# A CAUSAL MODEL OF HEALTH-RELATED QUALITY OF LIFE IN THAI CHILDREN WITH CANCER

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## Abstract

**The path analytic study aims to test a causal model of health-related quality of life (HRQOL) 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 questionnaires developed in English. Testing of the reliability of instruments showed that all instruments had an acceptable value of reliability between 0.82 and 0.93. Purposive sampling was used to recruit 199 children with cancer and 199 caregivers from eight tertiary hospitals in three parts of Thailand. Data were analyzed using path analysis. The modified model revealed that five 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 significant direct and indirect negative effects on HRQOL via state anxiety and functional status. Functional status had a significant positive direct effect on HRQOL. Coping, symptom distress, and state anxiety had no significant direct effects on HRQOL. However, coping had an indirect effect on HRQOL through state anxiety and functional status. Both symptom distress and state anxiety had negative indirect effects on HRQOL via functional status. The findings provide useful information for nurses to develop effective interventions to enhance HRQOL in Thai children with cancer.**

**Keywords: Causal model, health-related quality of life, Thai children, cancer**

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# Introduction

Childhood cancer is recognized as one of the major causes of death in children. The effects of 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). Nevertheless, the affected children still suffer from the severity of the symptoms associated with their disease and the treatment they receive (Miller *et al.*, 2011; Li *et al.*, 2013). Ruland *et al.* (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).

In addition, health, illness, and treatment are aspects of quality of life (Ferrans *et al.*, 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 *et al.*, 2008; Varricchio and Ferrans, 2010) and same as this study. Several studies have reported that children with cancer have a low level of health-related quality of life (HRQOL) when comparing with general children. The overall HRQOL has been reported poorer than that of general children among both newly-diagnosed cancer patients (Landolt *et al.*, 2006) and those undergoing therapy (Shankar *et al.*, 2005; Landolt *et al.*, 2006; Wu *et al.*, 2007). Furthermore, caregivers perceive the quality of life of children with cancer-both newly-diagnosed (Eiser *et al.*, 2005) and surviving with cancer (Eilertsen *et al.*, 2012; Speechley *et al.*, 2006) to be lower than that of the general population. In Thailand, the overall quality of life (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 *et al.*, 2008). Similarly, in the physical domain that is related to illness and treatment, it has been reported at a moderate level (Punthmatharith *et al.*, 2008; Jitnumsub, 2009).

A low or poor QOL in children with cancer was probably due to some contributing factors. Several studies have examined the factors, both non-modifiable and modifiable, that contribute to QOL in children with cancer. Non-modifiable factors associated with a low QOL in children with cancer are older age and gender (Zebrack and Chester, 2002; Landolt *et al.*, 2006; Wu *et al.*, 2007), low family income and a low level of caregiver education (Punthmatharith *et al.*, 2013), personality (De Clercq *et al.*, 2004), type of cancer (Zebrack and Chester, 2002; Chou and Hunter, 2009; Hinds *et al.*, 2009; Klassen *et al.*, 2011), treatment (Landolt *et al.*, 2006; Stam *et al.*, 2006; Maurice-Stam *et al.*, 2007; Reimers *et al.*, 2009; Klassen *et al.*, 2011), complications (Landolt *et al.*, 2006), prognosis (Zebrack and Chester, 2002; Maurice-Stam *et al.*, 2007; Maurice-Stam *et al.*, 2009), sickness duration (Punthmatharith *et al.*, 2013), and treatment duration (Maurice-Stam *et al.*, 2009).

Furthermore, modifiable factors such as symptoms, functional status, coping, anxiety, family functioning, and self-care behavior are associated with either the overall QOL or each domain of QOL. 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 *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 *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 *et al*., 2010). Furthermore, the QOL in Thai children with cancer had been shown to be influenced by self-care behavior (Punthmatharith *et al*., 2013).

It is evident, therefore, that several factors can affect HRQOL. Based on the revised Wilson and Clary conceptual model (WCM) of HRQOL 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 effects. Although previous studies suggest that the QOL 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 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 Thai context. However, it covered only the causal relationship among spiritual well-being, depression, and HRQOL (Suwannaosod, 2017).

The purposes of this study were to develop and test a hypothesized causal model of HRQOL in children with cancer. The hypothesized model was developed based on the revised WCM of HRQOL (Ferrans *et al*., 2005) and the previously mentioned empirical evidences regarding the factors that were associated with HRQOL or QOL in children with cancer. Six variables-family functioning, symptom distress, trait anxiety, state anxiety, functional status, and HRQOL were supported by the revised WCM of HRQOL (Ferrans *et al*., 2005) and the previously mentioned literature review. Two other variables-coping and self-care behavior-were chosen based on the evidences from previously mentioned studies. These factors were selected based on a moderate-to-high level statistical support either in correlation coefficients or prediction coefficients with QOL or HRQOL. In addition, these factors are significant predictors of HRQOL in children with cancer and appropriate to the Thai context. Therefore, the factors that were tested in the hypothesized model comprised 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 was shown in Figure 1. 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 resulting in further providing appropriate nursing care and developing effective interventions in order to improve the QOL in children with cancer in Thailand and beyond.

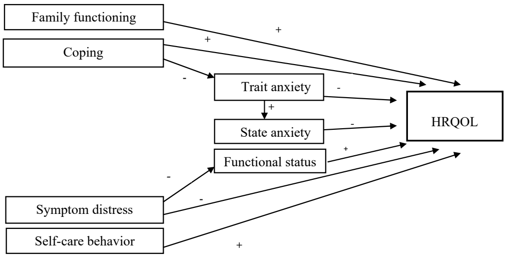

**Figure 1. The hypothesized model of health-related quality of life in children with cancer**

# Materials and Methods

## Design

A path analytic research design was used 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 in children with cancer.

## Sample and Setting

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 and Bernstein, 1994). This study had 7 independent variables; therefore, the required sample of this study was 210 children with cancer and 210 caregivers. The sample of this study composed of children with cancer aged 9-18 years old being hospitalized in Thailand and their caregivers or those being followed up at outpatient units in tertiary hospitals in Thailand and their caregivers. Inclusion criteria of children with cancer consisted of 1) had a good level of consciousness, 2) could communicate in Thai language, 3) had no serious conditions such as on oxygen or a ventilator, diagnosed with any types of cancer at least one month but no more than two years and undergoing therapy (Landolt *et al.*, 2006; Vlachioti *et al.*, 2016), 4) 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 5) had symptom experience. The inclusion criteria of caregivers comprised of 1) were the major caregivers who took responsibility of taking care of their child at least 1 year, and 2) could communicate in Thai language.

A purposive sampling was used to selected eight tertiary hospitals providing treatment for children with cancer in three regions (e.g., Northern, Northeastern, and Southern) of Thailand. Unfortunately, the central region was not included because of inaccessibility. The selected hospitals composed of three hospitals from the Northern region, two hospitals from the Northeastern region, and three hospitals from the Southern region. The number of each group of children and caregivers from Northern, Northeast and Southern hospitals was 60, 50, and 100, respectively, total 210. However, 11 children and their caregivers were excluded because of outliers (n = 6) and no symptom experience (n = 5).

## Ethical Considerations

Prior to data collection, a request form seeking approval to conduct the study and informed consent were submitted to the Ethical Committee, Faculty of Nursing, Prince of Songkla University (IRB No.0521.1.05/3009), and permission was also obtained from the ethical committees of the hospitals chosen for the study (e.g., Maharaj Nakorn Chiang Mai Hospital, IRB No. 389/2016; Chiangrai Prachanukroh Hospital, IRB No. 0032.102/3499; Buddhachinaraj Hospital, IRB No. 094/59; Srinagarind Hospital, IRB No. HE591152; Khon Kaen Hospital, IRB No. HE 60010; Songklanagarind Hospital, IRB No. 58-339-19-19; Hatyai Hospital, IRB No. 74/2015; and Suratthani Hospital, IRB No. 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.

## Instruments

1. Demographic data questionnaire (DDQ) was developed by the researchers based on literature review. It comprised of eight items including age, gender, child's level of education, type of cancer, illness duration, treatment and procedure parent's level of education, and family income. The caregivers were asked to answer this questionnaire.

2. The Thai version of Pediatric Quality of Life Inventory Version 4.0 (Thai version of PedsQL 4.0), the versions for children age 8-12 years old and 13-18 years old (Varni, et al. 1999) were used to measure HRQOL in children with cancer. It already had been

translated from English into Thai (Varni, 2014). The English version was developed to measure the main health dimensions as defined by WHO (Varni *et al*., 2001). It was used to measure HRQOL of children during the past 1 month. It consisted of 23 items and 4 dimensions of physical functioning (8 items), emotional functioning (5 items), social functioning (5 items), and school functioning (5 items). It is a 5-point Likert scale ranging from 0 (never a problem) to 4 (almost always a problem). All items were stated negatively. Therefore, the items were reverse scored and transformed to a 0-100 scale. The higher scores indicated 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. In this study, no missing data were found. The reliability of the instrument was tested with 20 children with cancer who met inclusion criteria, yielding the Cronbach's alpha coefficient of .93.

3. Chulalongkorn Family Inventory (CFI) (Trangkasombat, 2006) was developed based on the McMaster Model of Family Functioning (MMFF) (Epstein *et al*., 1983). It consisted of 36 items and is measured on a 4-point Likert scale ranging from 1 (not agree) to 4 (strongly agree) and 12 items were negative by worded that the score need to be reverse scored. The score of the instrument used was determined by the sum score of the items divided by the number of the items. The reliability of the instrument was tested with 20 caregivers having children who met inclusion criteria, yielding the Cronbach's alpha coefficient of .89.

4. The Memorial Symptom Assessment Scale for children aged 10-18 years old (MSAS 10–18) (Collins *et al*., 2000) was used to evaluate symptoms in terms of frequency, severity, and distress of children. It was modified from the MSAS for adults with cancer by Collins et al. (2000). In this study, only distress part (30 distress items) was interpreted as symptom distress and used for further analysis. It consisted of 30 items (30 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). The scores of symptom distress were computed as the sum of items divided by the number of items answered (the number of symptoms). In this study, since this instrument was developed in English, back translation was performed based on Hilton and Skrutkowski (2002). In this study, no symptom experience (n = 5) were excluded. The reliability of the instrument in this study was tested with 20 children with cancer who met inclusion criteria, yielding the Cronbach's alpha coefficient of .91.

5. The revised Thai version of the State-Trait Anxiety Inventory for Children (Thai STAIC-R) (Chaiyawat, 2000) was used to measure the levels of trait and state anxiety of children. 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. The A-State scale 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. The 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 on 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. The reliability of the instrument was tested with 20 children with cancer who met inclusion criteria, yielding the Cronbach's alpha coefficient of 0.88 for the A-State scale and 0.89 for the A-Trait scale.

6. The Play-Performance Scale for Children (PPSC) (Lansky, 1987) was developed to measure the performance status or functional status of the children with cancer aged 1-16 years, any types of cancer, inpatients or outpatients, and in active treatment and

long-term follow-up procedures. It is an 11-point continuous rating scale ranging from 0 (unresponsive) to 100 (fully active, normal) and was designed to be rated by a parent. In this study, since this instrument was developed in English, back translation was performed based on Hilton and Skrutkowski (2002). In this study, the test-retest intraclass correlation coefficient performed with 20 caregivers having children with cancer was 0.93.

7. The Thai version of Coping of Disease Inventory (Thai version of CODI) (Silapavitayatorn, 2008) was used to evaluate the coping strategies and coping ability of children. The instrument had been translated from English to Thai language by Silapavitayatorn (2008). It composed of 28 items and 6 domains which included avoidance, cognitive-palliative, emotional reaction, acceptance, wishful thinking, and distance. The first 27- item is a 5-point Likert scale ranging from 1 (never) to 5 (almost always). The final item (item 28) evaluated the overall coping ability which was measured on a 5-point Likert scale ranging from 1 (bad) 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 high score indicated high coping strategies used. The internal consistency was tested in Thai children with cancer, yielding the alpha coefficient of .88.

8. Self-Care Behavior Questionnaire (Punthmatharith *et al.*, 2008) was used to examine self-care behavior of children. This instrument was developed by Punthmatharith et al. (2008). It consists of 25 items in the Thai version. Cancer children were asked to rate their self-care behavior on a 4-point Likert scale ranging from 0 (never) to 3 (always). The higher scores indicated better self-care behavior of children. Cronbach's alpha coefficient after testing with 20 Thai children with cancer was 0.82.

## Data Collection Procedure

The data collection consisted of two phases including the preparation and data collection phases as follows:

Preparation phase: In this phase, the permission to collect data was obtained. The research assistants (RAs) were trained by the researcher regarding the instruction for recruitment of potential participants, administration of the instruments, and issues pertaining to informed consent.

Data collection phase: The data were collected from the participants who met the inclusion criteria and had agreed to participate in this study. 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. Children with cancer were requested to self-complete six questionnaires (e.g., Thai version of PedsQL 4.0, Thai version of CODI, Thai STAIC-R, Self-care Behavior, and MSAS10-18. His/her caregiver was requested to self-complete three questionnaires (e.g., DDQ, CFI, and PPSC). Additionally, the interview method was used for data collection in a few case of unavailability of reading. 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. Data collection was performed from July 2015-March 2017.

## Data Analysis

Descriptive statistics were used to describe the demographics of the participants, as well as the study variables. Pearson's product moment correlation was used to analyze the bivariate relationship among all study variables and path analysis was used to estimate the parameter of the hypothesized causal model for the variables by using AMOS 24.0 program. The assumptions such as normality, linearity, homoscedasticity, and multicollinearity were tested. The univariate normality was tested by using the z-scores of skewness and kurtosis and the results showed no greater than ±3.29 (Ghasemi and Zahediasl, 2012). The multivariate normality of variables was examined by the plotting of Mahalanobis

**Table 1. Possible score, actual score, mean (M), standard deviation (SD) of study variables (N = 199)**

| Variable | Possible score | Actual score | Mean | *SD* |
|---|---|---|---|---|
| Family functioning | 1-4 | 2.00-3.86 | 3.15 | 0.35 |
| Coping | 1-5 | 1.00-5.00 | 3.64 | 0.80 |
| Symptom distress | 0-4 | 0-2.83 | 1.04 | 0.64 |
| Self-care behavior | 0-75 | 30-75 | 59.41 | 10.55 |
| Trait anxiety | 20-60 | 20-48 | 30.23 | 6.77 |
| State anxiety | 19-57 | 19-39 | 28.38 | 3.82 |
| Functional status | 0-100 | 20-100 | 76.53 | 17.82 |
| Health-related quality of life | 0-100 | 28.26-100 | 70.79 | 15.24 |

distance against chi-square and the result presented in a straight line (Burdenski, 2000). The univariate linearity and multivariate linearity was examined by scatter plot (Tabachnick and Fidell, 2007). The results showed that the plot presented along the straight line. Homoscedasticity was checked by scatter plot of the residual plotted against the predicted values (Statistics Solutions, 2013). The results showed that the plot presented the same distance from the line. In this study, the multicollinearity was absence since no variable presented correlation coefficients more than 0.85, Tolerance value >0.6 and VIF less than 2 and the highest VIF was 1.46. Therefore, all assumptions were met.

## Results and Discussion

### Results

#### Participant Characteristics

The sample in this study comprised of 199 Thai children with cancer and 199 caregivers. The majority of children were male (64.8%) with average age equals to 11.9 years (SD = 2.23). They studied at 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 children were diagnosed with cancer for 1-12 months. Nearly two-thirds received chemotherapy (63.3%) and 21.2% underwent chemotherapy combined with surgery. For caregivers, most of them were educated at a high school or equivalent (43.2%) and followed by a primary school (39.7%). Only 16.1 % of caregivers were educated higher than a high school or equivalent. Nearly half of them had a family income of 5,000-10,000 Baht/month (53.3%).

### The Study Variables Characteristics

The family functioning scores ranged from 2 to 3.86 with a mean of 3.15 (SD = 0.35). The coping scores ranged from 1 to 5 with a mean of 3.64 (SD = 0.80). The symptom distress scores ranged from 0 to 2.83 with a mean of 1.04 (SD = 0.64). 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) (Table 1).

### The Model Testing Results

For model testing, all the fit indices showed the hypothesized model did not fit with the empirical data ($\chi 2$ = 104.11, df = 18, p = 0.00, $\chi 2$/df = 5.78, GFI = 0.89, AGFI = 0.78, NFI = 0.58, TLI = 0.39, CFI = 0.61, RMSEA = 0.16, SRMR = 0.133) (Figure 1). Then, modification of the model was performed by utilizing modification indices and theoretical evidence until it fit the data well. 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 whereas family functioning and self-care behavior were omitted because both factors did not significantly affect HRQOL and other endogenous variables. After adding paths as well as omitting 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 ($\chi2$ = 8.725, df = 4, p = 0.068, $\chi2$/df = 2.18, GFI = 0.99, AGFI = 0.93, NFI = 0.95, TLI = 0.90, CFI = 0.97, RMSEA = 0.077, SRMR = 0.047) (Figure 2).Trait anxiety had both significant negative direct and indirect effects on HRQOL. Functional status had a significant positive effect on HRQOL. Coping, symptom distress, and state anxiety had significant indirect effects on HRQOL. The results of the direct and indirect and total effects of HRQOL in Thai children with cancer are presented in Table 2

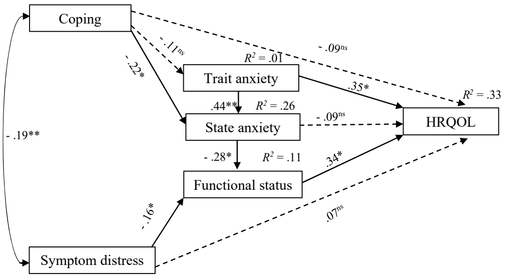

**Figure 2. The modified causal model of health-related quality of life in Thai children with cancer**
Note. * = p<0.05, * * = p<0. 01, ns = non significant, Model fit indices: $\chi2$ = 8.725, df = 4, p = 0.068, $\chi2$/df = 2.18, GFI = 0.99, AGFI = 0.93, NFI = 0.95, TLI = 0.90, CFI = 0.97, RMSEA = 0.077, SRMR = .047

## Discussion

The results revealed that the whole modified model accounted for 33% of the explained variance for HRQOL of Thai children with cancer. However, further examination of 67% of the unexplained variance for HRQOL is needed. The remainder of the variance in predicting HRQOL in children with cancer might be explained by either non-modifiable or

**Table 2 The direct effects, indirect effects, and total effects of the modified model (N = 199)**

| Dependent Variables/ Determinants | $R^2$ | Direct effects | | Indirect effects | | Total effects | |
|---|---|---|---|---|---|---|---|
| | | β | 95% CI | β | 95%CI | β | 95%CI |
| HRQOL | 0.33 | | | | | | |
| C - HRQOL | | -0.09$^{ns}$ | (-0.24, 0.01) | 0.09** | (0.04, 0.22) | -0.00$^{ns}$ | (-0.14, 0.11) |
| TA - HRQOL | | -0.35* | (-0.49, -0.23) | -0.08* | (-0.18, -0.01) | -0.43* | (-0.54, -0.32) |
| SA - HRQOL | | -0.09$^{ns}$ | (-0.22, 0.08) | -0.10* | (-0.18, -0.04) | -0.19$^{ns}$ | (-0.30, 0.12) |
| SD - HRQOL | | -0.07$^{ns}$ | (-0.20, 0.04) | -0.05* | (-.012, -0.01) | -0.12* | (-0.25, -0.01) |
| FS - HRQOL | | 0.34* | (0.21, 0.48) | - | - | 0.34* | (0.21, 0.48) |
| Trait anxiety | 0.01 | | | | | | |
| C - TA | | -0.11$^{ns}$ | (-0.29, 0.03) | - | - | -0.11$^{ns}$ | (-0.29, 0.03) |
| State anxiety | 0.26 | | | | | | |
| C - SA | | -0.22* | (-0.36, 0.07) | -0.05$^{ns}$ | (-0.15, 0.01) | -0.27** | (-0.42, -0.12) |
| TA - SA | | 0.44** | (0.32, 0.56) | - | - | 0.44** | (0.33, 0.55) |
| Functional status | 0.11 | | | | | | |
| C - FS | | - | - | 0.08** | (0.03, 0.16) | 0.08** | (0.03, 0.16) |
| SD - FS | | -0.16* | (-0.31, -0.01) | - | - | -0.16* | (-0.31, -0.01) |
| TA - FS | | - | - | -0.12** | (-0.21, -0.06) | -0.12** | (-0.21, -0.06) |
| SA - FS | | -0.28* | (-0.40, -0.12) | - | - | -0.28* | (-0.40, -0.13) |

*Note. * = p<.05, ** = p<.01, ns= non-significant*
HRQOL = Health-related quality of life, C = Coping, TA = Trait anxiety, SA = State anxiety, SD = Symptom distress, FS = Functional status; Standardized coefficients (β) and 95% confidence intervals (95% CI) are presented for direct effects (path coefficients connecting two variables in Figure 2, indirect effects (computed from all multi-arrow paths connecting two variables), and total effects (sum of direct and indirect effects). $R^2$ shows the proportion of the total variation of each dependent variable that is explained by the model. $R^2$ = 0.33 for the entire model.

modifiable variables which were not examined in this study.

Trait anxiety had a significant negative direct effect on HRQOL (β = -0.35). Besides, trait anxiety had a significant indirect negative effect on HRQOL (β = -0.08). It had a significant total effect on HRQOL (β = -0.43). The findings revealed that trait anxiety negatively affected HRQOL. This means that children who had high trait anxiety would have low HRQOL.Trait anxiety, as an individual's personality, was a latent character and was triggered by stressful stimuli. It is the tendency of a person to become state anxious (Spielberger and Reheiser, 2009). Based on the revised WCM of HRQOL, trait anxiety was one of psychological factors categorized under symptoms. This component has indirect influence on HRQOL via functional status, and general health perception (Ferrans *et al*., 2005). Besides, 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 (Sato *et al*., 2013).

Functional status had a significant positive direct effect on HRQOL (β = 0.34). 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 = 0.63, $p<0.001$). Similarly, 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 = -0.49, and -0.36, respectively; $p<0.05$) and negative emotions at 1 year after diagnosis (r = -0.30, $p<0.05$) (Landolt *et al*., 2006).

Coping had no direct effect on HRQOL. The non significant result of coping on HRQOL might be due to developmental stage of children. Hampel and Petermann (2005) identified that coping strategy that children use to cope depends on their developmental status. Cognitive coping strategies begin in middle childhood (6-12 years) and become more complex and flexible in adolescence (13-19 years) (Hampel and Petermann, 2005). As children progress to adolescence, they are able to use more complex cognitive coping strategies (Hampel and Petermann, 2005). The participants in this study had wide range of age (9-18 years old) and most of them (64.8%) were school age children or middle childhood (M of age = 11.9, SD = 2.23). This might affect coping ability and non-significant of this study. In contrast, this finding was not congruent with the previous study in American adolescents with cancer 6 months after the completion of treatment (Ruccione *et al*., 2013). Coping behaviors with humor was a positive predictor on the psychosocial HRQOL after the completion of treatment (Ruccione *et al*., 2013). This study measured coping behaviors with humor and one dimension of HRQOL but in the present study measured coping ability and overall HRQOL.

However, coping had a significant positive indirect effect on HRQOL through state anxiety and functional status (β = 0.09). The results showed that coping had a negative direct effect on state anxiety (β = -0.22) and also significant indirect effect on functional status through state anxiety (β = 0.08). 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. 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 (Simons *et al*., 2012). Similarly, in American adolescents with asthma, a high anxiety score was negatively correlated with asthma-related functioning (McCauley *et al*., 2007).

State anxiety did not have significant direct effect on HRQOL. 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, and in American children with cancer, child state anxiety was a negative predictor for HRQOL while receiving treatment for cancer (Fortier *et al.*, 2013). Possible reasons for the non-significant due to state anxiety refer to the level of an uncomfortable feeling when faced with threats (Spielberger and Reheiser, 2004) such as treatment or surgery. Factors such as knowledge (Vaezzadeh et al., 2011) can reduce state anxiety. A previous study found that giving information combination with therapeutic play before surgery can reduce state anxiety in school age children (Vaezzadeh *et al.*, 2011). In contrast, painful medical procedures experience was correlated with fear and anxiety before subsequent procedures (Pao and Bosk, 2011). Children in the present study had experience in receiving treatment with chemotherapy at least one cycle, or chemotherapy at least one cycle in combination with surgery or radiation. However, 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. They received information in management from the previous cancer treatment that probably reduced their state anxiety and most of them no experiences that triggered state anxiety. As present study, the mean score of state anxiety was nearly a half of total score (M = 28.38 from 57). Therefore, this might impact on the non significant result. Moreover, state anxiety is a non-permanent feeling depending on situations and also the trait anxiety of an individual (Spielberger and Reheiser, 2004). Similar in this study that found significant direct effect of trait anxiety on state anxiety (β = 0.44). The result supported by trait anxiety in school-age children was found to be a positive predictor of their state anxiety (Li and Lopez, 2005).

Symptom distress did not significant affect HRQOL. The possible reason was probably due to 40.7% of participants have been diagnosed with leukemia. Mostly, leukemia is treated by chemotherapy and nowadays because of advanced medical technology resulted its side effects is not so serious. Thus, children in this study would had low suffering from treatment and side effects of chemotherapy as supported by the mean score of symptom distress was 1.04 from total score of 4. Thus, symptom distress in this study did not predict HRQOL. The non significant finding of symptom distress on HRQOL was inconsistent with the previous evidence reported that some domains of QOL including physical functioning, emotional functioning, and school functioning were influenced by symptom distress (Hinds *et al.*, 2009). However, for the correlation result in the present study, the result was in line with the prior research, symptom distress correlated with HRQOL in American children and adolescents with cancer (Baggott *et al.*, 2011).

Both state anxiety and symptom distress had significant indirect effect on HRQOLvia functional status (β = -0.10 and -0.05, respectively) and they had a significant total effect on HRQOL (β = -0.19 and -0.12, respectively). This result partly support by the revised WCM of HRQOL. In the revised WCM of HRQOL, symptom had an indirect effect on HRQOL via functional status and general health perception. For the direct effect of state anxiety on functional status, based on the revised WCM of HRQOL, 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).

Besides, both symptom distress and state anxiety had a significantly direct effect on functional status (β = -0.16, and -0.28, respectively). This finding concurred with the revised WCM of HRQOL by Ferrans *et al.* (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. 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 (Dodd *et al.*, 2010). For the association between state anxiety and functional status was probably comparable with adolescents with asthma that found negatively correlated between high anxiety score and asthma-related functioning (McCauley *et al.*, 2007).

The additional finding revealed that coping significantly correlated with symptom distress (r = -0.19). 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 (β = 0.26, p<0.001) (Wenninger *et al.*, 2013). This study measured coping strategy with optimistic and psychological distress but in the present study measured coping ability and symptom distress.

## Conclusions

Based on the results of this study, the trait anxiety and functional status were significant predictors on HRQOL. Even though trait anxiety depends on the personality of the individual, nurses should assess the child's trait anxiety before providing nursing intervention. In addition, functional status measured by play performance positively influenced HRQOL. It is advisable for nurses to develop interventions using play to enhance HRQOL in Thai children with cancer. However, non-modifiable factors should be tested in the future model. 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.

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