INTERRELATIONSHIPS AMONG PHYSICAL SYMPTOM DISTRESS, PSYCHOLOGICAL DISTRESS, AND FATIGUE IN WOMEN WITH BREAST CANCER UNDERGOING RADIATION THERAPY

By

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A thesis submitted in conformity with the requirements for the degree of Master of Science
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Interrelationships among physical symptom distress, psychological distress, and fatigue in women with breast cancer undergoing radiation therapy

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Abstract

This secondary analysis was designed to examine how physical symptom distress, psychological distress, age, and tamoxifen affected level of fatigue in 101 women with breast cancer undergoing the last week of radiation treatment. All women experienced fatigue. Results of path analyses indicated that (a) psychological distress has a direct effect on fatigue, (b) physical symptom distress has a direct effect on fatigue, as well as having an indirect effect through its effect on psychological distress, and (c) age has an indirect effect on fatigue through its negative impact on psychological distress. Physical symptom distress had the greatest causal effect on the level of fatigue. Given the limitations indicated, this study suggests that nursing interventions must be directed at identifying the effective strategies in reducing physical symptoms in order to prevent or reduce fatigue.
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Chapter I

Introduction

Fatigue is a commonly experienced symptom which generally functions as a mechanism to protect an individual from overwork or exhaustion: it can be resolved with rest or sleep (Piper, Lindsey, & Dodd, 1987; Vincent, Irvine, Graydon, & Bubela, 1993). However, individuals with cancer, especially those who are receiving active treatments, often experience fatigue which is persistent and not easily dissipated by a good night’s sleep. Therefore, fatigue loses its protective function and can have a profound impact on cancer patients’ quality of life. Fatigue has been found to have a negative effect on patients’ sense of well-being, valued relationships, ability to carry on usual daily activities, and compliance with treatments (Aistars, 1987; Irvine, Vincent, Graydon, Bubela, Thompson, 1994; Pickard-Holley, 1991; Piper, 1993; Winningham, et al., 1994).

Fatigue is one of the most common side-effects reported by cancer patients undergoing radiation therapy. Its prevalence is found to range from 63% to 100% (Blesch et al., 1991; Irvine et al., 1994; King, Nail, Dreamer, Strohl, & Johnson, 1985; Kubrucht, 1984). The level of fatigue increases throughout the course of radiation therapy (Greenberg, Sawicka, Eisenthal, & Ross, 1992; Haylock & Hart, 1979; King et al., 1985; Piper, Lindsey, Dodd, Ferketich, Paul, & Weller, 1989): it then gradually declines and returns to the pretreatment levels by three months after the completion of radiation therapy (King et al., 1985; Vincent et al., 1993).

Although the prevalence, duration, pattern, and consequences of fatigue in cancer patients undergoing radiation therapy have been identified in the literature, the exact mechanisms that produce fatigue are not yet known. Research to date has shown that fatigue
is associated with physical symptom distress (Blesch et al., 1991; Graydon, 1994; Irvine et al., 1994; Jamar, 1989; McCorkle, & Young, 1978; Vincent et al., 1993) and with psychological distress in patients undergoing chemotherapy or radiation therapy (Blesch et al., 1991; Fobair et al., 1986; Greenberg et al., 1992; Irvine et al., 1994; Jamar, 1989; Knobf, 1986; McCorkle, & Young, 1978; Nerenz, Leventhal, & Love, 1982; Pickard-Holley, 1991; Vincent et al., 1993). Moreover, there is evidence to suggest that physical symptom distress and psychological distress in cancer patients undergoing treatment are interrelated (Graydon, 1994; Love, Leventhal, Easterling, & Nerenz, 1989; Nerenz et al., 1982; Oberst, Hughes, Chang, & McCubbin, 1991). However, knowledge is lacking on how physical symptom distress and psychological distress together contribute to fatigue. A clear understanding of the combined contribution of physical symptom distress and psychological distress to fatigue is essential to provide direction for future interventions to reduce this problem. In addition, age and hormone medications such as tamoxifen have been postulated to have an influence on the level of fatigue in cancer patients receiving active treatments (Piper, 1993; Piper et al., 1987). However, research to date has failed to support consistent relationships among these variables. Therefore, it is necessary to study the relationships among hormone medications, age, and fatigue. In order to understand the relationships among physical symptom distress, psychological distress, age, fatigue, and hormone medications, a conceptual model was developed based upon a modified Piper's Integrated Fatigue Model and the model was tested in this study using path analysis.

Breast cancer is one of the most prevalent forms of cancer in women. Following a breast conserving surgery and sometimes a modified radical mastectomy, patients are treated
with radiation therapy for local control of the disease. The purpose of radiation therapy is to eradicate microscopic tumor cells that may remain in the breast after surgery (Dest, & Fisher, 1994; Wilson, & Strohl, 1982). Since fatigue is a common side effect of radiation therapy, women with breast cancer receiving radiation therapy provided an unique opportunity to study the interrelationships among physical symptom distress, psychological distress, hormone medications, age and fatigue.

**Research Problem Statement**

Although fatigue has been found to be associated with physical symptom distress and psychological distress in cancer patients undergoing active treatment, knowledge is lacking on how physical symptom distress and psychological distress together contribute to the fatigue of women with breast cancer. Moreover, it is not clear whether age and hormone medications such as tamoxifen have effects on physical symptom distress, psychological distress, and fatigue. The purpose of this study was to test the extent to which the level of fatigue in women with breast cancer undergoing radiation therapy was directly related to the degrees of physical symptom distress and psychological distress, and the extent to which the level of fatigue was indirectly related to the effect of physical symptom distress on psychological distress. The effects of age and hormone medication, specially tamoxifen, on physical symptom distress, psychological distress, and fatigue were also tested.

**Review of Relevant Literature**

The empirical literature regarding the relationships among fatigue, physical symptom distress, psychological distress, tamoxifen, and age in cancer patients receiving active treatments was summarized here. The following domains were chosen to review because of their relevance to this study: (a) the relationship between fatigue and physical symptom...
distress, (b) the relationship between fatigue and psychological distress, (c) the relationship between physical symptom distress and psychological distress, (d) the effect of tamoxifen on fatigue, physical symptom distress, and psychological distress, and (e) the effect of age on fatigue, physical symptom distress, and psychological distress.

**Fatigue and Physical Symptom Distress**

There is empirical evidence indicating that fatigue in cancer patients undergoing active treatment correlates with physical symptom distress. In six prospective studies (Blesch et al., 1991; Graydon, 1994; Irvine et al., 1994; Jamar, 1989; McCorkle and Young, 1978; Vincent et al., 1993), findings consistently showed that the level of fatigue is moderately correlated with the degree of physical symptom distress.

Specific physical symptom distress and fatigue. McCorkle and Young (1978) conducted the initial study to assess the relationship between fatigue and distress from specific physical symptoms. They found that fatigue was positively related to the degree of distress from loss of appetite (r = 0.61) and insomnia (r = 0.55) in 52 cancer patients undergoing chemotherapy or radiation therapy, as well as in eight patients with other medical diagnoses. The patients ranged in age from 18 to 89 years with the majority between 50 and 69 years of age. Blesch et al. (1991) found a moderate positive correlation between the intensity of fatigue and the severity of pain (r = 0.48) in 44 patients with breast cancer and 33 patients with lung cancer undergoing chemotherapy or radiation therapy. The mean age was 51 years (range 24 - 69) in patients with breast cancer and was 58 (range in 38 - 74) in patients with lung cancer; the majority of patients with lung cancer were male (78.5%) and all patients with breast cancer were female.
Overall physical symptom distress and fatigue. In contrast to the previous studies which examined fatigue in relation to the distress of specific physical symptoms, the following studies examined the relationship between fatigue and overall physical symptom distress. Jamar (1989), who studied fatigue in 16 women aged from 36 to 66 years receiving chemotherapy for ovarian cancer, found a moderate positive correlation between fatigue and the degree of physical symptom distress ($r = 0.62$). Consistent with Jamar's finding, Graydon (1994), who studied the quality of life for 53 women who had breast-conserving surgery followed by radiation therapy for breast cancer, also found that fatigue was moderately correlated with the degree of physical symptom distress ($r = 0.56$). The mean age of the patients was 57 years (range 37 - 82).

Two studies found that physical symptom distress was a significant predictor of fatigue, i.e. the more physical symptom distress the patients experienced, the more fatigue they perceived. In a study of 101 cancer patients receiving chemotherapy or radiation therapy for breast, lung, cervical, ovarian, or endometrial cancer, Irvine et al. (1994) found that the degree of physical symptom distress was moderately correlated with fatigue ($r = 0.55$). This study then used a step-wise multiple regression analysis to determine which variables best predicted fatigue: it found that physical symptom distress explained 29% of the variance in the level of fatigue. The mean age of the patients was 55 years (range 25 - 77); the majority of the patients were female (96%) and had breast cancer (62%). Similarly, in the study of 131 cancer patients undergoing radiation therapy for lymphoma, breast, ovarian, or prostate cancer, Vincent et al. (1993) found that physical symptom distress, psychological distress, and the effectiveness of fatigue relief strategies together explained 47% of the variance in the level of fatigue during the last week of radiation therapy. The mean age of the patients was 61
years (range 33 - 84); the majority of the patients were female (82%) and had breast cancer (79%).

Fatigue and Psychological Distress

Studies investigating fatigue in cancer patients undergoing active treatments found that fatigue correlated with overall psychological distress and specifically depression and that overall psychological distress was a predictor of fatigue. Several researchers examined the relationship between fatigue and psychological distress and found a moderate positive correlation between fatigue and psychological distress (range from \( r = 0.47 \) to \( r = 0.64 \)) (Blesch et al., 1991; Irvine et al., 1994; Jamar, 1989; McCorkle and Young, 1978; and Vincent et al., 1993). Consistent with the above findings, Nerenz et al., (1982), who aimed to identify factors contributing to psychological distress in 61 cancer patients receiving chemotherapy for malignant lymphoma, found that vague, diffuse physical symptoms such as fatigue were more strongly associated with the degree of psychological distress than were acute, specific physical symptoms such as nausea and vomiting. The mean age of these 41 male and 20 female patients was 52 years (range 22 - 81).

Similar to physical symptom distress, psychological distress was also found to be a significant predictor of fatigue in cancer patients undergoing chemotherapy or radiation therapy (Irvine et al., 1994; Vincent et al., 1993). For example, by using a step-wise multiple regression analysis, Irvine et al. found that psychological distress explained an additional 4% of variance in the level of fatigue above that accounted for by physical symptom distress. Physical symptom distress and psychological distress together explained 33% of variance in the level of fatigue.
There are four studies examining the relationship between fatigue and depression. By studying psychosocial problems in 403 patients receiving radiation and/or chemotherapy for Hodgkin's disease, Fobair et al. (1986) found that loss of energy (i.e. fatigue) was strongly related to the degree of depression \((r = 0.95)\). The mean age of the patients was 36 years (range 15 - 78). Knobf (1986) also found that there was a correlation between fatigue and depression in 78 women with breast cancer receiving chemotherapy, with the mean age of 51 years (range 41 - 61). However, Pickard-Holley (1991) examined relationships between fatigue and various physical and psychological factors in 12 women with ovarian cancer undergoing chemotherapy and found that there was no relationship between fatigue and depression. The mean age of the patients was 55 (range 43 - 73). Greenberg et al. (1992) also found that fatigue was not associated with depression in 15 women with breast cancer receiving radiation therapy, with the mean age of 46 years (range 38 - 56). However, the sample sizes in both Pickard-Holley's and Greenberg et al. 's studies were small and the level of depression experienced by the patients in both studies was low which may have contributed to the lack of relationship between fatigue and depression.

**Physical Symptom Distress and Psychological Distress.**

Although research to date has shown that fatigue is associated with physical symptom distress as well as with psychological distress in cancer patients undergoing active treatments, a number of studies have provided evidence that physical symptom distress and psychological distress are interrelated (Graydon, 1994; Irvine et al., 1994; Love et al., 1989; Nerenz et al., 1982; Oberst et al., 1991). In a study of 61 cancer patients with the mean age of 52 years (range 22 - 81) receiving chemotherapy for malignant lymphoma, Nerenz et al. (1982) found that the number of physical side effects experienced, but not the degree of each
specific physical symptom, was positively correlated with psychological distress ($r = 0.55$). In contrast to Nerenz et al. (1982) who examined the relationship between each specific physical symptom distress and psychological distress, Love et al. (1989) studied the degree of overall physical symptom distress in relation to psychological distress. The latter study found that the degree of overall physical symptom distress was positively associated ($r = 0.36$) with psychological distress in 238 cancer patients having chemotherapy for breast cancer or malignant lymphoma. Their mean age was 52 years (range 19 - 83).

A significant relationship was also documented between physical symptom distress and psychological distress in cancer patients receiving radiation therapy. Oberst et al. (1991) found that physical symptom distress was highly correlated with psychological distress ($r = 0.71$) in 73 cancer patients receiving radiation therapy for breast, prostate, cervical, brain, or other solid tumors. The mean age of these 37 male and 35 female patients was 57 years (range 20 - 80). Graydon (1994) also found a moderate correlation between physical symptom distress and psychological distress ($r = 0.53$) in a study of 53 breast cancer women undergoing radiation therapy with the mean age of 57 years (range 37 - 82). Those subjects who experienced a higher level of physical symptom distress tended to have higher psychological distress. Consistent with the above studies, Irvine et al. (1994) found that the degree of physical symptom distress was moderately correlated with psychological distress ($r = 0.53$) in 101 cancer patients receiving chemotherapy or radiation therapy for breast, lung, cervical, ovarian, and endometrial cancer. The mean age of these patients was 55 years (range 25 - 77).

Hormone Medication

Tamoxifen, an anti-estrogen hormone medication, has been used as an adjuvant treatment in breast cancer. While no investigation of the relationship between tamoxifen and
fatigue has been undertaken, the literature indicates that about 4.4% of patients stop their tamoxifen therapy (Love, 1989) as a result of the distressing physical and psychological symptoms including nausea, hot flashes, edema, vaginitis, and depression (Crabbe, 1996; Doig, 1988; Love, 1989; McDaniel, Rhodes, Nelson, & Hanson, 1995). Because of its adverse effects, tamoxifen therapy may influence the levels of physical symptom distress and psychological distress in cancer patients undergoing active treatments.

**Age**

Age has been postulated as having an influence on fatigue. In the survey of 403 patients who received radiation therapy and/or chemotherapy for treatment of Hodgkin's disease, Fobair, et al. (1986) found that older patients (> 34 years old) required a longer time to recover from energy loss than younger patients ($p = 0.01$). However, in a number of studies, older cancer patients tend to experience less physical symptom distress than younger patients, i.e. older patients tend to report fewer numbers of side effects (Love et al., 1989; Nerenz, Love, Leventhal, & Easterling, 1986). As well, older patients have experienced less intense physical symptom distress and psychological distress than younger patients (Degner, & Sloan, 1995; McMillan, 1989; Tishelman, Taube, & Sachs, 1991). Because of the limited and contradictory evidence, the relationship between age and fatigue is still not clear and needed to be investigated further.

**Summary**

In summary, there is good empirical evidence for cancer patients undergoing active treatments that level of fatigue is moderately correlated with physical symptom distress and psychological distress. There is also evidence of a moderate to high correlation between physical symptom distress and psychological distress. However, knowledge is lacking of how
physical symptom distress and psychological distress together contribute to fatigue. 

Therefore, this study was designed to test whether physical symptom distress has an indirect effect on fatigue through its effect on psychological distress. While hormone medications, specifically tamoxifen, and age have been postulated to have an influence on the level of fatigue, research to date has failed to support consistent relationships among these variables. Therefore, the relationship of hormone medication and age on fatigue was tested in this study.

Conceptual Framework

Fatigue is defined as a self-recognized phenomenon involving subjective feelings of weariness, weakness, lack of energy, and exhaustion (Aistars, 1987; Irvine et al., 1994; Winningham et al., 1994); it varies in degree, frequency, and duration (Irvine et al., 1994; Piper, Lindsey, & Dodd, 1987). A modified version of Piper’s Integrated Fatigue Model (Piper, 1993; Piper et al., 1987) provided the conceptual framework for this study. According to Piper’s Integrated Fatigue Model, a number of physiological and psychosocial factors may interact or be synergistic in contributing to an individual’s perception of fatigue. The experience of fatigue can be influenced by symptom patterns, psychological patterns, treatment patterns, and innate host factors. While Piper’s fatigue model does not clearly indicate the interrelationships among the potential factors contributing to fatigue, the relationships among physical symptom distress, psychological distress, tamoxifen, age and fatigue are proposed based on the findings of previous research studies.

Physical symptom distress is defined as the degree of discomfort from a specific physical symptom (McCorkle, & Young, 1978; Rhodes, & Watson, 1987). According to Piper’s fatigue model (Piper, 1993; Piper et al., 1987), the experience of physical symptoms, such as nausea and vomiting, pain, dyspnea, or insomnia, is postulated to have an influence
on fatigue. The experience of physical symptoms may increase the expenditure of energy thus causing fatigue (Hart, & Freel, 1982).

Psychological distress is defined as the degree of emotional response to illness and treatment (Knobf, 1986; Rhodes, & Watson, 1987). According to Piper's fatigue model (Piper, 1993; Piper et al., 1987), psychological responses to illness and/or therapy can contribute to overall weakness and result in fatigue. Psychological distress is thought to deplete energy stores thus causing fatigue; people with higher psychological distress may experience more fatigue than those with lower distress (Aistars, 1987). As the diagnosis of cancer is viewed as threatening, the experience of physical symptom distress resulting from the illness and/or the treatment may further increase the degree of already existing psychological distress. Therefore, patients who experience distress from physical symptoms may have a higher level of fatigue than those who do not experience distress from physical symptoms (Nail, & King, 1987).

Other factors that may influence the level of fatigue include hormone medications and age. According to Piper's fatigue model (Piper, 1993; Piper et al., 1987), the level of fatigue can be influenced by medical treatments. Tamoxifen is an anti-estrogen hormone medication which is used as an adjuvant treatment to inhibit the growth of breast cancer cells (Love, 1989). Treatment with tamoxifen may intensify fatigue as a result of the experience of the physical and psychological discomfort from its side effects. In addition, the anti-estrogen actions of tamoxifen on body systems, causing alterations in body functioning may lead to an increase in the expenditure of energy thus causing fatigue (Hart, & Freel, 1982).

Age, an innate host factor, has been postulated as a risk factor for fatigue in Piper's fatigue model. However, because of the limited and contradictory evidence, it is not clear
whether one should expect fatigue to be more or less severe in older patients. While being older is thought to be a risk factor for persistent low energy (Fobair et al., 1986), older people are also thought to experience less physical symptom distress and psychological distress as they are more likely to have experienced chronic illnesses and to have learned ways of coping (Given, & Keilman, 1990). Based on the findings of previous research studies, age may have a negative effect on physical symptom distress and psychological distress, and may have a positive effect on fatigue.

Conceptually, the level of fatigue in women with breast cancer undergoing radiation therapy may be affected by physical symptom distress and psychological distress; the extent of physical symptom distress may affect the level of psychological distress. In addition, hormone medication such as tamoxifen and age may influence the levels of physical symptom distress and psychological distress, as well as fatigue. This study examined (1) the extent to which the level of fatigue was influenced directly by physical symptom distress and psychological distress and (2) the extent to which the level of fatigue was influenced indirectly by the effect of physical symptom distress on psychological distress. The effects of age and hormonal medications, specifically tamoxifen, on physical symptom distress, psychological distress, and fatigue was also examined. The conceptual model that was tested is shown in Figure 1.
This study was designed to test the conceptual model (i.e. Figure 1) by testing the following hypotheses:

1. The level of physical symptom distress and the level of psychological distress have direct positive effects on the level of fatigue in women with breast cancer undergoing radiation therapy.
2. The level of physical symptom distress has a direct positive effect on the level of psychological distress in women with breast cancer undergoing radiation therapy.

3. Treatment with tamoxifen has a direct positive effect on the levels of physical symptom distress, psychological distress, and fatigue in women with breast cancer undergoing radiation therapy.

4. Age has a direct negative effect on the levels of physical symptom distress and psychological distress and has a direct positive effect on the level of fatigue in women with breast cancer undergoing radiation therapy.

**Research Significance**

Through a better understanding of how physical symptom distress and psychological distress contribute to fatigue in cancer patients receiving radiation therapy, the ultimate purpose of this study was to provide directions to intervene in physical symptom and psychological distress. Interventions can then be developed to manage physical symptom and psychological distress which may prevent or reduce fatigue in cancer patients.
Chapter II

Methods and Procedures

Research Design

This study involved secondary analysis of data from a longitudinal correlational study of fatigue in cancer patients undergoing radiation therapy (Vincent et al., 1993). In the study conducted by Vincent et al., cancer patients receiving radiation therapy were surveyed at six points in time: pre-treatment (Time 1), 1st week of treatment (Time 2), 14 days of treatment (Time 3), last week of treatment (Time 4), 3 months post-treatment (Time 5), and 6 months post-treatment (Time 6). Data on fatigue, physical symptom distress, and psychological distress were measured at each Time period; data on age and tamoxifen were collected at the initial interview (i.e. Time 1). According to Vincent et al. (1993), the level of fatigue increased at 1st week of treatment (Time 2) and at 14 days of treatment (Time 3), and reached a peak at the last week of treatment (Time 4). The levels of fatigue at Time 2 to Time 4 were significantly higher than at Time 1. In order to determine the effects of physical symptom distress and psychological distress on the level of fatigue, this secondary analysis study will thus use data on fatigue, physical symptom distress, and psychological distress at Time 4; that is, a time when the level of fatigue was the highest.

Sample and Setting.

This secondary analysis study consisted of 109 women with breast cancer who were included in Vincent et al.'s (1993) study. In the initial study conducted by Vincent et al., a convenient sample was recruited at two centers designated as major treatment centers for oncology located in a metropolitan area, in southern Ontario, Canada. The sample consisted of 131 adult patients who (1) had a histological diagnosis of breast cancer, prostate cancer,
ovarian cancer, or lymphoma and were receiving a 4- or 5-week course of external radiation therapy, (2) could speak English, and (3) had no brain metastases, chronic renal failure, or psychiatric illness.

Ethical Considerations.

For the study of Vincent et al. (1993), an ethical review was conducted by the Office of Research Administration at the University of Toronto; permission to conduct the study was obtained from the research committee of each treatment center. Patients who were eligible to participate in the study were given the following information: (1) an explanation of the study, (2) the subjects’ rights regarding the study, (3) the safeguards to preserve anonymity, and (4) the risks and benefits of participation. Written consent was obtained from each patient who agreed to participate in the study.

Instrumentation.

Fatigue. The Pearson Byars Fatigue Feeling Checklist (PBFFC) was used to measure the level of fatigue the patients experienced (Vincent et al., 1993). The patients were asked to indicate whether they felt “better than”, “the same as”, or “worse than” each of the 13 statements on the checklist. A fatigue score was obtained by summing the responses to the individual items. Possible scores ranged from 13 to 39 with the higher scores indicating greater levels of fatigue.

Good internal consistency reliability with Cronbach’s alpha ranging from 0.82 to 0.97 have been reported (Graydon, Bubela, Irvine, & Vincent, 1995; Irvine et al., 1994; Vincent et al., 1993). Evidence of construct validity of the PBFFC scale was reported by Irvine et al.’s study (1994) who found that the scale was able to measure a significant difference (p < 0.01)
in fatigue scores between cancer patients receiving active treatments \( (n = 101) \) and a control group of healthy individuals \( (n = 53) \).

**Physical symptom distress.** A modified version of the Associated Symptom Subscale of the Piper Fatigue Scale was used to measure physical symptom distress (Vincent et al., 1993). The scale assesses the following 13 physical symptoms commonly experienced by patients undergoing cancer treatments: pain, headache, nausea, vomiting, eye strain, constipation, diarrhea, shortness of breath/difficulty breathing, cough, decrease in appetite, difficulty sleeping, muscle stiffness, and alterations in body temperature. Each symptom was measured using a 100-millimeter horizontal visual analogue scale (VAS). The patients were asked to place a slash through each 100-millimeter line at the point that best indicated the degree to which they were experiencing the symptom. A physical symptom distress score was obtained by summing the scores of the 13 symptoms. Possible scores ranged from 0 to 1300 with the higher scores indicating greater levels of physical symptom distress. The internal consistency reliability, Cronbach's alpha, for the total scale has been reported ranging from 0.74 to 0.85 (Vincent et al., 1993).

**Psychological distress.** The Linear Analogue Self-Assessment Scale (LASA) was used to measure psychological distress (Vincent et al., 1993). The scale consists of four 100-millimeter linear analogue scales which measure the following four dimensions of psychological distress: anxiety, confusion, depression, and anger. Patients were asked to place a slash through each 100-millimeter line at the point that best indicated how they were feeling. A psychological distress score was obtained by summing the scores of the four analogue scales. Possible scores ranged from 0 to 400, with the higher scores indicating greater levels of psychological distress.
A twenty-four hour test-retest reliability for the total psychological distress score on the LASA has been reported as 0.70 (Sutherland, Walker, & Till, 1988; Sutherland, Lockwood, & Cunningham, 1989). Good internal consistency reliability with Cronbach’s alphas ranging from 0.74 to 0.87 has been reported by Vincent et al. (1993). In addition, concurrent validity of the LASA has been determined by concurrently administering the Profile of Mood States (POMS), from which the LASA scale was derived; and finding the two scales were highly correlated with Spearman rank correlation coefficients of 0.79 (Sutherland et al., 1988) and 0.83 (Sutherland et al., 1989).

Sample characteristic information. A Chart Review Data Sheet was used to obtain illness information from hospital charts including stage and duration of breast cancer, type of and time since surgery. In addition, patients were asked about tamoxifen and other medical diagnoses during the initial interview (Vincent et al., 1993). A standardized demographic profile was used to obtain demographic information including patient’s age, marital status, income, and education (Vincent et al., 1993).

Data Collection

Patients who were eligible to participate in Vincent et al.’s (1993) study were contacted by the research assistant during their first appointment for radiation treatment. Patients received an explanation of the study, signed their consent, and then were asked to complete the research instruments at six measurement times as described in the section on Research Design. Patients were asked to complete the instruments at Time 1, Time 2, Time 3, and Time 4 during a scheduled clinic visit; a complete set of instruments was then given to patients for self-administration in their home at Time 5 and Time 6. A return addressed, stamped envelope was given for return of the completed questionnaires. In addition, patients
were telephoned to remind them complete the questionnaires. Demographic and illness data were also obtained.
Chapter III

Results

Sample Characteristics

The sample consisted of 108 women with breast cancer receiving a 4- or 5- week course of external radiation therapy. Five subjects were removed from the analysis because their duration of illness was considerably longer than the rest of the subjects. While the length of time the rest of the subjects had been diagnosed with breast cancer ranged from 1 to 7 months, these 5 subjects had been diagnosed for more than a year. In order to control for the possible impact of the duration of illness on the study findings, subjects who had been diagnosed with breast cancer for more than 7 months were excluded from the analysis leaving a sample of 103 women.

Demographic information. The sample ranged in age from 33 to 81 years with a mean of 60.02 years (SD = 10.81) (Table 1). The majority of subjects were married (66%) and had at least a high school education (76%) (Tables 2 and 3). Of the 92 subjects who reported their annual income, 59% had an annual income under $40,000 (Table 4). Most of the subjects were either employed full time (35%) or retired (36%) (Table 5).

Medical information. The length of time the subjects had been diagnosed with breast cancer ranged from 1 to 7 months, with a mean of 3.22 months (SD = 1.25) (Table 1). The majority of subjects had Stage I disease (88%) and had breast conserving surgery (96%) (Tables 6 and 7). The number of radiation therapy fractions received ranged from 16 to 29 fractions, with a mean of 21.55 fractions (Table 1). The most frequent total radiation dose received was 5,250 cGy (70%), with a mean of 5,092 cGy (SD = 347) (Table 1). Of the
31 subjects who had medical illnesses other than cancer, 44% had more than 1 other medical illness. The most common medical illness other than cancer experienced by the subjects were arthritis and hypertension. Slightly over half the subjects (52%) were on tamoxifen, an anti-estrogen hormone medication (Table 8).

Table 1. Summary Statistics of Age, Duration of Disease, Number of Radiation Therapy Fractions Received, and Total Radiation Dose Ordered.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Median</th>
<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>101</td>
<td>60.02</td>
<td>61.00</td>
<td>10.81</td>
<td>33</td>
<td>81</td>
</tr>
<tr>
<td>Duration of illness</td>
<td>102</td>
<td>3.22</td>
<td>3.00</td>
<td>1.25</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>(Months)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Radiation</td>
<td>103</td>
<td>21.55</td>
<td>21.00</td>
<td>1.88</td>
<td>16</td>
<td>29</td>
</tr>
<tr>
<td>Treatments Received</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Radiation Dose</td>
<td>103</td>
<td>5092.23</td>
<td>5250.00</td>
<td>347.17</td>
<td>3500</td>
<td>5800</td>
</tr>
<tr>
<td>Received (cGy)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 2. Martial Status of Subjects

<table>
<thead>
<tr>
<th>Status</th>
<th>Frequency</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>6</td>
<td>5.9</td>
</tr>
<tr>
<td>Married</td>
<td>68</td>
<td>66.7</td>
</tr>
<tr>
<td>Separated/Divorced</td>
<td>17</td>
<td>16.7</td>
</tr>
<tr>
<td>Widowed</td>
<td>11</td>
<td>10.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>102</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

### Table 3. Highest Education Achieved by Subjects

<table>
<thead>
<tr>
<th>Education</th>
<th>Frequency</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary / Partial High School</td>
<td>25</td>
<td>24.5</td>
</tr>
<tr>
<td>High School</td>
<td>37</td>
<td>36.3</td>
</tr>
<tr>
<td>University / College</td>
<td>40</td>
<td>39.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>102</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

### Table 4. Annual Income of Subjects

<table>
<thead>
<tr>
<th>Income Range</th>
<th>Frequency</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 20,000</td>
<td>15</td>
<td>16.3</td>
</tr>
<tr>
<td>21,000 - 40,000</td>
<td>39</td>
<td>42.4</td>
</tr>
<tr>
<td>41,000 - 60,000</td>
<td>21</td>
<td>22.8</td>
</tr>
<tr>
<td>Over 60,000</td>
<td>17</td>
<td>18.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>92</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
Table 5. Occupation Status of Subjects

<table>
<thead>
<tr>
<th>Status</th>
<th>Frequency</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employed full time</td>
<td>36</td>
<td>35.3</td>
</tr>
<tr>
<td>Employed part time</td>
<td>8</td>
<td>7.9</td>
</tr>
<tr>
<td>Unemployed</td>
<td>6</td>
<td>5.9</td>
</tr>
<tr>
<td>Retired</td>
<td>37</td>
<td>36.3</td>
</tr>
<tr>
<td>Homemaker</td>
<td>15</td>
<td>14.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>102</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Table 6. Stage of Disease of Subjects

<table>
<thead>
<tr>
<th>Stage</th>
<th>Frequency</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>91</td>
<td>88.3</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>9.7</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>103</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Table 7. Type of Surgery Recently Experienced by Subjects

<table>
<thead>
<tr>
<th>Type of Surgery</th>
<th>Frequency</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast conserving surgery</td>
<td>99</td>
<td>96.1</td>
</tr>
<tr>
<td>Modified radical mastectomy</td>
<td>4</td>
<td>3.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>103</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
Table 8. Tamoxifen Received by Subjects

<table>
<thead>
<tr>
<th>Receiving Tamoxifen</th>
<th>Frequency</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>54</td>
<td>52.4</td>
</tr>
<tr>
<td>No</td>
<td>49</td>
<td>47.6</td>
</tr>
<tr>
<td>Total</td>
<td>103</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Summary of the Variables Measured

Fatigue. The fatigue scores on the PBFFC at the last week of treatment (Time 4) ranged from 14 to 38, with a mean score of 25.42 (SD = 5.16) (Table 9). The distribution of the fatigue scores was close to a normal distribution; a histogram of the fatigue scores is presented in Figure 2. There was no extreme value or outlier identified in the box-and-whisker plot (Figure 3). In this study, the scale demonstrated good internal consistency reliability with Cronbach’s alpha, 0.89.

Table 9. Summary Statistics of Scores for Fatigue, Physical Symptom Distress, and Psychological Distress at the Last Week of Treatment (n = 103).

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>Standard Deviation</th>
<th>Skewness</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatigue</td>
<td>25.42</td>
<td>26.00</td>
<td>5.16</td>
<td>0.118</td>
<td>14</td>
<td>38</td>
</tr>
<tr>
<td>Physical symptom distress</td>
<td>153.67</td>
<td>118.00</td>
<td>143.92</td>
<td>1.715</td>
<td>0</td>
<td>823</td>
</tr>
<tr>
<td>Psychological distress</td>
<td>55.76</td>
<td>32.00</td>
<td>67.76</td>
<td>1.640</td>
<td>0</td>
<td>309</td>
</tr>
</tbody>
</table>
Physical symptom distress. The physical symptom distress scores on the Associated Symptom Subscale at Time 4 ranged from 0 to 823, with a mean score of 153.67 (SD = 143.92) (Table 9). The distribution of the physical symptom distress scores was positively skewed; 97% of the scores were below 463. A histogram of the scores is presented in Figure 4. The box-and-whisker plot indicated an extreme value (the score of 823) which is more than
3 box-lengths from the 75th percentile (Figure 5). Cronbach's alpha for the Associated Symptom Subscale was 0.84. The most distressing physical symptoms experienced were temperature changes (mean = 34.90; SD = 34.11), insomnia (mean = 25.16; SD = 27.68), and pain (mean = 24.17; SD = 25.50) (See Appendix).
Psychological distress. The psychological distress scores on the LASA scale at Time 4 ranged from 0 to 309, with the mean score of 55.76 (SD = 67.76) (Table 9). The distribution of the psychological distress scores was positively skewed. Twenty-four percent of the subjects experienced no psychological distress (score 0). A histogram of the scores is presented in Figure 6. An extreme value (the score of 309) was illustrated by the box-and-whisker plot (Figure 7). In this study, the internal consistency reliability was 0.82. The most distressing psychological symptoms experienced were anxiety (mean = 23.54; SD = 26.44) and depression (mean = 15.35; SD = 24.05) (Table 10).
As the skewness of the distribution of the physical symptom distress scores and psychological distress scores may interfere with the validity of statistical analyses, square root transformations of the scores for physical symptom distress and psychological distress were used to correct the skewed distributions. In addition, 2 subjects with the extreme values were removed from the statistical analyses as their scores were far beyond the rest of the data. Although the corrections were not perfect, the skewness of the physical symptom distress
scores and psychological distress was reduced from 1.715 to .007 and from 1.640 to .323 respectively (Table 11). The histograms of the transformed scores for physical symptom distress and psychological distress are presented in Figures 8 and 9. Because of the corrections made for the data, the transformed scores of physical symptom distress and psychological distress were used for the following statistical analyses. Also, with the exclusion of the 2 cases having the extreme values, further analyses were based on the results of the 101 subjects.

Figure 8. Frequency Distribution of Physical Symptom Distress Scores
(Square Root Transformation)
Figure 9. Frequency Distribution of Psychological Distress Scores
(Square Root Transformation)

Table 11. Skewness of Transformed Scores for Physical Symptom Distress and Psychological Distress at the Last Week of Treatment (n = 101).

<table>
<thead>
<tr>
<th></th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transformed physical symptom distress scores</td>
<td>0.007</td>
</tr>
<tr>
<td>Transformed psychological distress scores</td>
<td>0.323</td>
</tr>
</tbody>
</table>

Demographic and Medical Data in Relation to Fatigue, Physical and Psychological Distress

In this study, the level of significance, alpha, was set at 0.05 for all statistical tests. Bivariate analyses were conducted to test demographic and medical data in relation to fatigue, physical symptom distress, and psychological distress. Using the One-way Analysis of Variance (ANOVA) test, there were no significant differences in the fatigue, physical symptom distress and psychological distress scores related to education, marital status, occupational status, income, and type of surgery. There was also no significant correlation of the (a) length of time since diagnosis, (b) number of medical illnesses experienced, or (c) total
radiation dose received with the fatigue, physical symptom distress and psychological scores. However, there was a weak, significant, and positive correlation between the number of radiation therapy fractions received by the subjects and fatigue scores \((r = 0.20, p < 0.05)\), as well as physical symptom distress scores \((r = 0.17, p < 0.05)\).

**Correlation Between Studied Variables**

Bivariate analyses were conducted to determine the correlation between studied variables, including age, tamoxifen, fatigue, physical symptom distress, and psychological distress. The correlation matrix of the studied variables is presented in Table 12. Physical symptom distress \((r = 0.61, p < 0.01)\) and psychological distress \((r = 0.58, p < 0.01)\) were moderately, significantly and positively related to fatigue. There was a moderate, significant and positive correlation between physical symptom distress and psychological distress \((r = 0.58, p < 0.01)\). There was a weak, significant and negative correlation between age and psychological distress \((r = -0.24, p < 0.01)\). Age was not significantly correlated with fatigue or physical symptom distress. Tamoxifen was not significantly related to fatigue, physical symptom distress, or psychological distress.

**Table 12. Correlations Between Studied Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Age</th>
<th>Tamoxifen</th>
<th>Fatigue</th>
<th>Physical Symptom Distress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tamoxifen</td>
<td>.026</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fatigue</td>
<td>-.103</td>
<td>.122</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Symptom Distress</td>
<td>-.115</td>
<td>.144</td>
<td>.612**</td>
<td></td>
</tr>
<tr>
<td>Psychological Distress</td>
<td>-.238**</td>
<td>.026</td>
<td>.584**</td>
<td>.582**</td>
</tr>
</tbody>
</table>

**. p < 0.01.**
Further bivariate analyses were conducted to determine the extent to which the most distressing physical symptoms (i.e. temperature change, insomnia, and pain) and psychological symptoms (anxiety and depression) related to fatigue. Temperature changes ($r = 0.42, p < 0.01$), insomnia ($r = 0.43, p < 0.01$), and pain ($r = 0.54, p < 0.01$) were all moderately, significantly, and positively related to fatigue (Table 13). Anxiety ($r = 0.65, p < 0.01$) and depression ($r = 0.40, p < 0.01$) were also moderately, significantly, and positively related to fatigue (Table 13). The strongest correlates of fatigue were pain in the physical symptom category and anxiety in the psychological distress category.

Table 13. Correlations of Temperature Change, Insomnia, Pain, Anxiety, Depression With Fatigue.

<table>
<thead>
<tr>
<th></th>
<th>Temperature</th>
<th>Insomnia</th>
<th>Pain</th>
<th>Anxiety</th>
<th>Depression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatigue</td>
<td>.418**</td>
<td>.433**</td>
<td>.544**</td>
<td>.646**</td>
<td>.401**</td>
</tr>
</tbody>
</table>

**. $p < 0.01$

Physical Symptom Distress and Psychological Distress Measured in Relation to Tamoxifen

The Student t-test was used to examine the difference between subjects taking tamoxifen and those not taking tamoxifen on the 13 components of the physical symptom distress measure and the 4 psychological distress measures. There was a significant difference between the groups on mean scores for alterations in body temperature ($t(99) = 1.98, p = .05$). That is, subjects taking tamoxifen experienced greater alteration in body temperature ($\bar{x} = 40.0$) than those who were not on tamoxifen ($\bar{x} = 26.9$). With the exception of temperature change, there was no significant difference in mean scores for other components.
of the physical symptom distress measure or the psychological distress measure between the groups.

**Causal Model**

Path analysis was used to test the research hypotheses. In order to determine causal paths, three force entry multiple regression analyses were conducted in which each dependent variable was regressed on the predictor variable(s) (Munro, & Page, 1993; Pedhazur, 1982). In forced entry multiple regression, all independent variables were entered into the analysis simultaneously. For the first equation, as a dependent variable, the measure of fatigue was regressed on age, tamoxifen, physical symptom distress, and psychological distress (Table 14). Only physical symptom distress and psychological distress explained a statistically significant amount of variance in fatigue. Age and tamoxifen, which did not explain a significant amount of variance, were dropped from the analysis. Deleting a variable or variables changes the regression (beta) weights for the other variables, therefore the analysis was rerun with only the retained variables (Munro, & Page, 1993). As a result, fatigue was regressed on physical symptom distress and psychological distress (Table 15). The results of the analyses are presented in Tables 14 and 15.

For the second equation, as a dependent variable, the measure of psychological distress was regressed on age, tamoxifen, and physical symptom distress (Table 14). Only physical symptom distress and age were statistically significant. Therefore, tamoxifen was dropped from the analysis; age and physical symptom distress were regressed on psychological distress (Table 15).

For the third equation, as a dependent variable, the measure of physical symptom distress was regressed on age and tamoxifen (Table 14). Neither age nor tamoxifen were
statistically significant in this analysis. Therefore, this multiple regression analysis was deleted.

Standardized regression (beta) weights generated by the multiple regression equations were used as the path coefficients (Munro, & Page, 1993). The path coefficients were used to determine the direct, indirect, and total causal effects of the statistically significant variables on fatigue. Table 16 displays the effects of the variables on fatigue. The causal model is presented in Figure 10. The model indicated that the measure of psychological distress had a direct positive effect on fatigue. The measure of physical symptom distress had a direct positive effect on fatigue, as well as having an indirect effect through its positive direct effect on psychological distress. Age did not have a direct effect on fatigue but did have an indirect effect through its effect on psychological distress. In this analysis, physical symptom distress had the greatest causal effect on fatigue.
Table 14. Summary of Multiple Regression Equations

<table>
<thead>
<tr>
<th>Regression</th>
<th>Dependent Variable</th>
<th>Independent Variable</th>
<th>Beta</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fatigue</td>
<td>Psychological Distress</td>
<td>.341**</td>
<td>.455</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physical Symptom Distress</td>
<td>.413**</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Age</td>
<td>.024</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tamoxifen</td>
<td>.058</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Psychological Distress</td>
<td>Physical Symptom Distress</td>
<td>.556**</td>
<td>.356</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Age</td>
<td>-.173*</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tamoxifen</td>
<td>-.035</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Physical Symptom Distress</td>
<td>Age</td>
<td>-.120</td>
<td>.210</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tamoxifen</td>
<td>.176</td>
<td></td>
</tr>
</tbody>
</table>

**. $p < 0.01$

*. $p < 0.05$

Table 15. Summary of Multiple Regression Equations.

<table>
<thead>
<tr>
<th>Regression</th>
<th>Dependent Variable</th>
<th>Independent Variable</th>
<th>Beta</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fatigue</td>
<td>Psychological Distress</td>
<td>.343</td>
<td>.453</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physical Symptom Distress</td>
<td>.413</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Psychological Distress</td>
<td>Physical Symptom Distress</td>
<td>.549</td>
<td>.355</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Age</td>
<td>-.175</td>
<td></td>
</tr>
</tbody>
</table>
Table 16. Direct, Indirect, and Total Effects on Fatigue

<table>
<thead>
<tr>
<th>Variable</th>
<th>r</th>
<th>Direct Effect</th>
<th>Indirect Effect</th>
<th>Total Causal Effect</th>
<th>Non-Causal Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Symptom</td>
<td>.612**</td>
<td>.413</td>
<td>.188</td>
<td>.601</td>
<td>.011</td>
</tr>
<tr>
<td>Distress</td>
<td>.582**</td>
<td>.343</td>
<td>0.00</td>
<td>.343</td>
<td>.239</td>
</tr>
<tr>
<td>Psychological Distress</td>
<td>0.103</td>
<td>0.00</td>
<td>-.060</td>
<td>-.060</td>
<td>-.043</td>
</tr>
</tbody>
</table>

\[ \text{Total Causal Effect} = \text{Direct Effect} + \text{Indirect Effect}. \]

\[ \text{Noncausal Effect} = r - \text{Total Causal Effect}. \]

\[ **: p < 0.01 \]

Figure 10. Causal Model: Effects of Age, Physical Symptom Distress, and Psychological Distress on Fatigue.
Chapter IV

Discussion

Impact of Physical Symptom Distress on Fatigue

With the exception of the direct effects of tamoxifen and age on physical symptom distress and fatigue, and the direct effect of tamoxifen on psychological distress, all hypotheses proposed by the conceptual model (Figure 1) were confirmed. In this study, fatigue was experienced to some degree by all women with breast cancer receiving radiation therapy. This finding supports the results of other studies (Blesch et al., 1991; Irvine et al., 1994; King et al., 1985; Kubrucht, 1984) in which fatigue has been cited as one of the most common side-effects experienced by cancer patients undergoing radiation therapy. Consistent with previous findings (Blesch et al., 1991; Greenberg et al., 1992; Irvine et al., 1994), there was a variation in the level of fatigue experienced by the subjects in this study. This is not surprising because an individual’s experience of fatigue is known to be affected by multiple factors (Piper, 1993; Piper, et al., 1987). Of all the variables measured in this study, physical symptom distress had the greatest causal effect on the level of fatigue in women with breast cancer receiving radiation therapy regardless of their age. This is consistent with Irvine et al.’s (1994) findings that physical symptom distress was a greater predictor of fatigue in cancer patients undergoing active treatments than the level of psychological distress and suggests that physical symptom distress is the most important predictor of fatigue in women with breast cancer receiving radiation therapy. Therefore, managing their distress from physical symptoms might be the most effective way to prevent or reduce fatigue in this group of patients.
The finding that physical symptom distress had a direct effect on fatigue is consistent with the postulation from the modified version of Piper's Integrated Fatigue Model (Piper, 1993; Piper et al., 1987) that physical symptom distress has an influence on fatigue. Consistent with the results of other studies (Irvine et al., 1994; Knobf, 1986; Oberst et al., 1991), the extent of overall physical symptom distress experienced by women receiving radiation therapy for breast cancer in this study was low. Of the 13 physical symptoms measured, the most prevalent ones were alterations in body temperature, insomnia, and pain and they were all significantly correlated with fatigue. It is well documented that insomnia (Beszterczey & Lipowski, 1977; Degner & Sloan, 1995; Dorrepaal, Aaronson, & Van Dam, 1989; Foltz, Gaines, & Gullatte, 1996; Graydon, 1994; Knobf, 1986) and pain (Dorrepaal et al., 1989; Foltz, et al., 1996; Graydon, 1994) are prevalent physical symptoms experienced by cancer patients. However, the exact mechanisms of how these physical symptoms together contribute to fatigue are unclear. Insomnia may be the result of pain (Dorrepaal et al., 1989; McMorkle & Young, 1978) and alterations in body temperature (Ginsburg, 1994; Robinson, 1993); it can lead to increased sleepiness and fatigue. Cancer pain is known to be caused by the tumor itself and/or the results from cancer treatments including surgery, radiation therapy, and chemotherapy (Dorrepaal et al., 1989). However, little is known about the experience of temperature change in cancer patients. In this study, those subjects taking tamoxifen experienced greater alterations in body temperature than those not taking tamoxifen. It is consistent with Love et al. (1989)'s findings that hot flashes were more prevalent among cancer patients receiving tamoxifen than those not taking tamoxifen. This suggests that tamoxifen may have an influence on temperature change in women with breast cancer.
undergoing radiation therapy. The alterations in body temperature may lead to increase in the expenditure of energy thus causing fatigue (Hart & Freel, 1982).

While physical symptom distress had the greatest influence on fatigue in women with breast cancer receiving radiation therapy, the relationships among alterations in body temperature, insomnia, pain, and fatigue are unclear and complex. The fact that physical symptom distress had the greatest influence on the level of fatigue might be due to the interactive effects of multiple physical symptoms occurring simultaneously. Although the extent of distress from these three physical symptoms experienced by the subjects was low, these physical symptoms together contributed considerable to the amount of fatigue. According to Lenz, Pugh, Milligan, Gift, & Suppe (1997), the effect of the concurrence of multiple physical symptoms is often multiplicative rather than merely additive. When multiple physical symptoms occur at the same time, they tend to augment each other. This suggests that physical symptoms may not have to be severe in order to be problematic. It is important for future studies to investigate the interrelationships among these variables and to determine the most effective strategies in reducing these prevalent physical symptoms.

Although physical symptom distress influenced fatigue mainly directly, it also had a weak indirect effect on fatigue through its effect on psychological distress. The finding that physical symptom distress had a direct effect on psychological distress is consistent with the modified Piper fatigue model in which the experience of physical symptom distress resulting from the illness and/or the treatment is postulated to have an influence on psychological distress. The relationship between physical symptom distress and psychological distress is also well documented (Graydon, 1994; Irvine et al., 1994; Love et al., 1989; Nerenz et al., 1982). It is also consistent with Oberst et al.'s (1991) findings in which physical symptom
distress was a significant predictor of the intensity of negative mood in cancer patients undergoing radiation therapy.

**Impact of Psychological Distress on Fatigue**

The fact that the impact of psychological distress on fatigue was lesser than the level of physical symptom distress in this study could be due to the result of the low level of psychological distress experienced by the subjects. Out of the possible psychological distress scores on the LASA scale ranging from 0 to 400, 24% of the subjects experienced no psychological distress, with the mean score of 56. The fact that there was a low psychological distress experienced at the last week of radiation treatment is consistent with Vincent et al.'s (1993) findings in which the level of psychological distress decreases over the 4- or 5-week course of radiation therapy and then increases at 3 and 6 months post-treatment. Knof (1986) also found that women who completed the chemotherapy treatment for breast cancer experienced a higher level of psychological distress than those in process of receiving the treatment and suggested that having treatment may provide a sense of security as it is often perceived by the patients as controlling or destroying cancer cells. Therefore, the process of active treatments may not have been perceived as particularly threatening by women with breast cancer.

**The Effects of Age On Psychological and Physical Symptom Distress**

In this study, all women with breast cancer experienced fatigue. Age was found to have no direct effect on fatigue. It had only a weak indirect effect through its effect on psychological distress. Age was found to have a negative relationship with psychological distress. That is, older subjects experienced less psychological distress than younger subjects. This is consistent with Nerenz et al.'s (1986) findings in which there was a negative
relationship between age and emotional distress in cancer patients receiving chemotherapy. This result could be explained by the fact that older patients are less likely to have demands from their jobs and family and more likely to accept cancer as a natural occurrence at their stage of life (Nerenz et al., 1986).

The fact that age did not have an influence on physical symptom distress is contrary to the results of previous studies in which older cancer patients reported fewer numbers of side effects (Love et al., 1989; Nerenz et al., 1986), as well as less intense physical symptom distress than younger patients undergoing active treatments (Degner & Sloan, 1995; McMillan, 1989; Tishelman, Taube, & Sachs, 1991). The different findings might be due to the different measures of the experience of physical symptom. For instance, in contrast to this study which examined the degree of physical symptom distress experienced in relation to subjects' age, Love et al. and Nerenz et al. studied the numbers of side effects in relation to subjects' age. While this study examined the overall physical symptom distress in relation to age, McMillan studied the specific physical symptom distress (i.e. pain, nausea, and vomiting) in relation to age. Although the literature suggests that older people tend to experience less physical symptom distress as they are more likely to have experienced chronic illnesses and to have learned ways of coping (Given & Keilman, 1990), this study does not support this relationship and suggests that although older patients may experience less psychological distress resulting from the illness and/or treatment than the younger patients, they appear to experience the same degree of physical symptom distress that the younger experienced.
Physiologically Based Fatigue

It is clear that fatigue is a very complex phenomenon in its causes and manifestations. Fatigue can be physiologically engendered and be emotionally engendered with the presence of physiological and psychological manifestations (Glaus, 1993; Morris, 1982). The finding that physical symptom distress was more important than psychological distress in influencing the level of fatigue in this study may indicate that fatigue in women with breast cancer receiving radiation therapy is physiologically engendered rather than psychologically engendered. Depression, one of the psychological distress symptoms, is often viewed as a psychological symptom of fatigue (Piper, 1993). If the fatigue experienced by the subjects in this study was psychologically engendered, one would expect a high level of depression experienced by the subjects and a high correlation between depression scores and fatigue scores. In contrast to this expectation, this study found that the mean depression score was low and depression was only moderately correlated with fatigue. In addition, there was a weak and positive relationship between the number of radiation treatment fractions received by the subjects and the levels of fatigue and physical symptom distress. This finding is consistent with previous findings (Greenberg et al., 1992; Vincent et al., 1993) in which the level of fatigue was significant correlated with the number of radiation treatment fractions received by cancer patients. This suggests that the more radiation treatment fractions received by women with breast cancer, the higher the levels of fatigue and physical symptom distress experienced. However, caution must be exercised in the interpretation of these theoretical suggestions because the Pearson Byars Feeling Checklist used in this study was designed to measure the physical dimension of fatigue only. The absence of measuring the psychological dimension of fatigue could lead to attenuation of any real relationship between psychological
distress and fatigue. Therefore, it is necessary that future studies use a multidimensional fatigue measure to examine the sensory dimension (i.e. to explore the physical and psychological symptoms) of fatigue experienced in cancer patients receiving radiation therapy.
Chapter V

Summary

The purpose of this secondary analysis study was to test the extent to which the level of fatigue in women with breast cancer undergoing the last week of radiation treatment was directly related to the degrees of physical symptom distress and psychological distress, and the extent to which the level of fatigue was indirectly related to the effect of physical symptom distress on psychological distress. The effect of age and tamoxifen, an anti-estrogen hormone medication, on physical symptom distress, psychological distress, and fatigue were also tested. The sample consisted of 101 women with breast cancer receiving a 4- or 5-week course of external radiation therapy. There were no significant differences in the fatigue scores related to age, education, marital status, occupational status, income, type of surgery, the length of time since diagnosis, the number of medical illnesses experienced, or the total radiation dose received. However, there was a weak, significant, and positive correlation between the fatigue scores and the number of radiation therapy fractions received by the subjects (r = 0.20, p < 0.05).

Fatigue was significantly correlated with physical symptom distress (r = 0.612, p < 0.01) and psychological distress (r = 0.582, p < 0.01). Physical symptom distress had the greatest causal effect on the level of fatigue. Although psychological distress had a direct effect on fatigue, its impact on fatigue was lesser than the level of physical symptom distress. Age had an indirect effect on fatigue through its effect on psychological distress. Younger subjects experienced a greater psychological distress than older subjects and subsequently experienced more fatigue. However, the effect of age on fatigue was small. Age had no effect
on physical symptom distress. Older subjects appeared to experience the same degree of physical symptom distress than the younger experienced. The most prevalent physical symptoms experienced by the subjects were alterations in body temperature, insomnia, and pain. While tamoxifen had no effect on fatigue, physical symptom distress, or psychological distress, subjects taking tamoxifen experienced a significant greater alteration in body temperature than those who were not on tamoxifen (t(99) = 1.98, p < 0.50). Physical symptom distress had the greatest influence on the fatigue scores in women with breast cancer receiving radiation therapy, despite the fact that the mean score of physical symptom distress was low. Therefore, this study suggests that attention should be directed at determining the most effective strategies in managing physical symptoms especially alterations in body temperature, insomnia, and pain.

Study Limitations

This is the first study to examine the interrelationships among physical symptom distress, psychological distress, age, tamoxifen, and fatigue. Therefore, although the causal model in this study advances our understandings of how the studied variables influence fatigue experienced by women with breast cancer undergoing radiation therapy, the results must be considered only tentative until confirmed by repeated studies.

Generalizability of the results of this study is limited due to the use of a non-random convenience sample. This study included only women with breast cancer receiving a 4- or 5-week course of radiation therapy, with the majority of subjects having Stage I disease. Therefore, the findings of this study may not be representative of other breast cancer populations.
Another limitation of this study is that both of the physical symptom distress and psychological distress scores were positively skewed. The presence of these positively skewed distributions could be due to the possibility of the presence of measurement error. Although the scores of physical symptom distress and psychological distress were subjected to square root transformations and the extreme values were excluded from the statistical analyses in order to correct the skewed distribution, the corrections were not perfect as both of the scores of physical symptom distress and psychological distress were still slightly and positively skewed. Therefore, the results of this study may be affected by the skewed scores.

**Research Implications**

The present study results suggest the following directions for future research:

1. As this is the first study to investigate the interrelationships among physical symptom distress, psychological distress, age, tamoxifen, and fatigue, future research is needed to confirm the causal model tested in this study.

2. Since the generalization of this study is limited to women receiving radiation therapy for breast cancer, replication of this study with different populations including those receiving other types of treatments for breast cancer and those having advanced breast cancer is necessary.

3. The relationships among alterations in body temperature, insomnia, and pain and their effects on fatigue have not been clearly identified. Future research is needed to examine how these variables are related and the extent to which level of fatigue is influenced by each of these physical symptoms.

4. In this study, physical symptom distress had the greatest effect on the level of fatigue; the most prevalent physical symptoms experienced by the subjects were alterations in body
temperature, insomnia, and pain. Future research should be conducted to determine the most effective strategies to manage these symptoms in order to prevent or reduce the fatigue.

(5) As the Pearson Byars Feeling Checklist used in this study was designed to measure the physical dimension of fatigue only, the absence of measuring the psychological dimension of fatigue could lead to attenuation of any real relationship between psychological distress and fatigue. Future research is needed using a valid and reliable multidimensional fatigue measurement to explore the physical and psychological dimensions of fatigue experienced by cancer patients undergoing radiation therapy.

**Clinical Implications**

This study advances our knowledge about the interrelationships among physical symptom distress, psychological distress, age, tamoxifen, and fatigue and the extent to which fatigue is influenced by the studied variables. These data enable nurses to identify those women who may be at greatest risk of experiencing fatigue during radiation therapy, and to prescribe appropriate and effective nursing interventions. This study demonstrated that physical symptom distress is the most significant predictor of fatigue in women with breast cancer receiving radiation therapy regardless of their age. Nurses need to assess their patients for physical symptom distress over the course of radiation treatment, particularly the distress from temperature change, insomnia, and pain. As physical symptom distress was found to be the greatest predictor of fatigue in spite of its low mean score, it is necessary for nurses to understand that physical symptoms do not have to be in severe range to be problematic. In order to prevent or reduce fatigue, nursing interventions must be directed at identifying the effective strategies in reducing physical symptoms. Another clinical implication of this study is that the level of psychological distress experienced by women with breast cancer can be
reduced through the management of their physical symptom distress during radiation therapy. Younger women with breast cancer tend to experience a higher level of psychological distress during the radiation therapy than older patients. Therefore, nurses need to assess younger women with breast cancer for psychological distress.

**Conclusion**

In conclusion, the results of this study enhance our understanding of how physical symptom distress, psychological distress, age, and tamoxifen influenced fatigue directly and indirectly in breast cancer women receiving radiation therapy. This study provides evidence that physical symptom distress had the greatest causal effect on the level of fatigue. Physical symptom distress not only has a direct influence on fatigue but also has an indirect influence through its effect on psychological distress. The most prevalent physical symptoms experienced by these women are temperature change, insomnia, and pain. Women taking tamoxifen tend to experience a greater temperature change than those not taking tamoxifen. The results also provide evidence that age is not related to physical symptom distress but has a small indirect influence on fatigue through its negative impact on psychological distress. This study suggests that physical symptoms do not have to be in severe range to be problematic and nursing interventions must be directed at identifying the effective strategies in reducing physical symptoms in order to prevent or reduce fatigue. Given the limitations indicated earlier, the results of this study need to be replicated and validated using other samples of cancer patients.
References


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Appendix

Summary Statistics of Scores for the Physical Symptoms Measured

<table>
<thead>
<tr>
<th>Physical Symptom</th>
<th>Mean</th>
<th>Median</th>
<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Changes</td>
<td>34.90</td>
<td>28.00</td>
<td>34.11</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Insomnia</td>
<td>25.16</td>
<td>16.00</td>
<td>27.68</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Pain</td>
<td>24.17</td>
<td>15.00</td>
<td>25.50</td>
<td>0</td>
<td>92</td>
</tr>
<tr>
<td>Muscle</td>
<td>13.04</td>
<td>2.00</td>
<td>21.33</td>
<td>0</td>
<td>96</td>
</tr>
<tr>
<td>Headache</td>
<td>11.74</td>
<td>2.00</td>
<td>20.34</td>
<td>0</td>
<td>89</td>
</tr>
<tr>
<td>Eye Strain</td>
<td>9.08</td>
<td>0.00</td>
<td>18.72</td>
<td>0</td>
<td>95</td>
</tr>
<tr>
<td>Coughing</td>
<td>7.51</td>
<td>0.00</td>
<td>19.23</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Loss of Appetite</td>
<td>6.80</td>
<td>0.00</td>
<td>14.50</td>
<td>0</td>
<td>72</td>
</tr>
<tr>
<td>Shortness of breath</td>
<td>6.34</td>
<td>0.00</td>
<td>16.02</td>
<td>0</td>
<td>92</td>
</tr>
<tr>
<td>Nausea</td>
<td>6.26</td>
<td>0.00</td>
<td>15.77</td>
<td>0</td>
<td>84</td>
</tr>
<tr>
<td>Constipation</td>
<td>5.09</td>
<td>0.00</td>
<td>3.94</td>
<td>0</td>
<td>93</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>2.44</td>
<td>0.00</td>
<td>8.34</td>
<td>0</td>
<td>61</td>
</tr>
<tr>
<td>Vomiting</td>
<td>1.16</td>
<td>0.00</td>
<td>4.05</td>
<td>0</td>
<td>37</td>
</tr>
</tbody>
</table>