NIH Public Access
Author Manuscript
Eur J Oncol Nurs. Author manuscript; available in PMC 2012 September 1.

Published in final edited form as:
Eur J Oncol Nurs. 2011 September ; 15(4): 318–324. doi:10.1016/j.ejon.2010.10.003.

A comparison of disrupted sleep patterns in women with cancer-related fatigue and postmenopausal women without cancer (Resubmission)

Horng-Shiuann Wu, Ph.D., RN[a], **Jean E. Davis, Ph.D., RN**[a], **Josna P. Padiyar, M.S.**[a], and **Hossein Yarandi, Ph.D.**[a]

Jean E. Davis: ao9434@wayne.edu; Josna P. Padiyar: ax5158@wayne.edu; Hossein Yarandi: ay3998@wayne.edu

[a]Wayne State University, 5557 Cass Avenue, 337 Cohn Building, Wayne State University Detroit, MI USA 48202

Abstract

Purpose—Fatigue and disrupted sleep often coexist and both are prominent clinical problems in cancer affecting quality of life. Disrupted sleep patterns are likely related to cancer-related fatigue. The relationship needs further investigation. This study aimed to characterize and compare disrupted sleep patterns in fatigued breast cancer patients receiving chemotherapy with postmenopausal women without a history of cancer. Anxiety levels were also examined.

Methods—Data for this secondary analysis came from two studies. Global sleep quality and state anxiety were self-reported by 30 fatigued female breast cancer chemotherapy outpatients and 32 non-cancer postmenopausal women using Pittsburgh Sleep Quality Index (PSQI) and State-Trait Anxiety Inventory, respectively.

Results—Fatigued breast cancer patients showed significant sleep difficulties, characterized by prolonged sleep onset latency (*M*= 54.3, *SD*= 49.2 minutes) and frequent nighttime awakenings, despite 40% of the patients using sleep medications three or more times a week. Compared to the non-cancer comparison group, fatigued patients reported significantly longer sleep latency (p=0.041), more use of sleep medications (p=0.006), and higher total PSQI scores (p=0.005). State anxiety levels did not differ between the two groups (p=0.88).

Conclusions—Sleep is disrupted in fatigued breast cancer women undergoing chemotherapy. Nearly all fatigued patients (97%) had trouble sleeping (global PSQI scores >5), indicating significant difficulties in overall sleep quality among those patients. Knowledge of the nature of sleep disruption among cancer patients may contribute to CRF symptom management leading to tailored interventions designed to improve sleep quality in cancer patients thereby managing fatigue and improving quality of life.

Keywords

symptom management; cancer-related fatigue; disrupted sleep patterns; breast cancer

Corresponding Author: Horng-Shiuann Wu, Ph.D.,RN, 5557 Cass Avenue, 337 Cohn Building, Wayne State University, Detroit, MI USA 48202, Fax: 313-577-9809, Telephone: 313-577-4477, dx3264@wayne.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

NIH-PA Author Manuscript
NIH-PA Author Manuscript
NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

Introduction

Cancer-related fatigue (CRF) is a prominent clinical problem in persons with cancer. Fatigue is highly prevalent among cancer patients undergoing treatments (Curt and Johnston, 2003; Curt et al., 2000; Quick and Fonteyn, 2005) as well as survivors (Curt et al., 2000; Flechtner and Bottomley, 2003; Langeveld et al., 2003). Disrupted sleep patterns are often concurrent with fatigue in cancer (Sarna, 1993). These two symptoms alone can affect all aspects of patients' lives (Alexander et al., 2009; Byar et al., 2006; Davidson et al., 2002; Fortner et al., 2002; Redeker et al., 2000). Combinations of symptoms, such as coexistence of fatigue and disrupted sleep, may heighten the symptom distress (Sarna, 1993) and further decrease the individual's ability to function. As a consequence, quality of life suffers.

Disrupted sleep patterns are commonly observed in cancer patients (Davidson et al., 2002; Fortner et al., 2002; Koopman et al., 2002; Miaskowski and Lee, 1999; Palesh et al., 2007; Savard et al., 2001), especially among patients with breast cancer (Davidson et al., 2002). Breast cancer patients self-reported more difficulty sleeping and were less satisfied with their sleep relative to normal sleepers (Silberfarb et al., 1993). Payne and colleagues (Payne et al., 2006) observed trouble sleeping at night in 91% of breast cancer patients compared with 27% of women with no history of cancer. Similarly, Savard et al. (2001) found almost twice the prevalence of meeting the diagnostic criteria for clinical insomnia in patients with breast cancer as compared with an estimated prevalence of 20% in the general adult population.

Women with breast cancer suffer from disruptions in several sleep-related characteristics including difficulties in falling asleep (increased sleep onset latency), increased number and duration of nighttime awakenings, and waking up earlier than intended. In a study of sleep disturbances in 97 women with metastatic breast cancer, 44.3% reported waking during the night and 24.7% reported problems in falling asleep. Among 300 women with non-metastatic breast cancer, 75% complained of difficulties in falling asleep, 86% experienced problems in maintaining sleep, and 73% reported early awakening in the morning (Savard et al., 2001). Also, the women often concurrently experienced one or more types of sleep disturbance (Koopman et al., 2002; Palesh et al., 2007; Savard et al., 2001).

Compared to women with no history of cancer, breast cancer patients reported worse sleep quality and more problems with nighttime awakenings (Carlson et al., 2007). Although most of the studies showed a higher rate of interrupted sleep in women with breast cancer, some studies found that the disruptions did not differ from patients with other medical conditions (Fortner et al., 2002) or the general population (Fortner et al., 2002; Silberfarb et al., 1993). A few studies even suggested that women with breast cancer suffered less sleep disturbances than women without a history of cancer (Paskett et al., 2008; Payne et al., 2006). Inconsistent findings may be due to the fact that these studies included patients with heterogeneous treatment status and/or illness trajectory. The severity of sleep disturbances in those who are receiving or recently completed cancer treatment may differ from those who are living many years after completion of treatment.

Major cancer treatments, chemotherapy in particular, have been associated with a higher risk for disrupted sleep in breast cancer (Savard et al., 2001). One study found that those who had received chemotherapy were 4.3 times more likely to have had disrupted sleep than those who had not received chemotherapy (Savard et al., 2001). Also, sleep is more disrupted when patients are actively receiving cancer treatment (Fortner et al., 2002). A study by Kuo et al. (2006) showed that patients undergoing chemotherapy had an increased number and duration of nighttime awakenings and decreased sleep efficiency. Approximately half of the women with breast cancer experienced trouble falling asleep,

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

waking up during the night, and trouble falling back to sleep during chemotherapy (Berger and Higginbotham, 2000). To date, investigations of breast cancer chemotherapy patients have suggested that patients frequently experience increased nighttime awakenings (Berger, 1998; Berger and Farr, 1999).

Disrupted sleep patterns are likely related to CRF. Patients with CRF were more susceptible to problems with sleep (Alexander et al., 2009; Okuyama et al., 2001) and higher CRF levels were associated with more sleep disturbances (Andrykowski et al., 1998; Berger, 1998; Berger and Farr, 1999; Berger and Higginbotham, 2000; Redeker et al., 2000). When compared to the non-fatigued counterparts, women with breast cancer who were fatigued reproted significantly longer sleep latency and more frequent and longer nighttime awakenings (Alexander et al., 2009). Restless sleep at night, documented by wrist actigraphy, was strongly associated with higher levels of CRF (Berger and Farr, 1999; Berger and Higginbotham, 2000). A more recent study showed that the circadian activity rhythm was disrupted during chemotherapy (Savard et al., 2009) and more robust activity rhythms were associated with lower fatigue levels (Berger, 2009). In summary, disrupted sleep patterns, especially nighttime awakenings, are closely associated with CRF in breast cancer chemotherapy patients. However, data are limited regarding other sleep characteristics such as early awakenings and sleep outcomes such as daytime dysfunction, which are frequent complaints among patients with breast cancer.

Research on fatigue and sleep in oncology patients has been limited by heterogeneous samples of age, cancer diagnosis, treatment type, and treatment status (Alexander et al., 2009; Berger, 1998; Berger and Farr, 1999; Berger and Higginbotham, 2000; Carlson et al., 2007; Davidson et al., 2002; Fortner et al., 2002; Koopman et al., 2002; Kuo et al., 2006; Miaskowski and Lee, 1999; Palesh et al., 2007; Paskett et al., 2008; Payne et al., 2006; Redeker et al., 2000; Sarna, 1993; Savard et al., 2001; Silberfarb et al., 1993). Findings from mixed samples of patients who are actively receiving cancer treatments or have survived many years after treatments, are difficult to generalize as levels of symptom distress may differ during different disease trajectory. Another discrepancy among the women, especially in breast cancer studies, is menopausal status. As disrupted sleep has been documented in women experiencing menopausal symptoms (Owens and Matthews, 1998; Rebar, 1994), menopausal symptoms can confound sleep patterns in women with breast cancer as well as their non-cancer counterparts. Several sleep studies have used females without a history of cancer as a normal comparison to breast cancer patients undergoing treatment or survivors (Carlson et al., 2007; Fortner et al., 2002; Paskett et al., 2008). Without delineating and considering the menopausal status of those women, the findings are inconclusive. The other problem observed in the literature is a lack of consensus on sleep measurement, which makes the findings hard to interpret and compare across studies. The National Institutes of Health State-of-Science panel has suggested that various manifestations of sleep, such as difficulty in falling asleep, staying asleep, and restless sleep, should be all considered as key sleep parameters (Berger et al., 2005). Comprehensive evaluations are needed in studying CRF and sleep not only to evaluate the individual's overall sleep quality but also to characterize specific disruption in sleep. Although the association between CRF and sleep has been examined previously (Berger, 1998; Berger and Farr, 1999; Berger and Higginbotham, 2000; Redeker et al., 2000), studies are needed to further delineate multi-manifested patterns of disrupted sleep in fatigued patients undergoing major cancer treatment.

The purposes of this secondary analysis were to describe the characteristics of disrupted sleep patterns in breast cancer patients with CRF undergoing chemotherapy and compare their sleep characteristics with a group of postmenopausal women without a history of cancer. As studies have shown an association of anxiety with CRF (Brown and Kroenke,

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

2009; Luthy et al., 2010) and with sleep disruption (van den Berg et al., 2009; van Mill et al., 2010), levels of anxiety in both groups were also examined.

Methods

The data described in this secondary data analysis were collected from two different studies. The data on the fatigued women with breast cancer were collected as part of an on-going descriptive study navigating prevalence and symptom experience of sudden onset CRF. The data on the postmenopausal women without cancer were obtained as part of a major clinical trial designed to determine the effects of an exercise intervention on the disrupted sleep patterns of postmenopausal women without a history of cancer (Davis et al., 2010).

In this analysis, postmenopausal women not on hormone replacement therapy (HRT) and without breast cancer serve as a comparison for three reasons. First, in North America, natural menopause typically occurs at age 50 or older (Palacios et al., 2010) when the majority of breast cancer is diagnosed in women (*National Cancer Institute (NCI*). Second, absence of menses often occurs while women are undergoing chemotherapy (Walshe et al., 2006; Yu et al., 2010). Finally, the majority of postmenopausal women not on HRT complain of disrupted sleep patterns (Owens and Matthews, 1998). Thus, postmenopausal women comprise a group of the general adult population who suffer from sleep disruptions, and whose hormonal status is comparable to patients with CRF undergoing breast cancer chemotherapy.

Samples and Settings

The studies were approved by the Human Investigation Committee at Wayne State University and each of the study sites. Candidate participants for the CRF group were identified with the assistance of a medical oncologist and nurses at the study sites and approached by the research staff on the day of their chemotherapy treatment. After informed consent, the patients were screened by the International Statistical Classification of Diseases and Related Health Problems (10th revision) criteria for CRF (Cella et al., 2001; Sadler et al., 2002; Van Belle et al., 2005). The criteria for the CRF diagnosis include: (1) six or more, out of 13 possible fatigue symptoms, with one being “significant fatigue” or “diminished energy,” having been present every day or nearly every day during the same 2-week period in the past month; and (2) the symptoms cause clinically significant distress or impairment in important aspects of functioning. To be eligible, patients had to be 18 years of age or older, diagnosed with breast cancer, receiving chemotherapy, had completed the first cycle of chemotherapy, were mentally competent to consent, able to read and communicate in English, and had CRF. Patients diagnosed with AIDS-related malignancies or leukemia, or had a known history of neurological impairments or muscular dystrophies, were excluded.

Potential participants for the comparison group were initially screened over the telephone. Participants who met the screening criteria, reported to the exercise physiology laboratory where the study was explained in detail, written informed consent was obtained, and baseline data was acquired. Participants had to meet the following eligibility criteria: (1) female; (2) one to five years since cessation of menses; (3) FSH levels >40miU; (4) not on estrogen replacement therapy; (5) sedentary; (6) and one or more symptoms of difficulty maintaining sleep, such as frequent awakenings after sleep onset or awakening after sleep onset and not being able to fall back to sleep. Participants were excluded from the study if they had a history of surgical menopause, evidence of cardiovascular disease or stroke; history or evidence of sleep apnea; evidence of clinical depression, musculoskeletal problems; or taking prescribed medication for pain, hypertension, hyperlipidemia, psychotropic, sedative or antihistamine medication because these conditions may affect sleep/wake patterns.

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

The recruitment of the group of fatigued women with breast cancer took place in an outpatient breast center and chemotherapy infusion center of an urban teaching hospital in Southeast Michigan. The non-cancer comparison group was recruited from a community dwelling population residing in a 5-county metropolitan Detroit area. The women reported to the Hutzel Sleep Disorders Center at the Detroit Medical Center to obtain baseline all-night sleep data.

Variables and Measures

Global sleep quality in both CRF and comparison groups was measured by the Pittsburgh Sleep Quality Index (PSQI) (Buysse et al., 1989). The PSQI contains 19 self-report items measuring seven components of sleep, including sleep quality, latency, duration, efficiency, disturbance, medication use, and daytime dysfunction. Each component is rated on a 0-3 rating scale (0=*no difficulty* to 3=*severe difficulty*) yielding a component score. The total global PSQI score ranges 0-21, with a higher score indicating more severe sleep disturbance. A global PSQI score greater than 5 was found to have a sensitivity of 89.6% and a specificity of 86.5% in differentiating good and poor sleepers (Buysse et al., 1989). In a sample of chemotherapy patients, internal consistency reliability α was 0.81 for the global sleep quality scale and 0.69 for the sleep disturbance subscale (Beck et al., 2005).

State anxiety levels in both the CRF and comparison groups were measured by the State-Trait Anxiety Inventory (STAI) (Spielberger, 1983). The STAI comprises two separate self-report scales for measuring state and trait anxiety. Each scale consists of 20 items, using a 1-4 rating scale (1=*not at all* to 4=*very much so*), and measures the subjective feeling of worry, nervousness, tension, and apprehension “right now” and in general. Higher scores indicate more anxiety. Extensive data support the psychometric properties and the utility of this test, including internal consistency reliability. Alphas ranged from 0.86 to 0.94 for state and 0.89 to 0.92 for trait scales. Military recruits had much higher state score than college and high school students and provided the evidence in support of construct validity. Differences in trait scores suggested that the STAI discriminated between normal subjects and psychiatric anxious patients (Spielberger, 1983).

Procedure

For the CRF study, eligible breast cancer patients were instructed to complete a battery of self-administered instruments, including the PSQI (Buysse et al., 1989) and STAI (Spielberger, 1983) on the day of their chemotherapy treatment. Demographic information, including menopausal status, was also self-reported by patients. For the comparison group, participants eligible to participate in the study completed a series of questionnaires including the PSQI and STAI during collection of baseline data at Phase One of the study.

Data Analysis

T-tests and chi-squares tests were used to identify differences in demographic characteristics between the CRF and comparison groups. Descriptive statistics were computed to describe the sample and to characterize the disrupted sleep patterns of women with CRF and postmenopausal women without history of cancer.

To examine differences in disrupted sleep patterns, a Wilcoxon Two-Sample Test in which the component scores of PSQI served as dependent variables and group (CRF versus comparison group) served as the independent variable was computed. To determine the difference in levels of anxiety, a Wilcoxon Two-Sample Test in which the total state scores of STAI served as a dependent variable and group (CRF versus comparison group) served as the independent variable was performed.

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

Results

Participants

Table 1 summarizes the demographics of the study participants in both the CRF and comparison groups. The CRF group was composed of a convenience sample of 30 women with breast cancer, ages 31 to 65 (*M*= 52.1, *SD*=7.7), actively receiving chemotherapy on an outpatient basis in an urban cancer center. The majority of women were Black/African Americans (63%) and not married nor partnered (70%). Less than half of the women (37%) had greater than a high school education. All of the women in the CRF group were postmenopausal. The comparison group was composed of 32 postmenopausal women ages 44-63 (*M*=54.1, *SD*=5.4). The majority of women were White/Caucasian (68.8%). About half of the women were Married/Partnered (56.3%) and a majority had greater than a high school education (87.5%). The two groups were not significantly different in age and postmenopausal status.

The mean Body Mass Index (BMI) for the CRF group was 30.3 (*SD*=7.6) and for the comparison group was 28.1 (*SD*=5.4). The difference between the two groups was not statistically significant (p=0.18). The level of depression was measured by the Center for Epidemiological Studies – Depression (Radloff, 1977) and Beck Depression Inventory (Beck et al., 1961), for CRF patients and non-cancer comparisons, respectively. The depression scores were dichotomized into depressive versus non-depressive status in both groups. More than half of the participants in the CRF group (71.4%) were depressed, while none of their non-cancer counterparts were depressed.

Analysis of power suggests that the sample size used in this analysis is sufficient to detect a median effect size of 0.6 with a power of 0.80 at a .025 level of significance (adjusting levels of significance for the two outcome variables, sleep and anxiety).

Major Study Variables

Four quantitative variables, sleep latency, sleep duration, sleep efficiency, and state anxiety, were compared between fatigued breast cancer patients and postmenopausal women without a history of cancer (Table 2). The findings suggest that CRF patients slept about the same amount of time as the non-cancer postmenopausal group (*M*= 5.9 and *M*= 6.0 hours respectively). However, CRF patients took a significantly longer time to fall asleep (*M*= 54.3 vs. *M*= 31.8 minutes) and their sleep efficiency was significantly lower (*M*= 0.70 vs. *M*= 0.80) relative to the non-cancer group ($p \leq .05$). State anxiety did not significantly differ between the two groups (p=0.88).

CRF patients had a higher total PSQI score (p=0.005) than their non-cancer counterparts. The seven component scores from the PSQI were also examined (Table 3). Compared to the non-cancer group, the fatigued breast cancer patients reported significantly longer sleep latency (p=0.041) and more use of sleep medications (p=0.006). Although the fatigued breast cancer patients had worse component scores than the non-cancer cohort in subjective sleep quality, sleep duration, habitual sleep efficiency, sleep disturbances, and daytime dysfunction, the differences were not statistically significant between the two groups.

A comparison of the percentage of participants who reported "*severe difficulty*" for each of the seven components of the PSQI is shown in Figure 1. The most notable differences were observed in the components of subjective sleep quality, sleep latency, sleep duration, and habitual sleep efficiency. Seventeen percent of women in the CRF group expressed "*severe difficulty*" with sleep quality, while 3% of women in the comparison group were in this category. Forty-seven percent of CRF patients expressed "*severe difficulty*" with sleep latency, while 25% of postmenopausal women were in this category. Thirty percent of

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

women in the CRF group expressed "*severe difficulty*" with sleep duration, while 6% of women in the comparison group were in this category. Lastly, 47% of women in the CRF group were in the "*severe difficulty*" category for sleep efficiency, while 38% of women in the comparison group were in this category. Sleep efficiency was explored further in Figure 2. In the CRF group, 20% of women had greater than 85% sleep efficiency compared to 44% of women who reported greater than 85% sleep efficiency in the comparison group.

Discussion

This secondary analysis revealed that sleep is disrupted in breast cancer women with CRF undergoing chemotherapy. Nearly all patients (97%) had global PSQI scores greater than the cutoff score of 5 (Buysse et al., 1989), indicating significant difficulties in overall sleep quality among the fatigued breast cancer patients. Sleep efficiency, or the percentage of time spent asleep, ranged from 32% to 100%, with 80% of the patients having an inadequate sleep efficiency of less than 85% and only three (10%) patients having an ideal sleep efficiency of greater than 94%. The sleep disruption in this sample of breast cancer patients was characterized by prolonged sleep onset latency (trouble falling asleep within 30 minutes) and frequent nighttime awakenings or waking up earlier than intended, mainly attributed to pain, feeling too hot or too cold, and getting up to use the bathroom. In addition, fatigued breast cancer patients were more likely to use medications as sleep aids. Despite the fact that 40% of the patients took medications three or more times a week to help their sleep, prevalent and frequent sleep difficulties were observed among these patients. The prevalence usage of sleeping pills found in this study was higher than the 21.5% reported in a previous study of various types of cancer survivors (Davidson et al., 2002).

Extensive sleep disruption was shown among the group of non-cancer postmenopausal women who self-reported difficulty in maintaining sleep, but was otherwise healthy. The majority (88%) of the postmenopausal women had a global sleep quality score of greater than 5 and 56% had a sleep efficiency of less than 85%. The notable problems with sleep in this cohort of postmenopausal women without a history of cancer are consistent with previous findings (Baker et al., 1997). When compared to the postmenopausal group, the breast cancer women with CRF still reported worse overall sleep quality with significantly longer sleep onset latency and lower sleep efficiency.

Findings that the breast cancer patients with CRF who took a significantly longer time to fall asleep and had a significantly decreased sleep efficiency index compared to women without breast cancer were supported by previous findings (Koopman et al., 2002; Kuo et al., 2006; Palesh et al., 2007; Savard et al., 2001). In addition, fatigued breast cancer patients reported more disrupted sleep, greater use of sleeping medications and more daytime dysfunction relative to the non-cancer postmenopausal group. The findings of problems in initiating and maintaining sleep are consistent with the previous research showing women with breast cancer who were fatigued experienced significantly longer sleep latency, and more frequent and longer nighttime awakenings, when compared to their non-fatigued counterparts (Alexander et al., 2009). Frequent nighttime awakenings, in particular, was pervasive among women actively treated for breast cancer over the course of chemotherapy and was strongly associated with higher levels of CRF (Berger, 1998; Berger and Farr, 1999; Berger and Higginbotham, 2000). The findings supported that various sleep disruptions are prominent among women with breast cancer undergoing major cancer treatment (Beck et al., 2009; Berger, 1998; Berger and Farr, 1999; Berger and Higginbotham, 2000; Fortner et al., 2002; Kuo et al., 2006).

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

The fatigued breast cancer patients receiving chemotherapy in this analysis showed a trend toward more daytime dysfunction, but the effect was not statistically significant. Daytime sleepiness is difficult to distinguish from fatigue and has been largely ignored in cancer studies. Since daytime sleepiness is closely associated with daytime function and quality of life, napping during the day has been recommended as a parameter to measure sleep/wake disturbances (Berger et al., 2005) and should be considered in future studies of fatigue. The relationship between disrupted sleep, daytime sleepiness, and CRF are in need of further investigation.

By employing a comparison group of postmenopausal women without a history of cancer, the current analysis allows for the comparison of fatigued breast cancer women with similar women without a cancer history across a variety of sleep parameters. The unique nature of these two groups of women allows the comparison of cancer patients and non-cancer controls who have similar ages, hormonal status, and body weight. The findings highlight the significance of sleep problems in both groups of women that serve as a basis upon which further research can be developed. In addition to reveal the overall problem with sleep, the findings provide multi-manifested evaluation and characterize specific sleep disruption in the women undergoing chemotherapy. Information on specific disruptions in sleep is important as different sleep complaint requires different intervention. Knowledge of the nature of sleep disruption among patients undergoing chemotherapy contributes to CRF symptom management and is crucial in preparing patients for major cancer treatments.

One limitation of this secondary data analysis is that the women with breast cancer and the non-cancer post-menopausal women were recruited from two separate studies with different recruitment criteria. The samples are diverse in ethnicity, education, and marital status. Although studies show that CRF or sleep is associated with a few personal characteristics, such as age (Davidson et al., 2002; Schwartz, 2000), the available findings in racial differences (Paskett et al., 2008), education (Broeckel et al., 1998), and marital status (de Jong et al., 2004; de Jong et al., 2006) are limited and inconclusive (Prue et al., 2006). While the majority of the fatigued breast cancer participants in this study were African American, had lower educational levels, and were not partnered, the observed differences in disrupted sleep patterns can not be explained by those three demographic characteristics alone. Another major limitation is the significant differences in levels of depression between these two groups. As depression frequently presents concurrent with CRF and has been associated with difficulties in sleep (Andrykowski et al., 1997), the greater prevalence of depression may play a part in more disrupted sleep in the group of breast cancer patients. The other limitation is that the present study does not allow for the characterization of disrupted sleep across time, and it is unclear how the patterns of disrupted sleep may differ temporally between breast cancer patients and women without a history of cancer. Further studies are needed to understand specific types of sleep disruption experienced over the course of treatment and identify which specific types of sleep disruption may be more associated with fatigue in patients with cancer. In addition, studies have shown the impact of menopausal symptoms on fatigue and sleep in women with breast cancer (Carpenter et al., 2004; Stein et al., 2000). Additional research is needed to increase understanding of the ways menopausal symptoms interact with and affect the symptoms of cancer and its treatment.

Disrupted sleep and CRF are strongly and may be reciprocally related (Roscoe et al., 2007). Investigation of the role that disrupted sleep plays in fatigue may be helpful in understanding CRF. Including non-fatigued cancer patients as a comparison in future research will help to clarify the relationship between CRF and disrupted sleep. The factors contributing to CRF and disrupted sleep can also be better explored. Knowledge of the nature of sleep disruption among cancer patients contributes to CRF symptom management. Knowing specific disruptions in sleep could lead to tailored interventions designed to

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

improve the designated sleep complaints and overall quality of sleep in order to manage fatigue, thereby improving quality of life in cancer patients.

References

Alexander S, Minton O, Andrews P, Stone P. A comparison of the characteristics of disease-free breast cancer survivors with or without cancer-related fatigue syndrome. European Journal of Cancer. 2009; 45(3):384–392. [PubMed: 18977131]

Andrykowski MA, Carpenter JS, Greiner CB, Altmaier EM, Burish TG, Antin JH, et al. Energy level and sleep quality following bone marrow transplantation. Bone Marrow Transplantation. 1997; 20(8):669–679. [PubMed: 9383231]

Andrykowski MA, Curran SL, Lightner R. Off-treatment fatigue in breast cancer survivors: a controlled comparison. Journal of Behavioral Medicine. 1998; 21(1):1–18. [PubMed: 9547419]

Baker A, Simpson S, Dawson D. Sleep disruption and mood changes associated with menopause. Journal of Psychosomatic Research. 1997; 43(4):359–369. [PubMed: 9330235]

Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. Archives of General Psychiatry. 1961; 4:561–571. [PubMed: 13688369]

Beck SL, Berger AM, Barsevick AM, Wong B, Stewart KA, Dudley WN. Sleep quality after initial chemotherapy for breast cancer. Supportive Care in Cancer. 2009; 18(6):679–689. [PubMed: 19521723]

Beck SL, Dudley WN, Barsevick A. Pain, sleep disturbance, and fatigue in patients with cancer: using a mediation model to test a symptom cluster. Oncology Nursing Forum. 2005; 32(3):E48–55.

Berger AM. Patterns of fatigue and activity and rest during adjuvant breast cancer chemotherapy. Oncology Nursing Forum. 1998; 25(1):51–62. [PubMed: 9460773]

Berger AM. Update on the state of the science: sleep-wake disturbances in adult patients with cancer. Oncology Nursing Forum. 2009; 36(4):E165–177. [PubMed: 19581220]

Berger AM, Farr L. The influence of daytime inactivity and nighttime restlessness on cancer-related fatigue. Oncology Nursing Forum. 1999; 26(10):1663–1671. [PubMed: 10573683]

Berger AM, Higginbotham P. Correlates of fatigue during and following adjuvant breast cancer chemotherapy: a pilot study. Oncology Nursing Forum. 2000; 27(9):1443–1448. [PubMed: 11058976]

Berger AM, Parker KP, Young-McCaughan S, Mallory GA, Barsevick AM, Beck SL, et al. Sleep wake disturbances in people with cancer and their caregivers: state of the science. Oncology Nursing Forum. 2005; 32(6):E98–126. [PubMed: 16270104]

Broeckel JA, Jacobsen PB, Horton J, Balducci L, Lyman GH. Characteristics and correlates of fatigue after adjuvant chemotherapy for breast cancer. Journal of Clinical Oncology. 1998; 16(5):1689–1696. [PubMed: 9586880]

Brown LF, Kroenke K. Cancer-related fatigue and its associations with depression and anxiety: a systematic review. Psychosomatics. 2009; 50(5):440–447. [PubMed: 19855028]

Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Research. 1989; 28(2):193–213. [PubMed: 2748771]

Byar KL, Berger AM, Bakken SL, Cetak MA. Impact of adjuvant breast cancer chemotherapy on fatigue, other symptoms, and quality of life. Oncology Nursing Forum. 2006; 33(1):E18–26. [PubMed: 16470230]

Carlson LE, Campbell TS, Garland SN, Grossman P. Associations among salivary cortisol, melatonin, catecholamines, sleep quality and stress in women with breast cancer and healthy controls. Journal of Behavioral Medicine. 2007; 30(1):45–58. [PubMed: 17245618]

Carpenter JS, Elam JL, Ridner SH, Carney PH, Cherry GJ, Cucullu HL. Sleep, fatigue, and depressive symptoms in breast cancer survivors and matched healthy women experiencing hot flashes. Oncology Nursing Forum. 2004; 31(3):591–5598. [PubMed: 15146224]

Cella D, Davis K, Breitbart W, Curt G. Cancer-related fatigue: prevalence of proposed diagnostic criteria in a United States sample of cancer survivors. Journal of Clinical Oncology. 2001; 19(14):3385–3391. [PubMed: 11454886]

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

Curt G, Johnston PG. Cancer fatigue: the way forward. Oncologist. 2003; 8 1:27–30. [PubMed: 12626786]

Curt GA, Breitbart W, Cella D, Groopman JE, Horning SJ, Itri LM, et al. Impact of cancer-related fatigue on the lives of patients: new findings from the Fatigue Coalition. Oncologist. 2000; 5(5): 353–360. [PubMed: 11040270]

Davidson JR, MacLean AW, Brundage MD, Schulze K. Sleep disturbance in cancer patients. Social Science and Medicine. 2002; 54(9):1309–1321. [PubMed: 12058848]

Davis JE, Yarandi H, Engels HJ. Sleep, sleep quality, and daytime sleepiness in estrogen-deficient postmenopausal women. Sleep. 2010; 33:A208.

de Jong N, Candel M, Schouten HC, Abu-Saad HH, Courtens AM. Prevalence and course of fatigue in breast cancer patients receiving adjuvant chemotherapy. Annals of Oncology. 2004; 15(6):896–905. [PubMed: 15151946]

de Jong N, Kester A, Schouten HC, Abu-Saad HH, Courtens AM. Course of fatigue between two cycles of adjuvant chemotherapy in breast cancer patients. Cancer Nursing. 2006; 29(6):467–477. [PubMed: 17135820]

Flechtner H, Bottomley A. Fatigue and quality of life: lessons from the real world. Oncologist. 2003; 8 1:5–9. [PubMed: 12626781]

Fortner BV, Stepanski EJ, Wang SC, Kasprowicz S, Durrence HH. Sleep and quality of life in breast cancer patients. Journal of Pain and Symptom Management. 2002; 24(5):471–480. [PubMed: 12547047]

Koopman C, Nouriani B, Erickson V, Anupindi R, Butler LD, Bachmann MH, et al. Sleep disturbances in women with metastatic breast cancer. The Breast Journal. 2002; 8(6):362–370. [PubMed: 12390359]

Kuo HH, Chiu MJ, Liao WC, Hwang SL. Quality of sleep and related factors during chemotherapy in patients with stage I/II breast cancer. Journal of the Formosan Medical Association. 2006; 105(1): 64–69. [PubMed: 16440072]

Langeveld NE, Grootenhuis MA, Voute PA, de Haan RJ, van den Bos C. No excess fatigue in young adult survivors of childhood cancer. European Journal of Cancer. 2003; 39(2):204–214. [PubMed: 12509953]

Luthy C, Cedraschi C, Pugliesi A, Di Silvestro K, Mugnier-Konrad B, Rapiti E, et al. Patients' views about causes and preferences for the management of cancer-related fatigue-a case for non-congruence with the physicians? Supportive Care in Cancer. 201010.1007/s00520-010-0826-9

Miaskowski C, Lee KA. Pain, fatigue, and sleep disturbances in oncology outpatients receiving radiation therapy for bone metastasis: a pilot study. Journal of Pain and Symptom Management. 1999; 17(5):320–332. [PubMed: 10355211]

National Cancer Institute (NCI). Retrieved July 6, 2010, from http://www.cancer.gov/

Okuyama T, Tanaka K, Akechi T, Kugaya A, Okamura H, Nishiwaki Y, et al. Fatigue in ambulatory patients with advanced lung cancer: prevalence, correlated factors, and screening. Journal of Pain and Symptom Management. 2001; 22(1):554–564. [PubMed: 11516597]

Owens JF, Matthews KA. Sleep disturbance in healthy middle-aged women. Maturitas. 1998; 30(1): 41–50. [PubMed: 9819782]

Palacios S, Henderson VW, Siseles N, Tan D, Villaseca P. Age of menopause and impact of climacteric symptoms by geographical region. Climacteric. 2010; 13(5):419–428. [PubMed: 20690868]

Palesh OG, Collie K, Batiuchok D, Tilston J, Koopman C, Perlis ML, et al. A longitudinal study of depression, pain, and stress as predictors of sleep disturbance among women with metastatic breast cancer. Biological Psychology. 2007; 75(1):37–44. [PubMed: 17166646]

Paskett ED, Alfano CM, Davidson MA, Andersen BL, Naughton MJ, Sherman A, et al. Breast cancer survivors' health-related quality of life: racial differences and comparisons with noncancer controls. Cancer. 2008; 113(11):3222–3230.10.1002/cncr.23891 [PubMed: 18973178]

Payne J, Piper B, Rabinowitz I, Zimmerman B. Biomarkers, fatigue, sleep, and depressive symptoms in women with breast cancer: a pilot study. Oncology Nursing Forum. 2006; 33(4):775–783. [PubMed: 16858459]

NIH-PA Author Manuscript NIH-PA Author Manuscript NIH-PA Author Manuscript

Prue G, Rankin J, Allen J, Gracey J, Cramp F. Cancer-related fatigue: a critical appraisal. European Journal of Cancer. 2006; 42(7):846–863. [PubMed: 16460928]

Quick M, Fonteyn M. Development and implementation of a clinical survey for cancer-related fatigue assessment. Clinical Journal of Oncology Nursing. 2005; 9(4):435–439. [PubMed: 16117210]

Radloff LS. The CES-D Scale: a self-report depression scale for research in the general population. Applied Psychological Measurement. 1977; 1:385–401.

Rebar RW. Unanswered questions in hormonal replacement therapy. Experimental Gerontology. 1994; 29(3-4):447–461. [PubMed: 7925763]

Redeker NS, Lev EL, Ruggiero J. Insomnia, fatigue, anxiety, depression, and quality of life of cancer patients undergoing chemotherapy. Scholarly Inquiry for Nursing Practice. 2000; 14(4):275–290. [PubMed: 11372188]

Roscoe JA, Kaufman ME, Matteson-Rusby SE, Palesh OG, Ryan JL, Kohli S, et al. Cancer-related fatigue and sleep disorders. Oncologist. 2007; 12 1:35–42. [PubMed: 17573454]

Sadler IJ, Jacobsen PB, Booth-Jones M, Belanger H, Weitzner MA, Fields KK. Preliminary evaluation of a clinical syndrome approach to assessing cancer-related fatigue. Journal of Pain and Symptom Management. 2002; 23(5):406–416. [PubMed: 12007758]

Sarna L. Correlates of symptom distress in women with lung cancer. Cancer Practice. 1993; 1(1):21–28. [PubMed: 8324526]

Savard J, Liu L, Natarajan L, Rissling MB, Neikrug AB, He F, et al. Breast cancer patients have progressively impaired sleep-wake activity rhythms during chemotherapy. Sleep. 2009; 32(9): 1155–1160. [PubMed: 19750920]

Savard J, Simard S, Blanchet J, Ivers H, Morin CM. Prevalence, clinical characteristics, and risk factors for insomnia in the context of breast cancer. Sleep. 2001; 24(5):583–590. [PubMed: 11480655]

Schwartz AL. Daily fatigue patterns and effect of exercise in women with breast cancer. Cancer Practice. 2000; 8(1):16–24. [PubMed: 10732535]

Silberfarb PM, Hauri PJ, Oxman TE, Schnurr P. Assessment of sleep in patients with lung cancer and breast cancer. Journal of Clinical Oncology. 1993; 11(5):997–1004. [PubMed: 8487063]

Spielberger, CD. State-Trait Anxiety Inventory: A Comprehensive Bibliography. Consulting Psychologists Press; Palo Alto: 1983.

Stein KD, Jacobsen PB, Hann DM, Greenberg H, Lyman G. Impact of hot flashes on quality of life among postmenopausal women being treated for breast cancer. Journal of Pain and Symptom Management. 2000; 19(6):436–445. [PubMed: 10908824]

Van Belle S, Paridaens R, Evers G, Kerger J, Bron D, Foubert J, et al. Comparison of proposed diagnostic criteria with FACT-F and VAS for cancer-related fatigue: proposal for use as a screening tool. Supportive Care in Cancer. 2005; 13(4):246–254. [PubMed: 15549424]

van den Berg JF, Luijendijk HJ, Tulen JH, Hofman A, Neven AK, Tiemeier H. Sleep in depression and anxiety disorders: a population-based study of elderly persons. Journal of Clinical Psychiatry. 2009; 70(8):1105–1113.10.4088/JCP.08m04448 [PubMed: 19607762]

van Mill JG, Hoogendijk WJ, Vogelzangs N, van Dyck R, Penninx B. Insomnia and sleep duration in a large cohort of patients with major depressive disorder and anxiety disorders. The Journal of clinical psychiatry. 2010; 71(3):239–246.10.4088/JCP.09m05218gry [PubMed: 20331928]

Walshe JM, Denduluri N, Swain SM. Amenorrhea in premenopausal women after adjuvant chemotherapy for breast cancer. Journal of Clinical Oncology. 2006; 24(36):5769–5779. [PubMed: 17130515]

Yu B, Douglas N, Ferin MJ, Nakhuda GS, Crew K, Lobo RA, et al. Changes in markers of ovarian reserve and endocrine function in young women with breast cancer undergoing adjuvant chemotherapy. Cancer. 2010; 116(9):2099–2105.10.1002/cncr.25037 [PubMed: 20187091]

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

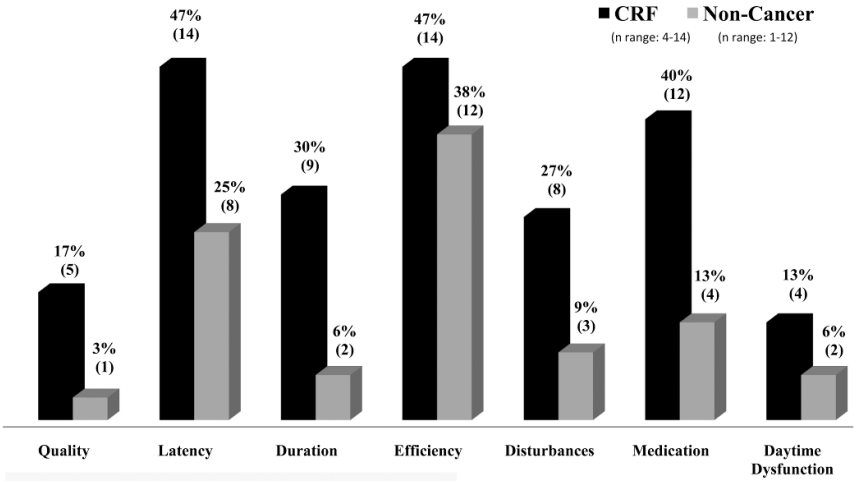

Figure 1. Percentage of "Very Bad" Category of Sleep Components in Pittsburg Sleep Quality Index

Note: Numbers in parentheses denote number of women who responded in each category

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

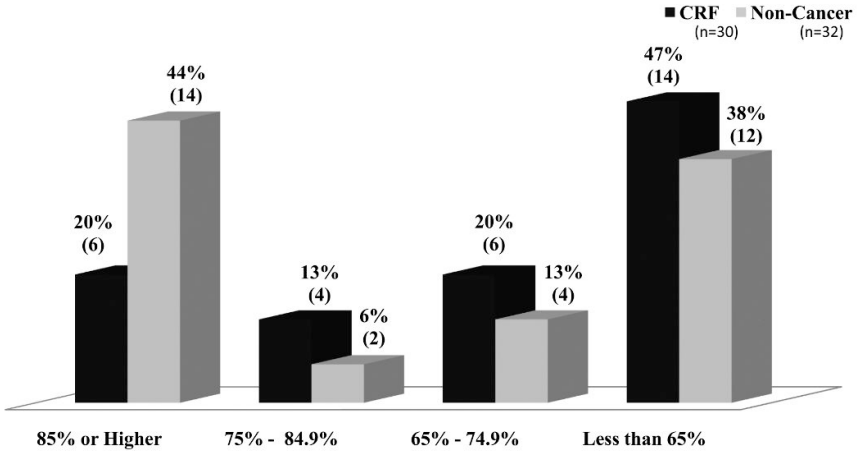

Figure 2. Sleep Efficiency

Note: Numbers in parentheses denote number of women who responded in each category

NIH-PA Author Manuscript
NIH-PA Author Manuscript
NIH-PA Author Manuscript

Table 1

Demographics (n = 62)

Variable	Mean (SD)		Number (%)		*p*-level
	[a]C	[b]NC	[a]C	[b]NC	
Age in yrs	52.1 (±7.7)	54.1 (±5.4)	-	-	0.2388
Marital Status					
Married/Partnered	-	-	10 (33.3)	18 (56.3)	
Single	-	-	10 (33.3)	4 (12.5)	
Separated	-	-	2 (6.7)	0 (0)	
Divorced	-	-	5 (16.7)	10 (31.3)	
Widowed	-	-	3 (10)	0 (0)	0.0062*
Education Level					
High School	-	-	18 (62.1)	4 (12.5)	
College	-	-	9 (31.0)	17 (53.1)	
Post-grad	-	-	2 (6.9)	11 (34.4)	0.0002*
Ethnicity					
White	-	-	9 (30.0)	22 (68.8)	
African American	-	-	19 (63.3)	10 (31.2)	
Hispanic	-	-	2 (6.7)	0 (0)	0.0061*
BMI	30.3 (±7.6)	28.1 (±5.4)	-	-	0.1833
Depression					
Yes	-	-	20 (71.4)	0 (0)	
No	-	-	8 (28.6)	32 (100)	<0.0001*
State Anxiety Score	43.6 (±14.6)	44.1 (±6.1)	-	-	0.88

[a]Cancer-Related Fatigue (CRF) Group (n = 30)

[b]Non-Cancer Comparison Group (n = 32)

*$p \leq .05$

NIH-PA Author Manuscript
NIH-PA Author Manuscript
NIH-PA Author Manuscript

Table 2

Major Study Variables (n = 62)

	Mean (SD)		Inclusive Range		*p*-level
	[a]C	[b]NC	[a]C	[b]NC	
Sleep Latency (minutes)	54.3 (±49.2)	31.8 (±33.7)	10.0 – 240.0	1.0 – 180.0	0.042*
Sleep Duration (hours)	5.9 (±1.6)	6.0 (±1.1)	3.0 – 10.0	4.0 – 9.0	0.774
Sleep Efficiency (%)	0.70 (±0.20)	0.80 (±0.20)	0.30 – 1.00	0.50 – 1.00	0.025*

[a]Cancer-Related Fatigue (CRF) Group (n = 30)

[b]Non-Cancer Comparison Group (n = 32)

*$p \leq .05$

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

Table 3

Pittsburgh Sleep Quality Index (PSQI) Scores (n = 62)

PSQI Components	Mean (SD)		*p*-level
	[a]C	[b]NC	
PSQI Component 1 Subjective Sleep Quality	1.57 (±0.94)	1.56 (±0.56)	0.4696
PSQI Component 2 Sleep Latency	2.17 (±0.91)	1.69 (±1.09)	0.0406*
PSQI Component 3 Sleep Duration	1.87 (±1.01)	1.66 (±0.75)	0.1195
PSQI Component 4 Habitual Sleep Efficiency	1.93 (±1.20)	1.45 (±1.39)	0.0811
PSQI Component 5 Sleep Disturbances	2.07 (±0.69)	1.84 (±0.57)	0.0901
PSQI Component 6 Use of Sleeping Medication	1.43 (±1.43)	0.56 (±1.08)	0.0063*
PSQI Component 7 Daytime Dysfunction	1.60 (±0.77)	1.31 (±0.78)	0.0877
PSQI Total Score	12.6 (±4.24)	10.1 (±3.42)	0.0050*

[a]Cancer-Related Fatigue (CRF) Group (n = 30)

[b]Non-Cancer Comparison Group (n = 32)

*$p \leq .05$