# CHAPTER 4

# RESULTS AND DISCUSSION

This chapter, comprising four sections, presents the results and discussion of data analyses. The first section presents the characteristics of the sample. The second section presents descriptive characteristics of the study variables. In the third section, the assumptions of multivariate analysis, hypotheses, proposed model, and modified model testing are presented. Finally, in the last section, the results of the hypotheses, proposed model, and the modified model testing are explained and discussed.

## Characteristics of the Sample

A sample of 162 Thai women with breast cancer, receiving adjuvant chemotherapy, were recruited from a day care or short stay service of two university medical center hospitals in Bangkok, Thailand. Through the EQS 6.1 program, three multivariate outliers were detected and deleted; thus, the sample used in the analysis consisted of 159 participants. The characteristics of the sample are displayed in Table 4-1.

The age of the sample ranged from 27 to 74 years, with a mean of 49.82 (SD = 9.37). 65.4% of the participants were married, and 24.5% were single. Only 10.1% of participants were widowed, divorced or separated. Most participants had primary school education (40.9%), followed by a bachelor degree or higher (35.2%), a secondary education (10.7%), diploma degree (8.2%), and no formal education (5%).

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With regard to occupation, 29.6% of the participants were unemployed; 5.7 % were retired; while 64.7% were employed as government officials (25.1%), business owners or traders (21.4%), employees (14.4%), and farmers (3.8%). About one-third of participants (32.7%) had a monthly income of more than 20,000 Baht. Moreover, 80.5% of participants had sufficient income for living. In terms of medical payments, most participants used total reimbursement (44%), "30 Baht Health Care Coverage" (26.4%), self-support (22%), social welfare (4.4%), and private insurance (3.1%). In addition, most (88.7%) had no problem with medical payment.

Table 4-1

*Demographic Characteristics of the Study Sample* (N = 159)

| Characteristics | Number | Percentage |
|---|---|---|
| Age (years) | | |
| (Mean = 49.82, SD = 9.37, Range = 27-74) | | |
| 20 – 40 | 28 | 17.6 |
| 41 – 60 | 110 | 69.2 |
| > 60 | 21 | 13.2 |
| Marital Status | | |
| Single | 39 | 24.5 |
| Married | 104 | 65.4 |
| Widowed, Divorced, Separated | 16 | 10.1 |
| Education | | |
| No formal education | 8 | 5.0 |
| Primary school | 65 | 40.9 |
| Secondary school | 17 | 10.7 |
| Diploma | 13 | 8.2 |
| Bachelor degree and higher | 63 | 35.2 |

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Table 4-1 (Continued)

*Demographic Characteristics of the Study Sample* (N = 159)

| Characteristics | Number | Percentage |
|---|---|---|
| Occupation | | |
| Employed | 103 | 64.7 |
| -Employee | 23 | 14.5 |
| -Government official | 40 | 25.2 |
| -Business owner or trader | 34 | 21.4 |
| -Framer | 6 | 3.8 |
| Unemployed | 47 | 29.6 |
| Retired | 9 | 5.7 |
| Monthly Income (Baht) | | |
| ≤ 4,000 | 7 | 4.4 |
| 4,001 – 8,000 | 36 | 22.6 |
| 8,001 – 12, 000 | 30 | 18.9 |
| 12,001 – 16,000 | 15 | 9.4 |
| 16,001 – 20,000 | 19 | 11.9 |
| > 20,000 | 52 | 32.7 |
| Sufficient Income | | |
| Yes | 128 | 80.5 |
| No | 31 | 19.5 |
| Medical Payment | | |
| Total reimbursement | 70 | 44.0 |
| 30 Baht Health Care Coverage | 42 | 26.4 |
| Self-support | 35 | 22.0 |
| Social Welfare | 7 | 4.4 |
| Private Insurance | 5 | 3.1 |
| Problem with Medical Payment | | |
| None | 141 | 88.7 |
| Mild | 12 | 7.5 |
| Moderate | 3 | 1.9 |
| Severe | 3 | 1.9 |

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*Medical History Data*

In regard to stage of breast cancer, approximately two-third of the women (64.8%) had stage II, 23.3% had stage III, while 11.9% had stage I. Regarding type of operation, most (87.4%) received modified radical mastectomy (MRM), while the rest had either a simple mastectomy or lumpectomy (Table 4-2).

Regarding chemotherapy protocol, nearly half of the women (46.5%) received CMF protocol, 34.6% received CAF protocol, and 18.9% received AC protocol, as well as 53.5% of all women received chemotherapy containing adriamycin. In addition, women receiving the second and the third cycle of chemotherapy during collecting data were 25.8% and 26.4%, respectively. All of them (100%) received dexamethasone and zofran or onsia intravenously as premedication before chemotherapy administration. Finally, 78.6% reported no co-morbidity; only 21.4% reported one or more co-morbidity, including hypertension (16.4%), hypercholesterol (5%), or diabetes mellitus type 2 (5%) (see Table 4-2).

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Table 4-2

*Descriptive of Medical History of the Sample* (N = 159)

| Medical History | Number | Percentage |
|---|---|---|
| Stage of Cancer | | |
| Stage I | 19 | 11.9 |
| Stage II | 103 | 64.8 |
| Stage III | 37 | 23.3 |
| Type of Operation | | |
| Modified Radical Mastectomy (MRM) | 139 | 87.4 |
| Lumpectomy or Simple Mastectomy | 20 | 13.6 |
| Chemotherapy Protocol | | |
| CMF | 74 | 46.5 |
| CAF | 55 | 34.6 |
| AC | 30 | 18.9 |
| Chemotherapy Containing Adriamycin | | |
| Yes | 85 | 53.5 |
| No | 74 | 46.5 |
| No. of Treatment Cycle | | |
| 1 | 22 | 13.8 |
| 2 | 41 | 25.8 |
| 3 | 42 | 26.4 |
| 4 | 23 | 14.5 |
| 5 | 12 | 7.5 |
| 6 | 19 | 11.9 |
| Premedication | | |
| Dexamethasone + Zofran or Onsia | 159 | 100 |
| Co-morbidity* | | |
| None | 125 | 78.6 |
| Hypertension | 26 | 16.4 |
| Hypercholesterol | 8 | 5.0 |
| Diabetes Mellitus Type 2 | 8 | 5.0 |

*Note*. CMF = Cyclophosphamide + Methrotaxate + 5FU, CAF = Cyclophosphamide + Adriamycin + 5FU, AC = Adriamycin + Cyclophosphamide;

*A participant might have more than one form of co-morbidity

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Characteristics of the Study Variables

The distributions of the study variables including body mass index (BMI), hemoglobin level (Hb), pain, nausea and vomiting, sleep disturbance, family support, friend support, Buddhist practices, anxiety, depression, and fatigue, are displayed. Descriptive statistics are also presented. Mean, standard deviation, range, skewness, and kurtosis are shown in Table 4-3 to describe the distribution of the study variables.

Body mass index (BMI) of the participants ranged from 15.28 to 38.38 with a mean of 23.97 (SD = 3.86). The skewness coefficient of BMI was highly positive (.76), indicating that most participants had scores of BMI below the mean, but in the normal range value (18.5 – 24.9 $kg/m^2$) as recommended by WHO (Calle, Thun, Petrelli, Rodriguez, et al., 1999). Regarding kurtosis, Jacobsen (1997) stated that if the value produced by dividing the kurtosis statistics by the standard error, is not beyond ± 1.96, the distribution has a normal curve. In the current study, kurtosis for BMI showed a high peakedness, beyond the normal limit (.83/.38 = 2.18), indicating its peakedness was a nonnormal distribution (see Table 4-3).

Hemoglobin (Hb) ranged from 8.1 to 14.6 with a mean of 11.84 (SD = 1.22). The skewness coefficient of Hb was slightly negative (-.28), indicating that most of the participants' hemoglobin levels were above the mean. The kurtosis value or Hb (-.12/.38 = -.32) was close to zero and not beyond normal limit, indicating that its value was a normal distribution (see Table4-3).

Pain score ranged from 0 to 8 with a mean of 2.01 (SD = 2.04). The skewness coefficient of pain was highly positive (.98), indicating that most of participants had scores of pain below the mean. The kurtosis value for pain was

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slightly peaked and not beyond normal limits (.29/.38 = .76), indicating that its distribution was within the normal peakedness curve (see Table4-3).

Nausea and vomiting score ranged from 0 to 9 with a mean of 3.53 (SD = 2.51). The skewness coefficient of nausea and vomiting was moderately positive (.34), indicating that most participants had scores of nausea and vomiting below the mean. The kurtosis value for nausea and vomiting was highly flatted and beyond normal limit (-.92/.38 = -2.42), indicating that its value was a nonnormal distribution (see Table 4-3).

Sleep disturbance score ranged from 2 to 83 with a mean of 38.22 (SD = 19.43). The skewness was slightly positive (.27), indicating that most participants had scores of sleep disturbance below the mean. The kurtosis value for sleep disturbance was highly flatted and was beyond normal limit (-.83/.38 = -2.18), indicating that its value was a nonnormal distribution (see Table 4-3).

Scores for family support ranged from 10 to 20 with a mean of 16.79 (SD = 2.31). The skewness was moderately negative (-.43), indicating that most participants had scores of family support above the mean. The kurtosis value for family support was slightly flatted and not beyond normal limits (-.19/.38 = -.50), indicating that its value was within a normal distribution (see Table 4-3).

Scores for friend support ranged from 9 to 20 with a mean of 15.55 (SD = 2.59). The skewness was slightly negative (-.26), indicating that most participants had scores above the mean. The kurtosis value for friend support was moderately flatted and not beyond normal limit (-.39/.38 = -1.02), indicating that its value was within a normal distribution (see Table 4-3).

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Scores for Buddhist practices ranged from 20 to 79 with a mean of 55.33 (SD = 11.16). The skewness was slightly negative (-.18), indicating that most participants had scores of Buddhist practices above the mean. The kurtosis value for Buddhist practices was slightly flatted and not beyond normal limits (-.13/.38 = -.34), indicating that its value was within a normal distribution (see Table 4-3).

Scores for anxiety ranged from 1 to 12 with a mean of 4.71 (SD = 2.75). The skewness was highly positive (.92), indicating that most participants had scores of anxiety below the mean. The kurtosis value for anxiety was slightly peaked and not beyond normal limits (.14/.38 = .37), indicating that its peakedness was within a normal distribution (see Table 4-3).

Scores for depression ranged from 0 to 12 with a mean of 4.27 (SD = 2.65). The skewness was highly positive (.89), indicating that most participants had scores of depression below the mean. The kurtosis value for depression was slightly peaked and not beyond normal limits (.22/.38 = .58), indicating that its peakedness was within a normal distribution (see Table 4-3).

Scores for fatigue ranged from .45 to 6.59 with a mean of 2.20 (SD = 1.41). The skewness was highly positive (.92), indicating that most participants had scores of fatigue below the mean. The kurtosis value for fatigue was close to zero and not beyond normal limits (.07/.38 = .18), indicating that its distribution was within the normal peakedness curve (see Table 4-3).

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Table 4-3

*Mean, Standard Deviation, and Range of Study Variables* (N = 159)

| Variable | Mean | SD | Actual Range | Possible Range | Skewness (SE = .19) | Kurtosis (SE = .38) |
|---|---|---|---|---|---|---|
| BMI | 23.97 | 3.86 | 15.28-38.38 | | .76 | .83 |
| Hb | 11.84 | 1.22 | 8.1-14.6 | | -.28 | -.12 |
| Pain | 2.01 | 2.04 | 0-8 | 0-10 | .98 | .29 |
| N&V | 3.53 | 2.51 | 0-9 | 0-10 | .34 | -.92 |
| Sleep dist | 38.22 | 19.43 | 2-83 | 0-140 | .27 | -.83 |
| FmS | 16.79 | 2.31 | 10-20 | 0-20 | -.43 | -.19 |
| FrS | 15.55 | 2.59 | 9-20 | 0-20 | -.26 | -.39 |
| BP | 55.33 | 11.16 | 20-79 | 0-84 | -.18 | -.13 |
| Anxiety | 4.71 | 2.75 | 1-12 | 0-21 | .92 | .14 |
| Depression | 4.27 | 2.65 | 0-12 | 0-21 | .89 | .22 |
| Fatigue | 2.20 | 1.41 | .45-6.59 | 0-10 | .92 | .07 |

*Note*. BMI = body mass index, Hb = hemoglobin, N&V = nausea and vomiting, Sleep dist = sleep disturbance, FmS = family support, FrS = friend support, BP = Buddhist practices, SE = standard error

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According to the level of anxiety and depression proposed by Nilchaikovit and colleagues (1996), the results found that 85.5% of participants had normal anxiety levels, while only 5% were definite cases of anxiety. Moreover, 87.4% of participants had normal depression levels, while only 4.4% were definite cases of depression (see Table 4-4).

Table 4-4

*Number and Percentage of the Sample by Anxiety and Depression Scores* (N = 159)

| Scale and Group | Values | Number | Percentage |
|---|---|---|---|
| Anxiety scores | | | |
| Normal | 0 – 7 | 136 | 85.5 |
| Borderline | 8 – 10 | 15 | 9.4 |
| Definite | ≥ 11 | 8 | 5.0 |
| Depression scores | | | |
| Normal | 0 – 7 | 139 | 87.4 |
| Borderline | 8 – 10 | 13 | 8.2 |
| Definite | ≥ 11 | 7 | 4.4 |

According to the levels of total and subscales of fatigue proposed by Piper (2002), the results show that total fatigue scores and fatigue scores in subscales, including behavior/severity, affective/meaning, sensory, and cognitive/ mood, were of low levels (see Table 4-5).

Table 4-5

*Descriptive Values of Levels of Fatigue of the Sample* (N = 159)

| Scale | Range | Mean | SD | Level |
|---|---|---|---|---|
| Total Fatigue Score | .45 – 6.59 | 2.20 | 1.41 | Low |
| Fatigue Subscale Score | | | | |
| Behavior/Severity | 0 – 7.33 | 2.69 | 1.85 | Low |
| Affective/Meaning | 0 – 8.00 | 2.29 | 2.02 | Low |
| Sensory | 0 – 7.00 | 2.20 | 1.68 | Low |
| Cognitive/Mood | 0 – 6.67 | 1.62 | 1.34 | Low |

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## Testing Assumptions of Multivariate Analysis

Before using multiple regression analysis and path analysis, the critical assumptions including normality, linearity, homoscedasticity, and multicollinearity needed to be examined. The researcher presented examination of each assumption as follows:

### *Normality*

Normality was detected by the inspection of all univariate distributions including skewness and kurtosis statistics. Criteria to test normality included the following:

According to Li, Harmer, Duncan, Duncan, Acock, and Boles (1998), an absolute value of 2 for skewness is considered a departure from normality. In this study, all skewness values of interesting variables were less than ± 2 (see Table 4-3), indicating the variables were normally distributed.

Regarding kurtosis, Jacobsen (1997) stated that if the value, produced by dividing the kurtosis statistics by the standard error, was not beyond ± 1.96, the distribution was a normal curve. In this study, kurtosis values showed that eight variables in the proposed model (hemoglobin level, pain, family support, friend support, Buddhist practices, anxiety, depression, and fatigue) met the assumptions of normal distribution. The other three variables (BMI, nausea and vomiting, and sleep disturbance) were not in the acceptable range as they had kurtosis values of 2.18, -2.42, and -2.18, respectively.

Further, according to West, Finch, and Curran (1995), they recommend that when measured variables are highly nonnormal (kurtosis = 21), the standard errors of

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parameter estimates are underestimated, resulting in an untrustworthy result. In this study, the kurtosis value for BMI, nausea and vomiting, and sleep disturbance (see Table 4-3) were not highly nonnormal. Therefore, all interesting variables were used in analysis process without transformation. In addition, the EQS program provided the robust statistics, where the normal distribution assumption is violated. The robust statistics perform better than uncorrected statistics (Bentler, 1995; Chou & Bentler, 1995).

*Linearity*

The linearity relationship between independent and dependent variables were tested by the residual plot which is the graphs between the standardized residuals (y-axis) versus the predicted values (x-axis). If the assumption of linearity is met, the standardized residuals should scatter randomly about a horizontal line (Stevens, 2002). The residual plots of four dependent variables including Buddhist practices, anxiety, depression, and fatigue all showed linear relationships (see Appendix O).

*Homoscedasticity*

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Homoscedasticity refers to a constant error variance between predicted and observed score. In other words, the variance of the residuals about a predicted score is the same for all predicted scores (or equal variance) (Tabachnick & Fidell, 1996). This assumption was tested by scatter plot. When standardized predicted values (y-axis) are plotted against observed values (x-axis), the data forms a straight line from the lower-left corner to the upper-right corner, indicating no violation of the assumption (Tabachnick & Fidell, 1996). Moreover, the equal scatter points around the zero axis of the residuals also indicate adequate assumption of homoscedasticity (Tabachnick & Fidell, 1996). In this study, plots of residual standardized of four dependent variables (Buddhist practices, anxiety, depression, and fatigue) between standardized predictive values and observed values showed homoscedasticity (see Appendix O).

*Multicollinearity*

In regression analysis, multicollinearity may produce problems, including (1) limitation of the size of multiple correlation (R); (2) difficulty to determine the importance of a given predictor; and (3) unstable estimates of regression coefficients (Stevens, 1996). To manage these problems, multicollinearity of variables was examined through three criteria comprising simple correlation among the predictors, tolerance value, and the variance inflation factor (VIF).

In the first criteria, Pearson Product Moment correlation was conducted to examine the extent, to which the variables were related to each other. The evidence of multicollinearity might be present if the correlation values exceed .80 (Hair, Anderson, Tatham & Black, 1998) or a value greater than .85 (Munro, 1997). Before correlation analysis, categorized variables needed to be coded as dummy coding: 1 or 0 (Polit, 1996). In this study, regarding the chemotherapy protocol, the code of 1 was assigned to the protocol containing adriamycin, and the code of 0 was assigned to protocol non-adriamycin. The results showed that the zero-order correlation among independent variables ranged from very low (.01) to high (.75) and values did not exceed .80, thus indicating no evidence of multicollinearity (Table 4-6).

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Concerning the second criteria, tolerance value, according to Munro (1997), tolerance "is the proportion of variance in a variable that is not accounted for by the other independent variables (1 - $R^2$)" (p. 268) and has a value ranges from 0 to 1. If the tolerance value is too low (.10 or below), it will have a problem in the analysis (Norusis, 1995; Tabacnick & Fidell, 1996). In this study, the tolerance value ranged from .33 to .92 (Table 4-7). This reflected no evidence of multicollinearity.

In the third criterion, the variance inflating factor (VIF), VIF was closely related to tolerance values. Variables with high tolerances had small VIF (Munro, 1997). According to Stevens (1996), VIF values, which were not more than 10 indicated no multicollinearity. In this study, VIF values ranged from 1.08 to 2.98 (Table 4-7), demonstrating no evidence of multicollinearity.

*Summary*. As a result of testing multivariate assumptions, normality, linearity, homoscedasticity, and multicollinearity were not violated. BMI, nausea and vomiting, and sleep disturbance had non-normal distributions, but not severe. The maximum likelihood estimation with robust statistics, including a robust test of the hypothesized model and robust standard errors, were recommended. Specifically, robust tests and standard errors were adjusted for the extent of non-normality (Bentler, 1995).

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Table 4-6

*Correlation Matrix of Study Variables* (N = 159)

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.Protocol | 1.00 | | | | | | | | | | | |
| 2. BMI | -.15 | 1.00 | | | | | | | | | | |
| 3. Hemoglobin level | -.27** | .18* | 1.00 | | | | | | | | | |
| 4. N&V | .59*** | -.11 | -.24** | 1.00 | | | | | | | | |
| 5. Pain | .47*** | -.06 | -.07 | .41*** | 1.00 | | | | | | | |
| 6. Sleep disturbance | .20* | -.16* | -.14 | .34*** | .14 | 1.00 | | | | | | |
| 7. Family support | -.28** | .13 | .13 | -.24** | -.19* | -.44*** | 1.00 | | | | | |
| 8. Friend support | -.32*** | .08 | -.03 | -.28** | -.12 | -.38*** | .61*** | 1.00 | | | | |
| 9. Buddhist practices | -.32*** | .08 | .13 | -.41*** | -.32*** | -.16* | .24** | .32*** | 1.00 | | | |
| 10. Anxiety | .39*** | -.02 | -.09 | .50*** | .38*** | .44*** | -.41*** | -.42*** | -.53*** | 1.00 | | |
| 11. Depression | .35*** | -.01 | -.06 | .39*** | .39*** | .38*** | -.45*** | -.40*** | -.45*** | .75*** | 1.00 | |
| 12. Fatigue | .45*** | -.06 | -.08 | .54*** | .39*** | .47*** | -.49*** | -.48*** | -.63*** | .84*** | .77*** | 1.00 |

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

Protocol: 0 = Protocol non-containing adriamycin; 1 = Protocol containing adriamycin

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Table 4-7

*Assessment of Multicollinearity Among Variables in the Model* (N = 159)

| Variable | Tolerance | VIF |
|---|---|---|
| 1.For the first equation (DV = Buddhist practices) | | |
| Pain | .81 | 1.37 |
| Nausea and Vomiting | .73 | 1.23 |
| Sleep disturbance | .73 | 1.37 |
| 2.For the second equation (DV = Anxiety) | | |
| Pain | .78 | 1.29 |
| Nausea and Vomiting | .68 | 1.47 |
| Sleep disturbance | .73 | 1.37 |
| Family support | .55 | 1.81 |
| Friend support | .58 | 1.72 |
| Buddhist practices | .75 | 1.33 |
| 3. For the third equation (DV = Depression) | | |
| Pain | .75 | 1.32 |
| Nausea and Vomiting | .64 | 1.55 |
| Sleep disturbance | .67 | 1.48 |
| Family support | .55 | 1.82 |
| Friend support | .57 | 1.75 |
| Buddhist practices | .50 | 1.99 |
| Anxiety | .57 | 1.74 |
| 4. For the fourth equation (DV = Fatigue) | | |
| Chemotherapy protocol | .53 | 1.90 |
| Body mass index (BMI) | .93 | 1.08 |
| Hemoglobin level | .84 | 1.19 |
| Pain | .66 | 1.94 |
| Nausea and Vomiting | .51 | 1.51 |
| Sleep disturbance | .65 | 1.53 |
| Family support | .52 | 1.94 |
| Friend support | .53 | 1.89 |
| Buddhist practices | .65 | 1.55 |
| Anxiety | .33 | 2.98 |
| Depression | .39 | 2.56 |

*Note*. VIF = variance inflation factor, DV = dependent variable

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## Model Testing and Modification

As stated in Chapter 1, this study aimed to determine which variables in the model (chemotherapy protocol, BMI, hemoglobin level, pain, nausea and vomiting, sleep disturbance, family support, friend support, Buddhist practices, anxiety, and depression) predicted fatigue among Thai women receiving adjuvant chemotherapy for breast cancer. It was hypothesized that BMI, hemoglobin levels, family support, friend support, and Buddhist practices would directly and negatively influence fatigue, while chemotherapy protocol, pain, nausea and vomiting, sleep disturbance, anxiety, and depression would directly and positively influence fatigue. In addition, pain, nausea and vomiting, and sleep disturbance would directly and positively influence Buddhist practices, as well as directly and positively influence anxiety, and depression. Family support, friend support, and Buddhist practices would directly and negatively influence anxiety, and depression. Finally, anxiety would directly and positively influence depression as shown in Figure 2-2.

In the analysis, the raw data were used and transformed by the EQS program into a covariance matrix (See Table 4-8). Maximum Likelihood Method with Robust was used to estimate the parameters. A non-significant chi-square ($\chi^2$) was expected as it indicated consistency of covariation among variables (Stevens, 1996). Moreover, other fit indices, including the comparative fit index (CFI), normed fit index (NFI), nonnormed fit index (NNFI), and root mean square error of approximation (RMSEA), were also considered. The CFI, NFI, and NNFI greater than .90 were expected, indicating a good fit model (Bentler, 1995; Mueller, 1996). Lastly, the RMSEA value

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Table 4-8

*Covariance Matrix of Study Variables* (N = 159)

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.Protocol | .250 | | | | | | | | | | | |
| 2. Body Mass Index | -.308 | 14.877 | | | | | | | | | | |
| 3. Hemoglobin level | -.164 | .873 | 1.492 | | | | | | | | | |
| 4. Nausea and vomiting | .747 | -1.105 | -.730 | 6.276 | | | | | | | | |
| 5. Pain | .481 | -.492 | -.171 | 2.101 | 4.152 | | | | | | | |
| 6. Sleep disturbance | 1.958 | -12.238 | -3.350 | 16.364 | 5.738 | 377.426 | | | | | | |
| 7. Family support | -.322 | 1.162 | .380 | -1.418 | -.934 | -19.848 | 5.352 | | | | | |
| 8. Friend support | -.421 | .769 | -.114 | -1.842 | -.627 | -19.115 | 3.649 | 6.692 | | | | |
| 9. Buddhist practices | -1.815 | 3.682 | 1.785 | -11.573 | -7.346 | -35.288 | 6.174 | 9.326 | 124.639 | | | |
| 10. Anxiety | .542 | -.241 | -.314 | 3.496 | 2.143 | 23.608 | -2.616 | -3.005 | -16.266 | 7.561 | | |
| 11. Depression | .462 | -.105 | -.195 | 2.635 | 2.142 | 19.839 | -2.781 | -2.788 | -13.367 | 5.490 | 7.034 | |
| 12. Fatigue | 7.226 | -7.588 | -3.440 | 43.642 | 25.534 | 291.992 | -36.051 | -40.138 | -224.674 | 73.632 | 65.921 | 1020.90 |

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less than .05 was expected, indicating a good fit model (Raykov & Marcoulides, 2000). The steps of analysis were as follows:

*Step One: Model 1 (Initial Model)*

According to the initial proposed model (Figure 2-2), four endogenous variables including Buddhist practices, anxiety, depression, and fatigue were identified. Therefore, four structural equations were tested for significance of the variance contributed by their respective predictor variables as follows:

*Equation 1*: Buddhist practices = Pain + Nausea and vomiting + Sleep disturbance + Error

*Equation 2*: Anxiety = Pain + Nausea and vomiting + Sleep disturbance + Family support + Friend support + Buddhist practices + Error

*Equation 3*: Depression = Pain + Nausea and vomiting + Sleep disturbance + Family support + Friend support + Buddhist practices + Anxiety + Error

*Equation 4*: Fatigue = Chemotherapy protocol + Body mass index + Hemoglobin level + Pain + Nausea and vomiting + Sleep disturbance + Family support + Friend support + Buddhist practices + Anxiety + Depression + Error

In the first equation, Buddhist practices was predicted by pain, nausea and vomiting, and sleep disturbance. In the second equation, anxiety was predicted by pain, nausea and vomiting, sleep disturbance, family support, friend support, and Buddhist practices. In the third equation, depression was predicted by pain, nausea and vomiting, sleep disturbance, family support, friend support, Buddhist practices, and anxiety. Finally, fatigue was predicted by the chemotherapy protocol, body mass

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index, hemoglobin level, pain, nausea and vomiting, sleep disturbance, family support, friend support, Buddhist practices, anxiety, and depression.

In step one, the results of path analysis indicated that the S-B $\chi_2$ was large (232.28) with 31 degrees of freedom; p-value was .00 and robust CFI was .72. The NFI and NNFI values were .71 and .39, respectively, which were less than .90. In addition, RMSEA was .21, which was greater than .05 (see Table 4-9 Model 1 and Figure 4-1), indicating that the initial model was wrongly specified and did not fit the data. In this step, the multivariate Wald Test, an index used to evaluate whether free parameters of non-significance could be dropped (Bentler, 1995, Norris, 1997), suggested dropping the path between BMI and fatigue.

*Step Two: Model 2 (Model Modification by Dropping a Path from Fatigue to BMI)*

In step two, after the path from BMI to fatigue was dropped, the results showed a decrease in chi-square from 232.28 to 224.24 with 21 degrees of freedom. However, the p value remained significant (p = .00) and the robust CFI = .72. The NFI and NNFI was .71 and .26, respectively, which remained less than .90. Further, the RMSEA was .25, which was still greater than .05 (see Table 4-9, Model 2). The goodness of fit indices indicated that the model still did not fit the data and needed further modification. Thus, the multivariate Wald Test suggested dropping 5 paths and 1 correlation including the path of (1) sleep disturbance to depression; (2) sleep disturbance to Buddhist practices (3) friend support to fatigue; (4) nausea and vomiting to depression; (5) pain to fatigue; and the correlation between pain and friend support.

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Table 4-9

*Process and Results for Model Modification: Model 1 and Model 2*

| Model | Scaled $\chi^2$ | df | p value | Robust CFI | NFI | NNFI | RMSEA |
|---|---|---|---|---|---|---|---|
| Model 1:Initial Model<br>(1) BP = Pain + N&V + Sleep dist + Error<br>(2) Anxiety = Pain + N&V + Sleep dist + FaS + FrS + BP + Error<br>(3) Depression = Pain + N&V + Sleep dist + FaS + FrS + BP + Anxiety + Error<br>(4) Fatigue = CT protocol + BMI + Hb level + Pain + N&V + Sleep dist + FaS + FrS + BP + Anxiety + Depression + Error | 232.28 | 31 | .00 | .72 | .71 | .39 | .21 |
| Model 2: Dropped 1 path: Fatigue predicted by BMI | 224.24 | 21 | .00 | .72 | .71 | .26 | .25 |

*Note*: BP = Buddhist practices, N&V = nausea and vomiting, Sleep dist = sleep disturbance, FaS = family support, FrS = friend support, CT protocol = chemotherapy protocol, Hb level = hemoglobin level

CFI = Comparative Fit Index, NFI = Normed Fit Index, NNFI = Non-Normed Fit Index, RMSEA = Root Mean Square Error of Approximate

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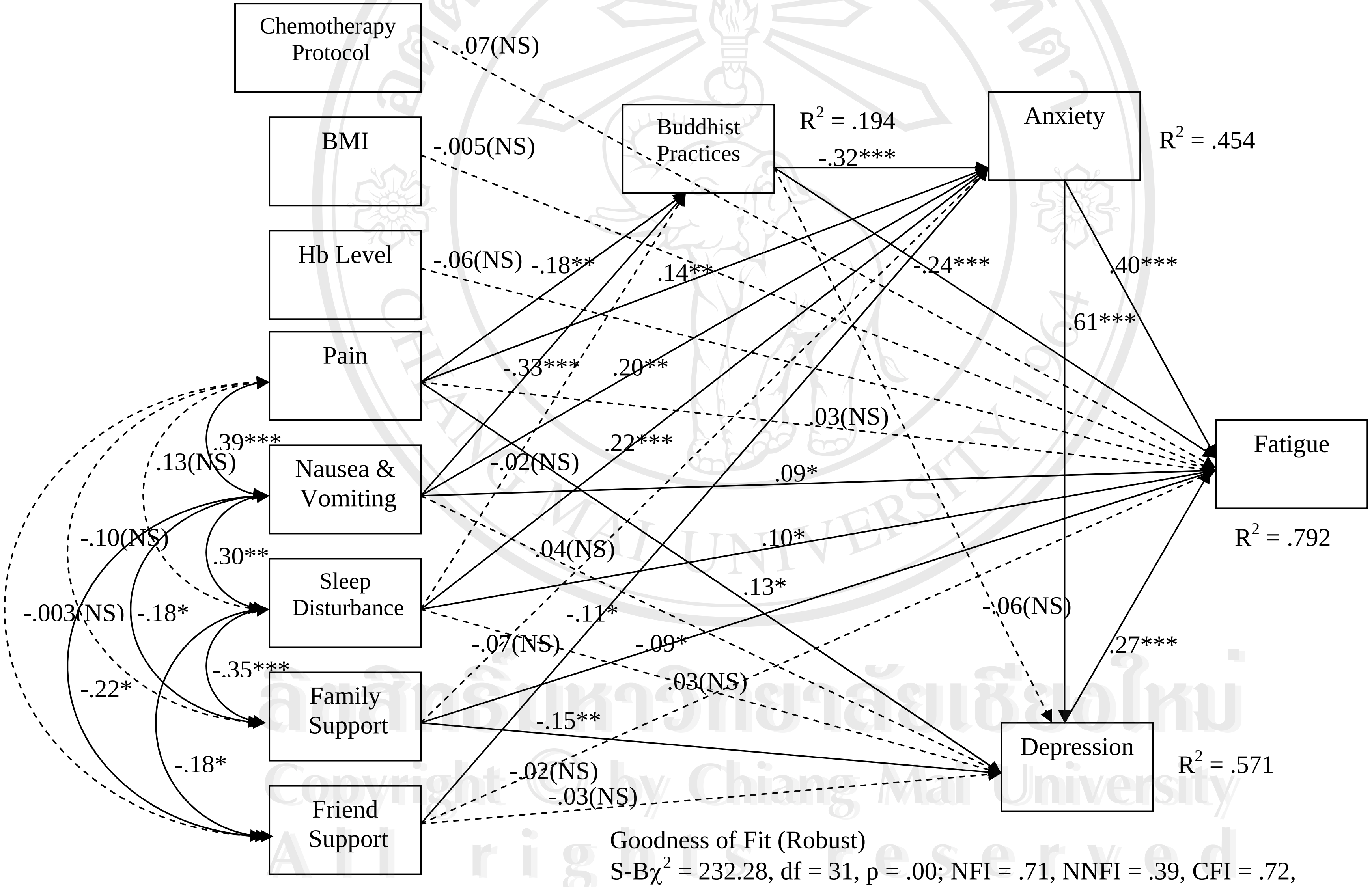
<u>Figure 4-1</u> An initial model for predicting fatigue among Thai women receiving adjuvant breast cancer chemotherapy




Note. ◄──► Correlation ──► Structural Effect (Standardized Weight)
- - - -► Non-significant path

Goodness of Fit (Robust)
S-B$\chi^2$ = 232.28, df = 31, p = .00; NFI = .71, NNFI = .39, CFI = .72, RMSEA = .21
NS = non-significant, * p < .05, ** p < .01, *** p < .001

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*Step Three: Model 3 (Model Modification by Dropping All Non-Significant Paths)*

After dropping 5 paths and one correlation as suggested in step two, the scaled chi-square decreased from 224.24 to 212.57 with 26 degrees of freedom. However, the p value remained significant (.00) and the robust CFI was .74. The NFI and NNFI were .72 and .45, respectively, and the RMSEA was .21 (see Table 4-10). These results indicated that the model still did not fit the data; therefore, it needed modification.

In this step, the multivariate Wald Test suggested dropping 5 paths and 2 correlations including the path of (1) chemotherapy protocol to fatigue; (2) friend support to depression; (3) hemoglobin to fatigue; (4) family support to anxiety; (5) Buddhist practices to depression; correlation between (1) sleep disturbance and pain; and (2) family support and pain.

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Table 4-10

*Process and Results for Model Modification (Model 3)*

| Model | Scaled $\chi^2$ | df | p value | Robust CFI | NFI | NNFI | RMSEA |
|---|---|---|---|---|---|---|---|
| Model 3: Dropped 5 paths with non-significance:<br>1) Depression predicted by Sleep dist<br>2) BP predicted by Sleep dist<br>3) Fatigue predicted by FrS<br>4) Depression predicted by N&V<br>5) Fatigue predicted by Pain<br>Dropped a correlation between Pain and FrS | 212.57 | 26 | .00 | .74 | .72 | .45 | .21 |

*Note*: BP = Buddhist practices, N&V = nausea and vomiting, Sleep dist = sleep disturbance, FrS = friend support, CFI = Comparative Fit Index, NFI = Normed Fit Index, NNFI = Non-Normed Fit Index, RMSEA = Root Mean Square Error of Approximate

*Step Four: Model 4 (Model Modification by Adding Covariate)*

After dropping 5 paths and 2 correlations as suggested in step three, the scaled chi-square decreased from 212.57 to 87.71 with 15 degrees of freedom, and the p value remained significant (.00). Although the robust CFI increased from .74 to .87, it was less than .90. The NFI and NNFI also increased from .72 to .85, and .45 to .68, respectively, but remained less than .90. The RMSEA decreased from .21 to .17, but still non-significant (see Table 4-11). These results indicated that the model still did not fit the data and needed additional modifications.

In this step, the multivariate Wald Test suggested that none of the free parameters needed to be dropped. However, the multivariate Lagrange Multiplier Test (LM Test), an index used to evaluate whether some of the fix parameters in the

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model could be freed (Bentler, 1995), suggested adding one correlation and one path. They included a correlation between friend support and family support, and a path from friend support to Buddhist practices.

Table 4-11

*Process and Results for Model Modification (Model 4)*

| Model | Scaled $\chi^2$ | df | p value | Robust CFI | NFI | NNFI | RMSEA |
|---|---|---|---|---|---|---|---|
| Model 4: Dropped 5 paths with non-significance:<br>1) Fatigue predicted by CT protocol<br>2) Fatigue predicted by Hb level<br>3) Anxiety predicted by FaS<br>4) Depression predicted by FrS<br>5) Depression predicted by BP<br>Dropped 2 correlation paths between 1) Pain and FaS; and 2) Pain and Sleep dist | 87.71 | 15 | .00 | .87 | .85 | .68 | .17 |

*Note*: BP = Buddhist practices, Sleep dist = sleep disturbance, FaS = family support, FrS = friend support, CT protocol = chemotherapy protocol, Hb level = hemoglobin level, CFI = Comparative Fit Index, NFI = Normed Fit Index, NNFI = Non-Normed Fit Index, RMSEA = Root Mean Square Error of Approximate

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*Step Five: Model 5 (Final Modified Model)*

The LM test in the fourth step suggested adding a correlation between friend support and family support, and a structural path between friend support and Buddhist practices. Although the relationship between family support and friend support, and the path between friend support and Buddhist practices were not hypothesized initially, the relationship between family support and friend support was added due to support from a previous study in older Thai adults (Malathum, 2001).

For the structural path between friend support and Buddhist practices, although, it was questionable because there is no literature supporting this direct cause-and-effect relationship, findings from previous studies and from the researcher's clinical experience could imply support for the relationship between friend support and Buddhist practices.

Previous studies indicated that friend or peer support increased the sense of personal competence (Lugton, 1997; Sandstrom, 1996), and diminished fear (Chan, Molassiotis, Yam, Chan & Lam, 2001; Lugton, 1997; Sandstrom, 1996; Whittemore, Rankin, Callahan, Leder & Carroll, 2000). These may lead to diminished distress and improvement of mental health by initiating and enhancing coping behaviors including performing Buddhist practices.

Moreover, from the researcher's clinical experience, while waiting for chemotherapy, breast cancer women often discussed and shared their experiences by exchanging information with each other, such as strategies to deal with side effects and psychological problems. Buddhist practices including merit making, chanting, and meditation were often suggested as helping to cope with physical and psychological distress. Therefore, in the fifth step, a structural path between friend support and Buddhist practices was added.

Therefore, after adding the correlation between friend support and family support, and a structural path between friend support and Buddhist practices, the goodness-of-fit indices showed a strong improvement. The scaled chi-square decreased from 87.71 to 10.30 with 12 degrees of freedom. The p value was non-

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significant (.59) and the robust CFI was 1.0, indicating that this modified model (Model 5) fit the data well. In addition, the NFI and NNFI demonstrated that the model adequately fit the data (the value greater than .90): the NFI was .98 and NNFI was 1.0. Moreover, the RMSEA value was .00 (Table 4-12), which was less than .05, indicating that the model fit the data.

Table 4-12

*Process and Results for Model Modification (Model 5: Final Model)*

| Model | Scaled $\chi^2$ | df | p value | Robust CFI | NFI | NNFI | RMSEA |
|---|---|---|---|---|---|---|---|
| Model 5: Final Model, Added 1 correlation between FaS and FrS Added 1 path: BP predicted by FrS<br><br>(1) BP = -.19*Pain - .27*N&V + .23*FrS + Error<br>(2) Anxiety = 15*Pain +.19*N&V + .25*Sleep dist - .16* FrS - .32* BP + Error<br>(3) Depression = .12* Pain -.17*FaS + .65*Anxiety + Error<br>(4) Fatigue = .10*N&V + .09*Sleep dist - .09* FaS -.23* BP + .40*Anxiety + .27*Depression + Error | 10.30 | 12 | .59 | 1.0 | .98 | 1.0 | .00 |

*Note*: BP = Buddhist practices, N&V = nausea and vomiting, Sleep dist = sleep disturbance, FaS = family support, FrS = friend support, CT protocol = chemotherapy protocol, Hb level = hemoglobin level, CFI = Comparative Fit Index, NFI = Normed Fit Index, NNFI = Non-Normed Fit Index, RMSEA = Root Mean Square Error of Approximate

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The final model (Model 5) was determined by eliminating or trimming causal paths that were not statistically significant within the context of the hypothesized model (Figure 4-2). A summary of path coefficients of the model is presented in Table 4-13. Pain, nausea and vomiting, and friend support together accounted for 22.8% of total variance in Buddhist practices. Moreover, pain, nausea and vomiting, sleep disturbance, friend support, and Buddhist practices accounted for 47.3% of total variance in anxiety. Additionally, pain, nausea and vomiting, sleep disturbance, family support, friend support, Buddhist practices and anxiety accounted for 57.8% of total variance in depression. Finally, pain, nausea and vomiting, sleep disturbance, family support, friend support, Buddhist practices, anxiety, and depression together accounted for 80.4% of total variance in fatigue.

*Summary*. Results from EQS analysis found 11 structural paths and 3 correlations were dropped; while 1 structural path and 1 correlation were added. Moreover, the output showed that all paths that remained in the final model were significant. The structural equations with standardized estimates are presented in Table 4-12 (Model 5).

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Figure 4-2 A final modified model for predicting fatigue among Thai women receiving adjuvant breast cancer chemotherapy

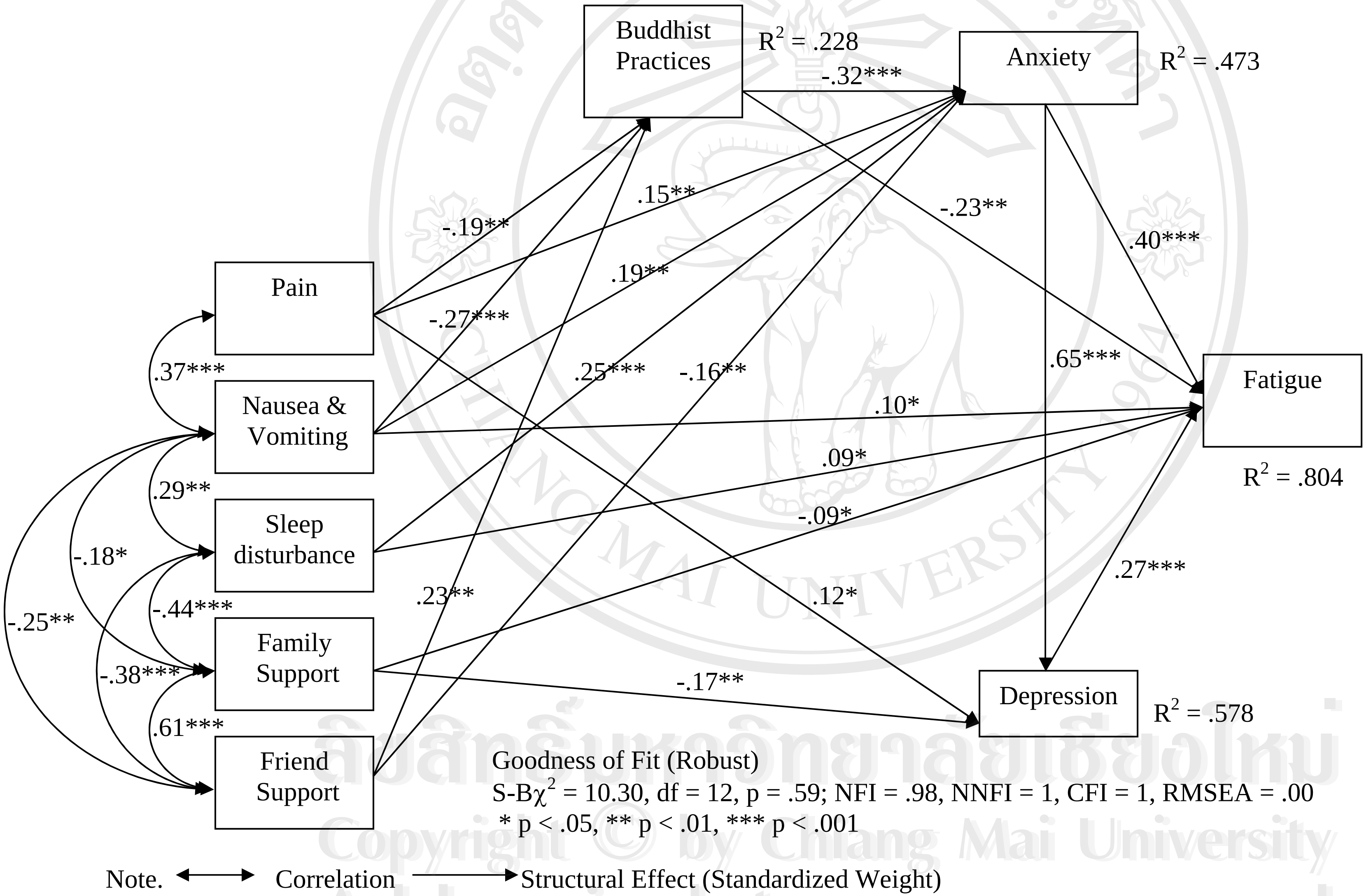


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Table 4-13

*Direct, Indirect, and Total Effects of Causal Variables on Affected Variables* (N = 159)

| Causal Variables | Affected Variables | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Buddhist practices | | | Anxiety | | | Depression | | | Fatigue | | |
| | DE | IE | TE | DE | IE | TE | DE | IE | TE | DE | IE | TE |
| Pain | -.19** | -- | -.19** | .15** | .06* | .21** | .12* | .14** | .26*** | -- | .20** | .20** |
| Nausea and vomiting | -.27*** | -- | -.27*** | .19** | .09* | .28*** | -- | .18** | .18** | .10* | .22** | .32*** |
| Sleep disturbance | -- | -- | -- | .25*** | -- | .25*** | -- | .16** | .16** | .09* | .14** | .23** |
| Family support | -- | -- | -- | -- | -- | -- | -.17** | -- | -.17** | -.09* | -.05* | -.14** |
| Friend support | .23** | -- | .23** | -.16** | -.07* | -.23** | -- | -.15** | -.15** | -- | -.18** | -.18** |
| Buddhist practices | | | | -.32*** | -- | -.32*** | -- | -.20** | -.20** | -.23** | -.18** | -.41*** |
| Anxiety | | | | | | | .65*** | -- | .65*** | .40*** | .17*** | .57*** |
| Depression | | | | | | | | | | .27*** | -- | .27*** |
| | $R^2$ = .228 | | | $R^2$ = .473 | | | $R^2$ = .578 | | | $R^2$ = .804 | | |

*Note*: DE = Direct Effect, IE = Indirect Effect, TE = Total Effect
* p< .05, ** p< .01, *** p< .001

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Hypothesis Testing Results

By analyzing the influence effects of all variables in the proposed model; eleven research hypotheses in this study were answered. The structural effects of all variables in the final model comprised 3 parts including direct, indirect and total effect. Results of all structural effects on each variable were presented in Table 4-13.

*Hypothesis 1*: Chemotherapy protocol containing adriamycin has a direct positive effect on fatigue.

The statistical analysis showed that chemotherapy protocol containing adriamycin had a non-significant direct effect on fatigue ($\gamma = .07$, $p > .05$). As a result, hypothesis one was not supported.

*Hypothesis 2*: BMI has a direct negative effect on fatigue.

The findings suggested that BMI had a non-significant direct effect on fatigue ($\gamma = -.005$, $p > .05$). Therefore, hypothesis two was not supported.

*Hypothesis 3*: Hemoglobin level has a direct negative effect on fatigue.

The results demonstrated that hemoglobin level had a non-significant direct effect on fatigue ($\gamma = -.06$, $p > .05$). Thus, hypothesis three was not supported.

*Hypothesis 4*: Pain has a direct positive effect on Buddhist practices, anxiety, depression, and fatigue.

The analysis outcome revealed that pain had a direct negative effect on Buddhist practices ($\gamma = -.19$, $p < .01$), as well as a direct positive effect on anxiety ($\gamma = .15$, $p < .01$), and on depression ($\gamma = .12$, $p < .05$). However, it had a non-significant

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direct positive effect on fatigue ($\gamma = .03, p > .05$). The fourth hypothesis therefore, was partially supported.

Additionally, pain had a significant indirect positive effect on anxiety ($\gamma = .06, p < .05$) through Buddhist practices, and on depression ($\gamma = .14, p < .01$) through anxiety, as well as on fatigue ($\gamma = .20, p < .01$) through Buddhist practices, anxiety and depression (see Figure 4-2 and Table 4.13).

*Hypothesis 5*: Nausea and vomiting has a direct positive effect on Buddhist practices, anxiety, depression, and fatigue.

The outcome illustrated that nausea and vomiting had a significant direct negative effect on Buddhist practices ($\gamma = -.27, p < .001$), as well as a significant direct positive effect on anxiety ($\gamma = .19, p < .01$), and on fatigue ($\gamma = .10, p < .05$). However, it had a non-significant direct effect on depression ($\gamma = .04, p > .05$). Therefore, hypothesis five was partially supported.

In addition, nausea and vomiting had a significant indirect positive effect on anxiety ($\gamma = .09, p < .05$) through Buddhist practices; and on depression ($\gamma = .18, p < .01$) through anxiety, as well as on fatigue ($\gamma = .22, p < .01$) through Buddhist practices and anxiety (see Figure 4-2 and Table 4-13).

*Hypothesis 6*: Sleep disturbance has a direct positive effect on Buddhist practices, anxiety, depression, and fatigue.

Results of the analysis indicated that sleep disturbance had a significant positive direct effect on anxiety ($\gamma = .25, p < .001$), and on fatigue ($\gamma = .09, p < .05$), but had a non-significant direct effect on Buddhist practices ($\gamma = -.02, p > .05$), as well

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as on depression ($\gamma$ = .03, $p > .05$). The sixth hypothesis therefore, was partially supported.

Moreover, it had both a significant positively indirect effect on depression ($\gamma$ = .16, $p < .01$), and on fatigue ($\gamma$ = .14, $p < .01$) through anxiety (see Figure 4-2 and Table 4-13).

*Hypothesis 7*: Family support has a direct negative effect on anxiety, depression, and fatigue.

The analysis revealed that family support had both a significant negative direct effect on depression ($\gamma$ = -.17, $p < .05$), and on fatigue ($\gamma$ = -.09, $p < .05$), but had no direct effect on anxiety. The seventh hypothesis therefore, was partially supported. In addition, it had a significant negative indirect effect on fatigue ($\gamma$ = -.05, $p < .05$) through depression (see Figure 4-2 and Table 4-13).

*Hypothesis 8*: Friend support has a direct negative effect on anxiety, depression, and fatigue.

The results demonstrated that friend support had a significant direct negative effect on anxiety ($\gamma$ = -.16, $p < .01$). However, it had no direct effect on depression ($\gamma$ = -.03, $p > .05$), and on fatigue ($\gamma$ = -.02, $p > .05$). Thus, hypothesis eight was partially supported.

Unexpectedly, friend support had a significant direct positive effect on Buddhist practices ($\gamma$ = .23, $p < .01$) and this path was added during analysis. Additionally, friend support had a significant negative indirect effect on anxiety ($\gamma$ = -.07, $p < .05$) through Buddhist practices, and on depression ($\gamma$ = -.15, $p < .01$) through

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anxiety, as well as on fatigue ($\gamma$ = -.18, p < .01) through Buddhist practices and through anxiety (see Figure 4-2 and Table 4-13).

*Hypothesis 9*: Buddhist practices have a direct negative effect on anxiety, depression, and fatigue.

The outcomes revealed that Buddhist practices had both a significant negative direct effect on anxiety ($\beta$ = -.32, p < .001), and on fatigue ($\beta$ = -.23, p < .01). However, it had no direct effect on depression (($\beta$ = -.06, p > .05). Accordingly, hypothesis nine was partially supported.

In addition, Buddhist practices had both a significant negative indirect effect on depression ($\beta$ = -.20, p < .01), and on fatigue ($\beta$ = -.18, p < .01) through anxiety (see Figure 4-2 and Table 4-13).

*Hypothesis 10*: Anxiety has a direct positive effect on depression, and fatigue.

The results revealed that anxiety had both a significant positive direct effect on depression ($\beta$ = .65, p < .001), and on fatigue ($\beta$ = .40, p < .001). In addition, it also had a significant indirect positive effect on fatigue ($\beta$ = .17, p < .01) through depression (see Figure 4-2 and Table 4-13). The tenth hypothesis therefore, was supported.

*Hypothesis 11*: Depression has a direct positive effect on fatigue.

The results suggested that depression had a significant positive direct effect on fatigue ($\beta$ = .27, p < .001) (see Figure 4-2 and Table 4-10). Accordingly, hypothesis eleven was supported.

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*Summary of Results*

This part reports the demographic characteristics of the sample, and descriptive statistics of 12 study variables. The EQS 6.1 software program was employed to test and modify the study model. The model fit was also analyzed under the multiple selected goodness-of-fit indices, and the final modified model was verified to have a good fit with the data. Among the predictors in the proposed model, chemotherapy protocol, BMI, and Hb level did not affect fatigue. Eight predictors had direct and/ or indirect effect on fatigue including pain, nausea and vomiting, sleep disturbance, family support, friend support, Buddhist practices, anxiety, and depression. Nausea and vomiting, sleep disturbance, family support, Buddhist practices, anxiety, and depression, had both direct and indirect effect on fatigue, while pain and friend support had only indirect effect on fatigue. Pain, nausea and vomiting, sleep disturbance, anxiety, and depression had positive total effect on fatigue, while family support, friend support, and Buddhist practices had negative total effect on fatigue. All eight predictors in the final model explained 80.4% of total variance in fatigue.

## Discussion

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A final model for predicting fatigue is discussed to test the hypothesized relationships among the variables and to predict fatigue. The discussion orders will be discussed in the final model followed by variables which were diagrammatically depicted from the left (exogenous variables) to the right (endogenous variables). The presentation arrangements are also consistent with the sequence of the eleven research hypotheses proposed.

*The Model for Predicting Fatigue*

When comparing the final model for predicting fatigue in this study and an explanatory model of fatigue in western women receiving adjuvant breast cancer chemotherapy of Berger and Walker (2001) which used the PIF Model as the conceptual framework, three main points were presented as follows:

Firstly, both studies found that biological variables including BMI, and Hb level, did not affect fatigue. However, Berger and Walker's study found that chemotherapy protocols containing adriamycin were directly associated with higher fatigue only in the first cycle of chemotherapy treatment, while this study did not.

Secondly, in this study, pain, nausea and vomiting, sleep disturbance, family support, friend support, Buddhist practices, anxiety, and depression had direct and/ or indirect effects on fatigue. Further, pain, nausea and vomiting, sleep disturbance, anxiety, and depression had a positive total effect on fatigue, while family support, friend support, and Buddhist practices had negative total effect on fatigue. These findings are partially consistent with Berger and Walker's study, which found that higher levels of symptom distress including negative moods, nausea, and sleep difficulty positively directly influenced on fatigue.

Thirdly, in this study, eight predictors in the final model (pain, nausea and vomiting, sleep disturbance, family support, friend support, Buddhist practices, anxiety, and depression) explained 80.4% of variance in fatigue, while all predictors (symptom distress, chemotherapy protocol, interpersonal relations behaviors, and confronting reaction to the diagnosis) in an explanatory model of fatigue (Berger & Walker, 2001) explained 42% to 62% of variance in fatigue which was lower than this study.

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Another interesting point, in this study, it was also revealed that Buddhist practices was a mediator variable between physical symptoms distress and psychological disturbances. This finding supports the notion that Buddhist practices, uniquely a trait of Thai culture, are important factors that help Thai people to cope with suffering and promote mental health (Tongprateep & Tipseankhun, 2002), which in turn help to reduce fatigue.

This study found that the PIF Model is limited on clarifying the relationships among influencing factors of fatigue to guide causal relationships. This limitation is of concern. Therefore, to develop a model for predicting fatigue, it is necessary to use the PIF Model with evidence from literature review. This will strengthen the developing causal relationships.

*Correlations Among Exogenous Variables*

Results from analysis, as shown in Figure 4-2, indicate that nausea and vomiting, sleep disturbance, family support, and friend support were all significantly correlated with each other; however, pain was significantly positively correlated with nausea and vomiting. That is, women who reported severe pain also reported severe nausea and vomiting. A possible explanation for the association of pain, and nausea and vomiting, is that pain sensations activate both the cerebral cortex and limbic system, which directly affects the vomiting center at reticular formation in the medulla oblongata (Guyton, 1991; Namjanta, 1992). This finding is consistent with O' Brien's study (2003) in breast cancer patients, showing that pain was often associated with nausea and vomiting ($r = .25$, $p < .01$).

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Pain was not significantly associated with sleep disturbance, family support, and friend support. The explanation of this phenomenon may be that two-thirds of the participants were in the early stages of breast cancer (stage I and II). Therefore, their pain experiences were more likely consequent upon chemotherapy treatment and age-specific (69.2% were in 41-60 year group), not cancer pain. For this reason, most participants in this study explained characteristics of their pain as headache, scalp ache, tightness at the surgical scar area, and muscle and joint pain that was unrelated to cancer pain. This may explain why participants experiencing low levels of pain with mean score of 2.01 (possible range 0 to 10) did not have disturbance of sleep, and did not demand special help or support from family or friends; thus, associations between pain and sleep disturbance, family support, and friend support were absent.

In this study, nausea and vomiting, sleep disturbance, family support, and friend support were interrelated. Nausea and vomiting was significantly positively associated with sleep disturbance, while nausea and vomiting and sleep disturbance were significantly negatively related to family support and friend support. That is, women who reported more severe nausea and vomiting also reported higher sleep disturbance, but less satisfaction with their family and friend support.

A possible explanation for these findings is that severity of nausea and vomiting may disturb patients' sleep (Suzuki et al., 1994). In the same way, inadequate sleep may contribute to stress that activates the sympathetic nervous system, anterior pituitary gland, and adrenal gland to secrete stress hormone (Andrykoski, 1990). This stress response elicits many body reactions including gastro-intestinal disturbance contributing to severe nausea and vomiting (Andrykoski, 1990). In addition, social support, including support from family and friend, had a

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stress buffering effect in increasing effective coping and adaptation, and improving health status (Cohen & Wills, 1985), contributing to a decrease of nausea and vomiting, and improving sleep.

Another possible explanation is that in Thai socio-culture, there are intimate relationships and responsibilities among family members. When a person suffers from any condition such as a serious illness and its treatment, Thais will provide a variety of support and care for their family members (Caffrey, 1992; Phengjard, 2001). This may decrease distress symptoms, contributing to participants' perception of low severity of nausea and vomiting, and sleep disturbance. These results were consistent with the findings of both Soivong (1995), and Pritsanapanurungsei (2000), who found a negative relationship between nausea and vomiting and adequate sleep. Further, Dalopakarn's study (2002) showed that in 160 Thai women with breast cancer, symptom distress, including nausea and vomiting, was negatively associated with sleep quality ($r = -.645$, $p < .01$), and social support ($r = -.33$, $p < .01$). Namjanta (1992) and Rhodes (1990) found that cancer patients who perceived high social support from family and friends, experienced low levels of nausea and vomiting. In like manner, Manning-Walsh (2005) examined the relationship between symptom distress and quality of life in 100 women with breast cancer and found that social support from family members and friends helped women to decrease the negative effects of symptom distress, including nausea and vomiting, and sleep difficulty.

This study found that friend support was significantly negatively associated with nausea and vomiting and sleep disturbance (see Figure 4-2). A possible explanation for these findings is that Thais diagnosed with cancer perceive life as

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threatening, hopeless, and painful (Kestsampun, 1993; Pongthavornkamol, 2000). Therefore, family and friends' attempts to minimize the patients' suffering by offering support, decrease negative symptoms, including nausea and vomiting, and sleep disturbance (Manning-Walsh, 2005).

In addition, this study found that family support was strongly positively associated with friend support (see Figure 4-2). This relationship was identified and added during path analysis. This finding was similar to Malathum's study (2001) in Thai older adults, who found that the participants who were satisfied with support from their family were less likely to expect support from others or friends. They tended to appreciate existing support from friends (Malathum, 2001). Hence, further study regarding the relationship between family support and friend support would be noteworthy.

Not surprisingly, results in this study found the relationship among symptoms, pain related to nausea and vomiting, and nausea and vomiting related to sleep disturbance. These findings support the recent studies that found symptoms frequently occur, not in isolation, but in clusters (Dodd, Miaskowski, & Lee, 2004; Dodd, Miaskowski, & Paul, 2001). A symptom cluster has been defined as three or more concurrent symptoms related to each other (Dodd, Miaskowski, & Paul, 2001). Further, symptom clusters might influence the occurrence of other symptoms (Dodd, Miaskowski, & Lee, 2004). Therefore, evaluating multiple symptoms and identifying symptom clusters in people with cancer are important components of understanding the symptoms, and should be considered in further study.

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*Effects of Exogenous Variables on Endogenous Variables*

The purpose of the present study was to examine a model for predicting fatigue among Thai women receiving adjuvant breast cancer chemotherapy. According to the PIF model and literature review, variables including the chemotherapy protocol, BMI, hemoglobin levels, pain, nausea and vomiting, family support, friend support, Buddhist practices, anxiety, and depression were hypothesized to have an effect on fatigue. The proposed model was developed to optimize prediction of fatigue, but also to investigate causal structures among predicting variables as shown in Figure 2-2.

Results from path analysis through the EQS 6.1 program showed that the direct causal pathways from chemotherapy protocol, BMI, hemoglobin levels, pain, and friend support were not supported in the final model; instead, the effect of pain on fatigue was demonstrated to be mediated through Buddhist practices, anxiety, and depression (see Figure 4-2). Similarly, the effect of friend support on fatigue was mediated through Buddhist practices and anxiety. In addition, nausea and vomiting had both direct and indirect effects on fatigue through Buddhist practices, and anxiety. Also, sleep disturbance had direct and indirect effects on fatigue through anxiety, while family support had both direct and indirect effects on fatigue through depression, as shown in Figure 4-2.

Due to the guidelines for determining the strength of path coefficients by Kline (1998), the standardized path coefficient with absolute values less than .10 indicated a “small” effect; values around .30 had a “medium” effect, while a value of

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.50 or more indicated a "large" effect. Using these guidelines, anxiety had a large effect (.57) on fatigue, followed by Buddhist practices, nausea and vomiting, depression, sleep disturbance, and pain, which had medium effect (-.41, .32, .27, .23, .20, respectively). Moreover, friend support, and family support had a small effect on fatigue (-.18, -.14, respectively) (see Table 4-13).

*Effect of Chemotherapy Protocol on Fatigue*

Analysis results in the final model revealed that the chemotherapy protocol had no effect on fatigue. That is, women who received intravenous adriamycin containing regimens or not, reported no difference in their levels of fatigue. This finding was consistent with Greene and colleagues' study (1994) and Piper's prospective study (1993), which report no significant difference in intensity of fatigue symptom related to whether adriamycin was included in the treatment protocol for breast cancer.

Berger and Walker's prospective study (2001) in 60 women during the first three cycles of adjuvant chemotherapy for breast cancer, found that chemotherapy including adriamycin had a direct effect on fatigue during the first treatment. A possible explanation for these different findings is that more than 85% of participants in the present study received more than one cycle of chemotherapy, and about only 14% received the first treatment of chemotherapy (Table 4-1). Thus, most participants living with a fatigue symptom for a long time may adjust their tolerance of this symptom and alter their perception of its intensity and level of distress (Rustoen, Wahl, Hanestad et al., 2004; Visser, Smets, Sprangers, & de Haes, 2000). The participants therefore, perceived low levels of fatigue on total and all subscales (see

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Table 4-5). In addition, other factors than the protocol may have influenced fatigue at subsequent treatment times.

*Effect of Body Mass Index (BMI) on Fatigue*

Contrary to that which was hypothesized, BMI had no direct effect on fatigue. This finding did not support previous studies, which reported relationships between fatigue and weight loss (Blesch et al., 1991). Berger and Walker (2001) found that BMI had a significant contribution to fatigue ($\beta$ = .19, P = .10) during the first cycle of adjuvant breast cancer chemotherapy.

However, the finding of this study was similar to Dalopakarn's (2002) finding that nutritional status in terms of BMI was not correlated to fatigue in 160 Thai women with breast cancer. The reason for this finding was BMI may not be adequate to determine patients' nutritional status, because body weight alone can be deceivingly affected by edema, ascitis, or dehydration (Robuck & Fleetwood, 1992). Moreover, Ottery (1995) found that identifying any recent changes in oral intake or recent weight loss (10% of body weight) is useful to confirm nutritional status. The percent of weight loss may reflect nutritional status and thus be examined for further study.

*Effect of Hemoglobin Level on Fatigue*

The analysis showed that hemoglobin level had no effect on fatigue, and so did not support the hypothesized model. The finding was similar to studies by Berger (1996), Berger & Walker (2001), Blesch and colleagues (1991), and Dalopakarn

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(2002). These studies found that hemoglobin level was not a significant predictor of fatigue.

A possible explanation for these inconsistent findings regarding the correlations between degree of anemia and fatigue intensity was probably a factor affecting fatigue only when patient's hemoglobin level was generally well below normal (Bruera & MacDonald, 1988). Cella and colleagues (2002), Lind and colleague (2002), and Jacobsen and colleagues (2004) support this explanation, as they found that cancer patients experiencing greater anemic level (hemoglobin level < 10 gm/dL) were significantly associated with increases in fatigue scores. Since, hemoglobin levels of the participants in the present study were near normal level (Hb level ≥ 12 gm/dL) as mean scores of 11.84 gm/dL, consequently, hemoglobin level had no effect on fatigue.

Further, an exploratory study to determine physiologic variables predicting fatigue in hematologic malignancies and solid tumors including breast cancer was confirmed by Mendoza and colleagues (1999). They found that hemoglobin level was a significant predictor of fatigue ($\beta = -.20$, $p < .05$) for the hemotologic groups, but not significant in solid tumors. Normally, hematologic malignant groups had lower hemoglobin levels than those with solid tumors. These results also confirm the notion that hemoglobin level was probably a factor affecting fatigue only when the patient's hemoglobin level was greatly below normal, as stated earlier.

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*Effect of Pain on Fatigue*

Contrary to that which was hypothesized, pain had no direct effect on fatigue. However, pain had a small negative indirect effect on fatigue through

Buddhist practices ($\gamma = -.19$, $p < .01$), and a small positive indirect effect on fatigue through anxiety ($\gamma = .15$, $p < .01$), and depression ($\gamma = .12$, $p < .05$) (see Figure 4-2 and Table 4-13), indicating that women who experienced high levels of pain contributed to perceiving high levels of depression and anxiety. Severity of pain affected women by causing them to decrease Buddhist practices. Low performance of Buddhist practices contributed to severity of fatigue. Also, high levels of depression and anxiety affected women to report high levels of fatigue.

Pedhazur (1982) recommended that when an interpretation is made, not only the direct effect but also the total effect including direct and indirect effects of a variable affecting a given endogenous variable should be used; using only the direct effect for interpretation might be misleading. Therefore, the indirect effect of pain is important and should be considered.

The finding that pain had no direct effect on fatigue is consistent with O'Brien's (2003), who found that pain did not contribute to fatigue. Even though, pain had no direct effect in the present study, pain had an indirect effect on fatigue through anxiety as well as through depression (Table 4-13). Consistent findings with Ahles & Martin's (1992), Gaston-Johansson and colleagues' (1999), Hann and colleagues' (2002), and Spiegel, Sands, and Koopman's (1994), found that worse pain was related to high levels of depression and anxiety, as well as that pain preceded depression (Ciaramella & Poli, 2001). Additionally, the greater the depressive symptoms and the higher level of anxiety, the greater increase in fatigue (Hann, Jacobsen, Martin, Kronin, et al., 1997).

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*Effect of Nausea and Vomiting on Fatigue*

As hypothesized, nausea and vomiting had a small positive direct effect on fatigue ($\gamma = .10, p < .05$), and had a medium negative indirect effect on fatigue through Buddhist practices ($\gamma = -.27, p < .001$), as well as a small positive indirect effect on fatigue through anxiety ($\gamma = .19, p < .01$), but not through depression (see Figure 4-2 and Table 4-13). These results could be interpreted as 1) the higher the severity of nausea and vomiting women reported, the higher the level of fatigue that was perceived; 2) severity of nausea and vomiting contributed to decrease women's Buddhist practices, and increase their level of anxiety; and 3) increasing Buddhist practices and decreasing anxiety affected women's perception of fatigue as at a lower level.

Similar findings were found in literature including Berger and Walker (2001), Dalopakarn (2002), and Lam (1997), who reported that symptom distress including pain, and nausea and vomiting was positively correlated to psychological distress symptoms including depression and anxiety. In addition, symptom distress had a significant positive direct effect on psychological symptoms (Lam, 1997). Further, physical symptom distress had a significant positive direct effect on fatigue (Berger and Walker, 2001; Dalopakarn, 2002; Lam, 1997), and psychological symptoms had a significant positive direct effect on fatigue (Dalopakarn, 2002; Lam, 1997).

A possible explanation is, when facing distress symptoms from cancer and chemotherapy, including nausea and vomiting, Thai women with cancer often perform Buddhist practices such as merit making, chanting and meditation as coping

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strategies to deal with suffering from treatment and side effects in order to decrease psychological disturbances (Chaithaneeyachati, 2002; Chunlestskul, 1998; Junda, 2004; Kaveevivitchai, 1993; Pongpruk, 1998; Tiansawad and Jaruwacharapanichkul, 1997). However, perceived high severity of symptoms including pain, and nausea and vomiting, influencing participants' health might limit their abilities to engage in a range of religious activities or practices and interfere with their concentration to practice meditation. In this study found that, because items in the Buddhist Practice Scale indicated activities related to Buddhist religion that individuals perform during treatment with chemotherapy, women need energy or physical abilities to perform them. Therefore, women who perceived a low severity of pain, and nausea and vomiting, performed increased Buddhist practices in turn to decrease anxiety and fatigue.

*Effect of Sleep Disturbance on Fatigue*

As hypothesized, sleep disturbance had a small positive direct effect on fatigue ($\gamma = .09$, $p < .05$), and had a positive indirect effect through anxiety ($\gamma = .25$, $p < .001$), but not through Buddhist practices and depression (see Figure 4-2 and Table 4-13). This means the high level of sleep disturbance contributed to a perception of high level of fatigue, as well as contributing to high anxiety, and that high level of anxiety affected the perception of high levels of fatigue.

A possible explanation for sleep disturbance contributing to fatigue was that during sleep, body organs decrease energy use, and increase blood supply and energy to the brain, which make a person feel refreshed and not fatigued (Gall, 1996). Therefore, inadequate sleep causing exhaustion may lead to physical changes of

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deterioratation and inevitable fatigue (Dixon & Hickey, 1993; Nail & Winningham, 1995). This finding supports Berger and Farr's (1999), Berger and Higginbotham's (2000), Broeckel and colleagues' (1998), Davidson and colleagues' (2002), and Pritsanapanurungsei's (2000) studies, which found that sleep disturbance or sleep problems are positively associated with fatigue. Dalopakarn (2002) also found that sleep quality was a negative predictor of fatigue ($\beta = -.159$, $p < .01$) in Thai women with breast cancer. Further, Redeker, Lev and Ruggiero (2000) findings support the present study in that sleep disturbance, in terms of insomnia, fatigue, and anxiety, are positively correlated with one another ($r = .26$ to $r = .69$, $p < .001$).

However, the present finding that sleep disturbance did not affect depression was contrasted with the finding of Dalopakarn (2002), showing that quality of sleep was negatively related to depression in women with breast cancer receiving chemotherapy ($r = -.48$, $p < .01$).

*Effect of Family Support on Fatigue*

As hypothesized, family support had a small negative direct effect on fatigue ($\gamma = -.09$, $p < .05$), as well as a small indirect effect on fatigue through depression ($\gamma = -.17$, $p < .01$), but not through anxiety (see Figure 4-2 and Table 4-13). Thus, the lower the family support women perceived, the higher the level of fatigue was reported. Also lower family support contributed to higher depression; and the higher the level of depression affected perceived fatigue.

A plausible explanation was, family provided the family member with breast cancer an opportunity to rest by assisting in their daily household responsibilities, contributing to decreased fatigue. Further, when a family member with breast cancer

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suffered, other family members responded by providing a variety of support to make the sick member feel comfortable and confident in fighting against stress (Charoenkitkarn, 2000). This may be a beneficial effect on coping, adaptation, as well as physical and psychological well-being (Cohen & Wills, 1985). Thus, family support had both a powerful negative direct effect on fatigue and depression, as well as a negative indirect effect on fatigue through the mediating effect of depression.

Family support had an indirect effect on fatigue through depression. This result was consistent with the study suggesting that when facing stressful situations in life including cancer diagnosis, individuals who did not have social support tended to develop greater depression, compared to those who had a strong family (Elliott, Herrick, & Witty, 1992; Elliott & Shewchuk, 1995; Hwang et al., 2000).

Moreover, another possible explanation is, family support provided greater temporal stability than did friend support. This explanation was supported by Stice and colleagues (2004), who found in 496 adolescent girls that deficits in family support, in terms of parental support, predicted subsequent increases in depressive symptoms over a 2-year period, but deficit in peer support did not predict subsequent increases in depressive symptoms.

Therefore, support contributed to the physical assistance that family and friends could offer. In addition, support also contributed to decreased psychological distress and improve mental health.

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*Effect of Friend Support on Fatigue*

Even though, the results showed that friend support had no direct effect on fatigue, it had a medium positive indirect effect on fatigue through Buddhist practices

($\gamma = .23$, $p < .01$), as well as a weak negative indirect effect on fatigue through anxiety ($\gamma = -.16$, $p < .01$), but not through depression. That is, participants who perceived high friend support frequently performed Buddhist practices, which lead to low fatigue. Further, participants who perceived low friend support reported high anxiety that contributed to perceived high fatigue.

A possible explanation for the findings was that, in this study, approximately 64.7% of participants had responsibility in paid employment (see Table 4-1). Therefore, some participants faced financial constraints when they could not work due to their limited physical function from cancer and its treatment effects (Pongthavornkamol, 2000). Additionally, information gained from observation and communication during data collection, found that participants tended to identify their co-workers and peers or other breast cancer patients, as their close friends, thus giving support to them during their treatment. During chemotherapy treatment, their friends or co-workers often assigned them limited responsibilities, as their co-workers were concerned that the patients would not complete their work. In some cases, patients received sympathy from their friends or co-workers by being relieved from their regular schedule, particularly during treatment with chemotherapy. Support such as this helped participants feel better and dissipated negative emotions and financial concerns, contributing to decreased anxiety.

An explanation that friend support did not predict or decrease depressive symptoms was that, friend support did not stabilities as much as family support. This finding was consistent with Stice and colleagues (2004), who reported that deficits in parental support predicted subsequent increased depressive symptoms over a 2-year period, but deficit in peer support did not increase depressive symptoms.

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The direct effect of friend support on Buddhist practices was added to the model, according to the Lagrange Multiplier Test (LM Test). In the literature reviewed, this relationship between friend support and Buddhist practices was absent. However, findings from previous studies in patients with cancer (Chan, Molassiotis, Yam, Chan & Lam, 2001; Lugton, 1997), and HIV/AIDS (Sandstrom, 1996), found that support from friends or other patients increased the sense of personal competence (Lugton, 1997; Sandstrom, 1996), and diminished fear (Chan, Molassiotis, Yam, Chan & Lam, 2001; Lugton, 1997; Sandstrom, 1996; Whittemore, Rankin, Callahan, Leder & Carroll, 2000). These factors may contribute to improving mental health by initiating and enhancing coping behaviors, including Buddhist practices. Another possible explanation was that friends or other patients may encourage or persuade women to perform Buddhist practices to relieve their distress and suffering.

Findings about social support including family support and friend support in this study verified previous studies (Cohen & Wills, 1985; Norbeck, 1988; Uphold, Lenz, & Soeken, 2000) showing that social support was a predictor of physical and psychological well-being. Regarding the cultural aspect, this study suggested that family and friend support were important to Thai women. However, family and friend support had only a small total effect on fatigue. An explanation for these findings is that social support in this study, including only family and friends, might be necessary but not sufficient. Support from health care professionals should be included in measuring social support, as cancer patients needed specific information to manage symptoms from cancer and chemotherapy treatment that they are not likely to receive from family or friends. Health care professionals were also a valuable

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source of emotional support in addition to being the main source of information support (Fridfinnsdottir, 1997).

Another explanation is the measurement issue. The family and the friend support questionnaires used in this study measure general support. Both questionnaires measure only three types of social support, comprising emotional, instrumental, and appraisal support, but not illness-specific supports. They may be appropriate for individuals who have no chronic illness. Thus, in this study, family and friend support had only a small total effect on fatigue. Social support questionnaires, including items that measure informational support, which related specifically to managing side effects from treatment for the chronic illness condition, should be considered for further study.

*Effects of Mediating Variables on Endogenous Variables*

*Effect of Buddhist Practices on Fatigue*

As hypothesized, Buddhist practices had a negative direct effect both on fatigue ($\beta = -.23$, $p < .01$) and on anxiety ($\beta = -.32$, $p < .001$), as well as an indirect effect on fatigue through anxiety ($\beta = -.18$, $p < .01$). Even though Buddhist practices had no direct effect on depression, it had an indirect effect on depression through anxiety ($\beta = -.20$, $p < .01$) (see Figure 4-2 and Table 4-10). That is, participants who frequently perform Buddhist practices report low fatigue and low anxiety. Further, those who frequently perform Buddhist practices report low anxiety, which contributes to low fatigue and low depression.

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An explanation for these findings was that Buddhist practices enable patients to be free from a sense of self, feel more peaceful, able to better concentrate, gain more emotional and mentally stability, and have more positive feelings toward life (Buddhasa, n.d.; Dhammapitika, 2003). Thus, religious belief and practices support an individual's well-being by providing hope (Bhanthumnavin et al., 1997; Tongprateep & Tipseankhun, 2002).

The results from this study suggest that Buddhist practices help Thai people cope with stressful circumstances and promote mindfulness to feel free from physical and psychological symptoms, including fatigue, anxiety and depression in a variety of types of illness, such as in breast cancer (Chaithaneeyachati, 2002; Kongsaktrakul, 2004; Pongpruk, 1998; Pritsanapanurungsie, 2000), in lung cancer (Kongsaktrakul, 2004), in AIDS (Dane, 1992), in rheumatoid arthritis (Petmaneechote, 2000), and in burn patients (Setakasikorn, 1997). Similarly, Jenkins and Pargament (1995) proposed religion as a resource for coping with cancer. In addition, religious activities help decrease the level of anxiety, hostility and social isolation, as well as higher levels of life satisfaction and perhaps a lower mortality rate.

Thai women easily adapt to living with fatigue, using Buddhist practices as coping strategies to deal with cancer and fatigue. This finding supports previous studies that Buddhist practices such as merit making, praying, listening to dharma tapes, and practicing meditation are effective strategies to manage fatigue in Thai breast cancer (Kongsaktrakul, 2004; Pritsanapanurungsie, 2000). It can be concluded that Buddhist practice consequent on Buddhist belief, a uniqueness of Thai culture, is an important factor for Thai people in dealing with suffering and stressful circumstances.

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*Effects of Anxiety on Fatigue*

As hypothesized, anxiety had both a large positive direct effect on fatigue ($\beta = .40$, $p < .001$), and on depression ($\beta = .65$, $p < .001$), as well as a positive indirect effect on fatigue through depression ($\beta = .17$, $p < .01$) (see Figure 4-2 and Table 4-10). This reflects the high anxiety women with breast cancer experience contributing to the severity of fatigue and depression.

A possible explanation of these findings was that the diagnosis of breast cancer was viewed as a threatening situation (Pongthavornkamol, 2000) contributing to psychological distress, the experience of physical symptom distress resulting from cancer and cancer treatment might further increasing the degree of existing psychological distress, including anxiety and depression (Hoskin, 1997; Schreier & Williams, 2004; Thompson & Shear, 1998). Consequently, anxiety and depression as psychological responses that reacted to stressors activate the sympathetic nervous system, anterior pituitary gland, and adrenal gland to release stress hormones, including cortisol, epinephrine and norepinephrine, contributing to somatic stress symptoms including fatigue (Guyton, 1991). Further, feelings of depression could also be experienced by cancer patients because of the sense of hopelessness that results from anxiety (Kelter, Schwecke, & Bostrom, 1999).

The findings in this study were consistent with previous studies (Blesch et al., 1991; Can, Durna, & Aydiner, 2004; Haghighat et al., 2003; Lam, 1997; Redeker, Lev, & Ruggiero, 2000), which found that anxiety was associated with fatigue, and therefore contributed to fatigue (Haghighat et al., 2003; Lam, 1997). Moreover, anxiety could trigger depression (Williams & Schreier, 2004).

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*Effect of Depression on Fatigue*

As hypothesized, depression had a medium positive direct effect on fatigue. The contribution of depression to fatigue in this study was consistent with previous studies, which reported positive relationships between depression and fatigue (Blesch et al., 1991 Can et al., 2004; Dalopakarn, 2002; Dimeo et al., 1997; Irvine et al., 1994; Redeker, Lev & Ruggiero, 2000) and depression was a predictor of fatigue (Akechi, et al., 1999; Dalopakarn, 2002; Haghighat et al., 2003; Irvine et al., 1994; Lam, 1997).

A possible explanation of this phenomenon was that depression overlaps with anxiety in many ways and the two variables are linked. Depression is an emotion with a strong physical side that often impairs in interpersonal relationships and occupational function, which contributes to hopelessness (Delay et al., 1981 as cited in Tongsawan, 2000; Kelter, Schwecke, & Bostrom, 1999). The same as stress response in anxiety, depression contributes to fatigue by depleting stored energy (Aistars, 1987, Ryden, 1977 as cited in Winningham et al., 1994).

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*Summary*

The model for predicting fatigue among Thai women with breast cancer was tested. The findings partially supported the PIF model. In the final model, among eight exogenous variables, three (chemotherapy protocol, BMI, and hemoglobin level) did not significantly affect fatigue. The others (pain, nausea and vomiting, sleep disturbance, family support, and friend support) contributed to fatigue directly and/or indirectly through three mediating variables (Buddhist practices, anxiety, and depression). These mediating variables also contributed to fatigue. These findings have been discussed based on theoretical and methodological aspects as well as on a review of previous related studies.

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