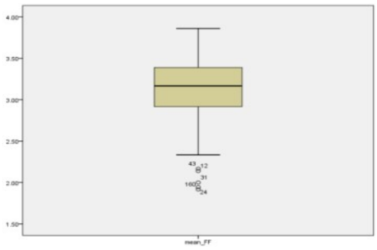
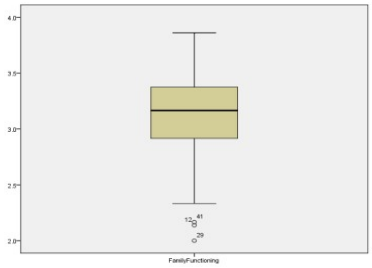
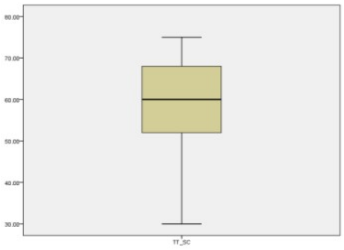
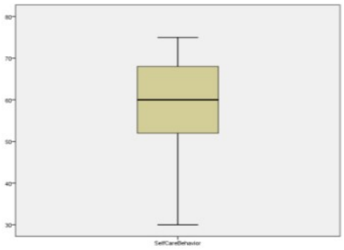
Univariate outlier can identify by using boxplot as present as Table 9. Some outliers presented in some variables such as symptom distress, coping, trait anxiety, state-anxiety, functional status, family functioning.

Table 9

Boxplot test results N = 205 and N =199.

Variables/ Boxplot (*N* = 205)	Variables/ Boxplot (*N* = 199)
1. Health-related quality of life	1. Health-related quality of life
	

Variables/ Boxplot ($N = 205$)	Variables/ Boxplot ($N = 199$)
2. Symptom distress 	2. Symptom distress 
3. Coping 	3. Coping 
4. Trait-anxiety 	4. Trait-anxiety 
5. State-anxiety 	5. State-anxiety 

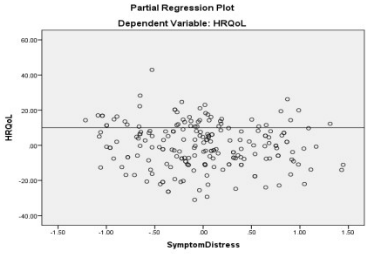
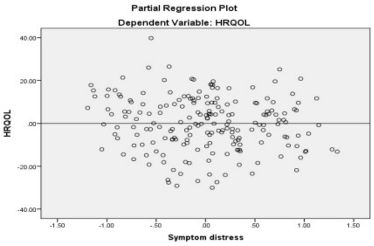
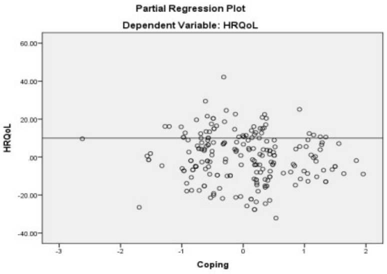
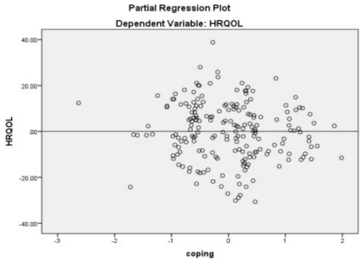
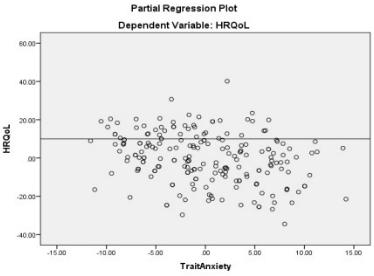
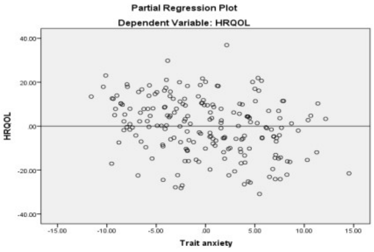
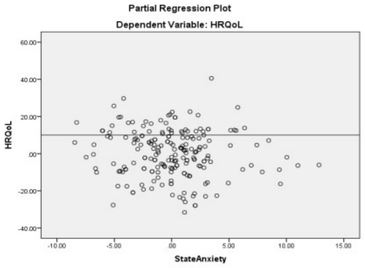
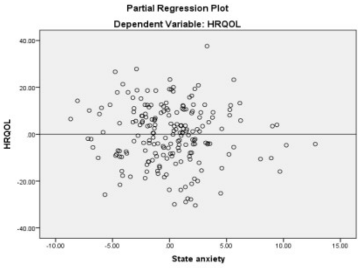
Variables/ Boxplot ($N = 205$)	Variables/ Boxplot ($N = 199$)
6. Functional status	6. Functional status
	
7. Family functioning	7. Family functioning
	
8. Self-care behavior	8. Self-care behavior
	

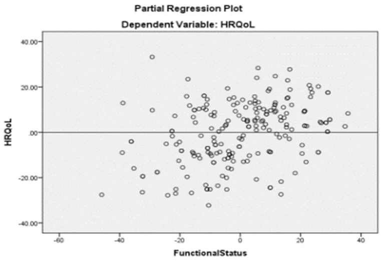
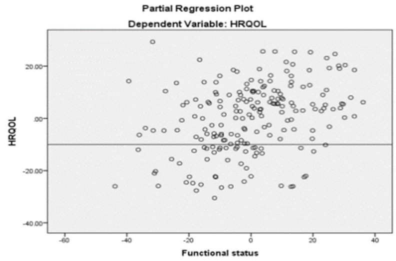
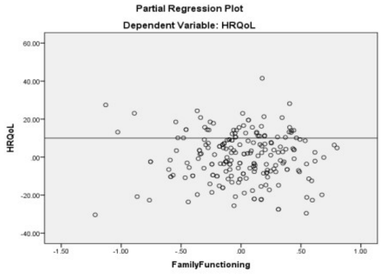
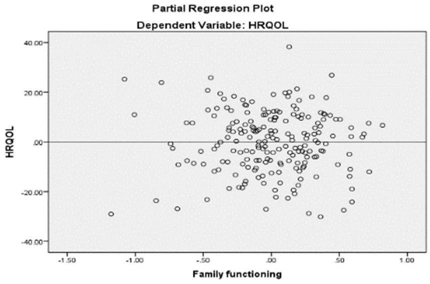
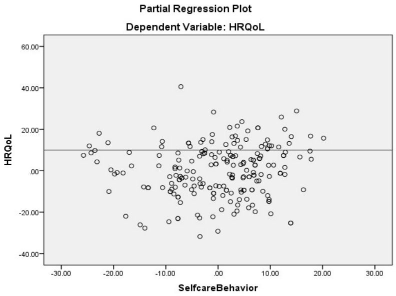
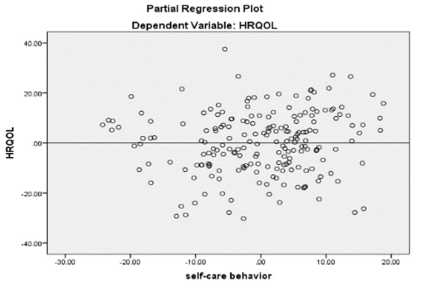
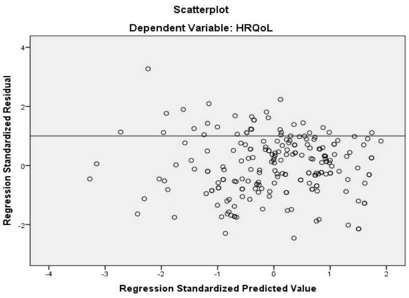
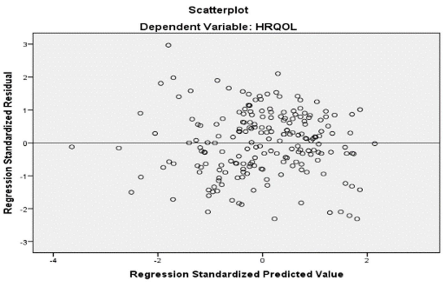
3. Bivariate linearity test results and multivariate linearity test results

The results showed that the plot presented along the straight line. Therefore, the relations among the variables were linear.

Table 10

Linearity test results N = 205 *and N* =199

Variables/ Scatter plot (*N* = 205)	Variables/ Scatter plot (*N* = 199)
1. Symptom distress and HRQOL  	1. Symptom distress and HRQOL 
2. Coping and HRQOL  	2. Coping and HRQOL 
3. Trait-anxiety and HRQOL  	3. Trait-anxiety and HRQOL 
4. State-anxiety and HRQOL  	4. State-anxiety and HRQOL 

Variables/ Scatter plot (*N* = 205)	Variables/ Scatter plot (*N* = 199)
5. Functional status and HRQOL  	5. Functional status and HRQOL 
6. Family functioning and HRQOL  	6. Family functioning and HRQOL 
7. Self-care behavior and HRQOL  	7. Self-care behavior and HRQOL 
8. Multivariate linearity test  	8. Multivariate linearity test 

4. Homoscedasticity test results

Homoscedasticity was investigated by testing the constant of variance. The scatterplot of standardized predicted value plotted against with standardized residual value were used in this study. The results showed that the plot presented the same distance. The majority of errors ranged over -2 and below 2, due to the narrow distribution. Therefore, it could be concluded that the data had constant variance.

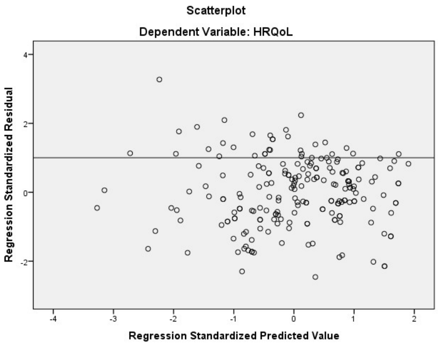


Figure 8. Homoscedasticity test results
$N = 205$

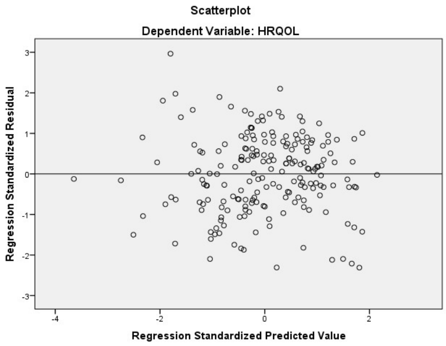


Figure 9. Homoscedasticity test results
$N = 199$

5. Multicollinearity test results

5.1 The tolerance value and the variance inflation factor value test result

Tolerance value close to 0 (Munro, 2005b), and Variance Inflation factor (VIF) more than 10 were used to detect multicollinearity (Hair et al., 2010; Munro, 2005b). In this study, Tolerance value > 0.6 and VIF less than 2 and the highest VIF was 1.46. Therefore, the data was no multicollinearity.

Table 11

The tolerance value and the variance inflation factor value test result N = 205 *and N* =199

variables	Collinearity Statistics			
	Tolerance (*N*=205)	Tolerance (*N*=199)	VIF (*N*=205)	VIF (*N*=199)
Symptom distress	.816	.822	1.226	1.216
coping	.899	.872	1.112	1.146
Trait-anxiety	.653	.685	1.531	1.461
State-anxiety	.693	.701	1.443	1.427
Functional status	.871	.856	1.147	1.168
Family functioning	.934	.928	1.070	1.077
Self-care behavior	.814	.801	1.229	1.249

5.2 The correlation among variables

A Pearson correlation coefficient of more than .85 used to identify multicollinearity (Munro, 2005b). The correlation coefficients among predicted variables ranged from .003 to .511 with *N* = 205, and ranged from .001 to -.463 with *N* = 199. Therefore, the results indicated absence of multicollinearity.

Table 12

A correlation test results N = 205

Variables	C	TA	SA	FF	SCB	SDS	FS	HRQOL
C	1							
TA	-.101	1						
SA	-.228**	.511**	1					
FF	.133	-.132	-.152*	1				
SCB	-.070	-.282**	-.171**	.003	1			
SDS	-.179*	.199**	.088	-.201**	-.248**	1		
FS	.175*	-.227**	-.256**	.106	-.091	-.183**	1	
HRQOL	.028	-.471**	-.336**	.088	.167*	-.191**	.421**	1

Note. *p<.05 **p<.01 ***p<.001

C = coping, TA = Trait anxiety, SA= State anxiety, FF = Family functioning, S = Symptom, FS = Functional status, HRQOL = Health-related quality of life

Table 13

A correlation test results *N* =199

Variables	C	TA	SA	FF	SCB	SDS	FS	HRQOL
C	1							
TA	-.107	1						
SA	-.267**	.463**	1					
FF	.185**	-.105	-.135	1				
SCB	-.064	-.294**	-.165*	.001	1			
SDS	-.190**	.176*	.081	-.199**	-.248**	1		
FS	.195**	-.219**	-.297**	.112	-.092	-.179*	1	
HRQOL	.050	-.467**	-.334**	.057	.133	-.181*	.432**	1

Note. **p*<.05 ***p*<.01 ****p*<.001

C = coping, TA = Trait anxiety, SA= State anxiety, FF = Family functioning, S = Symptom, FS = Functional status, HRQOL = Health-related quality of life

6. Autocorrelation

Autocorrelation was used to test the errors that were not correlated with the independent variables by using the Durbin-Watson statistic. The acceptable value is 1.5 - 2.5 (Munro, 2005b). The value of Durbin-Watson in this study was 2.03 *(N* = 205) and 1.84 *(N* = 199). It indicated that no autocorrelation

Table 14

The Durbin-Watson results *N* =199 and *N*=205

The Number of samples	Durbin-Watson
N = 205	1.840
N = 199	2.031

Appendix F

List of Experts

Six experts and one native speaker involved in back translation process in this study as follows.

1. Assoc. Prof. Dr. Kittikorn Nilmanat
   Division of Adult and Elderly Nursing, Faculty of Nursing, Prince of Songkla University
2. Assoc. Prof. Dr. Piyanuch Jittanoon
   Division of Community Nurse Practitioner, Faculty of Nursing, Prince of Songkla University
3. Dr. Jintana Damkliang
   Division of Adult and Elderly Nursing, Faculty of Nursing, Prince of Songkla University
4. Assoc. Prof. Dr Karnsunaphat Balthip
   Division of Community Nurse Practitioner, Faculty of Nursing, Prince of Songkla University
5. Asst. Prof. Dr. Aporntip Buapeth
   Division of Community Nurse Practitioner, Faculty of Nursing, Prince of Songkla University
6. Dr. Pissamai Wattanasit
   Division of Child and Adolescent Nursing, Faculty of Nursing, Prince of Songkla University
7. Dr. Alan Geater
   Epidemiology Unit, Faculty of Medicine, Prince of Songkla University.

VITAE

Name Mrs. Pranee Khamchan

Student ID 5510430004

Educational Attainment

Degree	Name of Institue	Year of Graduation
Bachelor in Nursing Science	Prince of Songkla University	1997
Master in Nursing Science (Adult Nursing)	Prince of Songkla University	2005

Scholarship Awards during Enrollment

1. Faculty of Nursing, Prince of Songkla University.
2. Thesis Grant from the Graduate School, Prince of Songkla University.

Work-Position and Address

Nursing Instructor, Department of Child and Adolescent, Faculty of Nursing, Prince of Songkla University, Hat Yai, Songkhla, 90110, Thailand

Email: pranee.ko@psu.ac.th

List of Publication and Proceeding

Sumalee Wungthanakorn, Chutima Phatidumlongkul, Pranee khomchan. (2008). Factors affecting medication taking behaviors in hypertensive patients. *Songklanagarind Medical Journal, 26*(6): 539-547.

Pranee Khomchan, Kanittha Naka, Sang-arun Isaramalai. (2009). Effects of self-care promotion program on recovery of post-thoracotomy patients. *Songklanagarind Journal of Nursing. 29*(2): 14-29.

Utaiwan Buddharat, Kaitsara Sen-Ngam, Pranee Khamchan. (2015). Application eastern wisdoms in nursing care for hospitalized patients in the south of Thailand. *Songklanagarind Journal of Nursing. 32*(2): 1-20.