# The Relationship of Sick Leave Benefits, Employment Patterns, and Individual Characteristics to Radiation Therapy–Related Fatigue

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**Purpose/Objectives:** To examine the relationship among sick leave benefits, employment patterns, individual characteristics, and fatigue in patients receiving radiation therapy.

**Design:** Prospective, longitudinal design.

**Setting:** A community hospital radiation oncology department.

**Sample:** 77 patients receiving radiation therapy to the breast, chest, head and neck, pelvis, or prostate. All were employed at the time of diagnosis.

**Methods:** The Piper Integrated Fatigue Model guided the study. The Revised Piper Fatigue Scale (PFS), Brief Fatigue Inventory, and a single-item scale were used to measure five dimensions of subjective fatigue. Sick leave, employment, individual characteristics, and fatigue were measured at baseline, weekly during treatment, and at one month post-treatment.

**Main Research Variables:** Employment patterns, availability of sick leave benefits, and fatigue.

**Findings:** Mean total fatigue scores on the PFS ranged from 0–4.77 at baseline ($\bar{X}$ = 0.46, SD = 0.93), 0–8.77 at the completion of treatment ($\bar{X}$ = 2.84, SD = 2.40), and 0–4.82 at one month post-treatment ($\bar{X}$ = 0.77, SD = 1.20). Side effects, education, living situation, age, treatment site, and work were associated with fatigue along the trajectory of radiation therapy. Study participants who were working at the end of radiation had lower fatigue scores than those who were not. Availability of sick leave benefits was associated with employment patterns during treatment.

**Conclusions:** Work may have benefits during radiation therapy but may be affected by radiation therapy–related fatigue.

**Implications for Nursing:** Management of treatment side effects, including fatigue, may help patients remain in the workforce during radiation.

## Key Points . . .

- ➤ Fatigue continues to be one of the most common side effects of radiation therapy and is influenced by a variety of factors, including working during treatment.
- ➤ Current sick leave policies at workplaces do not adequately support patients' needs to adjust employment because of side effects of treatment, such as fatigue.
- ➤ Oncology nurses need to take an active role in policies related to employment issues and symptom management for patients undergoing cancer treatment.

The American Cancer Society (2006) estimated that 1,399,790 new cases of cancer would be diagnosed in the United States in 2006. Approximately 60% of all people diagnosed with cancer will receive radiation therapy at some point during their treatment (Hilderly, 1997). Although radiation therapy plays a major role in the cure, control, or palliation of cancer, it also produces adverse effects. Haylock and Hart (1979) were among the first to describe fatigue as a result of radiation therapy for cancer. Since that time, fatigue consistently has been reported as the most common and distressing side effect of radiation therapy (Munro & Potter, 1996; Oberst, Hughes, Chang, & McCubbin, 1991; Williams et al., 2001).

Research has revealed an inconsistency between patients' and healthcare providers' perceptions of fatigue and fatigue management (Dillon & Kelly, 2003; Passik et al., 2002; Stone et al., 2003). In surveys conducted in the United States and Ireland, a much higher percentage of healthcare providers reported providing information on fatigue management than patients reported receiving such information (Dillon & Kelly; Stone et al.). Interestingly, of those who reported fatigue in the study conducted in Ireland, 46% discussed the symptom with their doctor and 44% discussed it with a nurse (Dillon & Kelly). In a companion study of patients in the United States, 79% discussed fatigue with their doctor, whereas only 28% spoke with a nurse (Curt et al., 2000). Therefore, in spite of recommendations by professional organizations that clinicians assess and manage fatigue, evidence shows that this is not happening.

Although fatigue in patients receiving radiation therapy has been well described, few investigators have examined the relationship of specific lifestyle behaviors, such as participation in the workforce, to the prevalence and severity of cancer-related fatigue. Financial necessity and the need to maintain health insurance may force many patients with cancer to work during their treatment. Others may choose to work to maintain a sense of normalcy in their lives.

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This study, then, tested the following hypotheses.

1. Radiation therapy–related fatigue follows a predictable pattern in patients receiving radiation therapy, beginning during approximately the second week of treatment, increasing as treatments progress, and returning close to pretreatment levels by one month post-treatment.
2. The purposes of this study were to examine the pattern of fatigue in patients receiving radiation therapy and to examine factors associated with radiation therapy–related fatigue in patients undergoing radiation therapy for cancer.

## Literature Review

Fatigue associated with radiation therapy appears to follow a pattern, increasing over the course of treatment and declining after completion of treatment (Geinitz et al., 2001; Greenberg, Sawicka, Eisenthal, & Ross, 1992; Irvine, Vincent, Graydon, & Bubela, 1998; Schwartz et al., 2000). Onset of radiation therapy–related fatigue generally is expected to occur by the end of the second week of treatment (Greenberg et al.; Irvine et al.). Selected individual characteristics are thought to be related to radiation therapy–related fatigue, including anatomic site-specific treatment-related side effects, pain, sleep disturbances, exercise patterns, previous or concurrent chemotherapy, age, gender, race or ethnicity, living situation, education, disease site, anatomic treatment site, disease stage, extent of surgery, comorbidities, baseline hemoglobin, and medications (Akechi, Kugaya, Okamura, Yamawaki, & Uchitomi, 1999; Anderson et al., 2003; Bansal et al., 2004; Cella, Lai, Chang, Peterman, & Slavin, 2002; Cimprich, 1998; Curt et al., 2000; Donovan et al., 2004; Gift, Stommel, Jablonski, & Given, 2003; Hwang, Chang, Rue, & Kasimis, 2003; Magnan & Mood, 2003; Mock et al., 2001; Schwartz, 1998; Stone, Hardy, Huddart, A'Hern, & Richards, 2000; Wang et al., 2001).

Few studies have been conducted using employment status as a contributing factor to cancer-related fatigue. Two large telephone surveys conducted in the United States and Ireland found that nearly 75% of patients who were working at the time of cancer diagnosis made changes to their employment as a result of treatment-related fatigue (Curt et al., 2000; Curt & Johnston, 2003). Patients accepted fewer work responsibilities, reduced hours of work, took sick days, or discontinued work altogether because of fatigue. Burnie (2000), in a qualitative study of 25 women with breast cancer, found that nearly half experienced a change in employment as a result of their diagnosis. Although fatigue itself was not mentioned specifically, support from colleagues at work was found to be an effective strategy for coping with treatment-related side effects (Chan, Molassiotis, Yam, Chan, & Lam, 2001; Wengstrom, Haggmark, & Forsberg, 2001).

## Conceptual Framework

The Piper Integrated Fatigue Model (IFM) (Berger & Walker, 2001; Piper et al., 1998; Piper, Lindsey, & Dodd, 1987) guided the study. The IFM, a synthesis of much of the available data on cancer-related fatigue (Berger & Walker), encompasses six manifestations or dimensions of subjective fatigue: temporal (timing and duration), sensory (physical), cognitive or mental, affective or emotional, behavioral or severity, and physiologic (Piper et al., 1987; Sitton, 1997). The IFM delineates the multiple interrelated factors or causes that lead to fatigue in patients with cancer, such as life event patterns, social patterns, environmental patterns, regulation or transmission factors, psychological patterns, symptom patterns, oxygenation patterns, innate host factors, accumulation of metabolites, energy or energy substrate patterns, activity and rest patterns, sleep and wake patterns, and disease and treatment patterns (Berger et al., 2003; Piper et al., 1987; Sitton). Employment and individual characteristics represent the various patterns identified in the IFM as potential causes of fatigue.

## Methods

### Sample

Seventy-seven study participants were recruited from one community hospital radiation oncology department. One study participant did not complete the one-month follow-up assessment because of disease progression but completed all other visits. The original plan, which was to enroll approximately 150 study participants, was based on an expectation of a medium effect size, using Cohen's (1988) formulas. Findings, however, revealed large effect sizes when data had been collected from 77 study participants, with powers of 0.97–0.99.

Figure 1 summarizes the inclusion and exclusion criteria for the study. Study participants with unstable medical or psychiatric comorbidities were excluded to avoid confounding radiation therapy–related fatigue with fatigue that may be associated with those conditions.

### Instruments

Although researchers agree that cancer-related fatigue is a subjective phenomenon, no accepted measure is used to quantify subjective physiologic fatigue (Berger et al., 2003). Physiologic fatigue is a correlate or underlying mechanism of cancer-related fatigue, and possible measures are expensive and inexact (B. Piper, personal communication, October 1,

**Inclusion Criteria**

- Radiation therapy for curative or adjunctive intent for four weeks or longer
- Radiation therapy to chest, lung, breast, abdomen, pelvis, head and neck, or extremities
- Aged 18–67 years
- Karnofsky Performance Status 70 or more
- Absence of unstable medical or psychiatric comorbidity
- Ability to speak and read English
- Ability to give written informed consent
- Employed prior to diagnosis of cancer

**Exclusion Criteria**

- Radiation therapy for palliation for fewer than four weeks
- Radiation therapy to the brain
- Age younger than 18 years or older than 67 years
- Karnofsky Performance Status less than 70
- Presence of unstable medical or psychiatric comorbidity (e.g., uncontrolled hypertension, uncontrolled diabetes, severe depression)
- Inability to speak or read English
- Inability to give written informed consent
- Not employed prior to diagnosis of cancer

**Figure 1. Inclusion and Exclusion Criteria**

2003). The physiologic dimension of the IFM's conceptualization of fatigue was therefore not measured in this study.

**Numeric scale:** A single-item numeric scale was used to measure the temporal dimension of fatigue and was used as a screening measure for fatigue. Study participants were asked to rate the degree of fatigue they were currently experiencing on a scale of 0 (no fatigue) to 10 (a great deal of fatigue).

**Piper Fatigue Scale:** The Piper Fatigue Scale (PFS) was used to measure four dimensions of subjective fatigue: behavioral and severity, affective and emotional, sensory, and cognitive and mental. The revised PFS consists of 22 items scaled from 0 (no fatigue) to 10 (severe fatigue) that measure the four dimensions of subjective fatigue and includes five open-ended questions that provide qualitative information on contributing and relieving factors to cancer-related fatigue (Piper et al., 1998). Cronbach's standardized alpha coefficients were 0.98 for the entire scale and 0.79–0.98 for the subscales in the present study.

**Brief Fatigue Inventory:** Based on the Brief Pain Inventory, the Brief Fatigue Inventory (BFI) consists of nine items rated on a scale of 0–10 that evaluate present, usual, and worse fatigue over the previous 24 hours as well as interference with usual functioning (Schwartz, 2002; Wu & McSweeney, 2001). Cronbach's standardized alpha coefficient for the BFI was 0.98 in the present study.

**Sick leave benefits questionnaire and Employment Patterns Questionnaire:** An investigator-developed questionnaire measured availability and use of formal sick leave benefits such as the Family and Medical Leave Act and informal benefits such as decreased workload and working from home. Participants answered questions about hours and days of work in the Employment Patterns Questionnaire as well as questions about job title and actual duties performed. The *Boston Area Survey* (Center for Survey Research, 2002) was used as a source of questions about employment patterns.

**Demographic data worksheet:** Individual characteristics were recorded on the demographic data worksheet. The information was obtained via study participant self-report and review of participants' medical records and included age, gender, race or ethnicity, education, living situation (i.e., alone, spouse or domestic partner, roommate, dependent children, grown children, older adult parents, or other relative), usual exercise patterns, sleep disturbances, cancer and treatment site, previous or concurrent treatment for cancer (e.g., surgery, chemotherapy), stage of disease, comorbidities, baseline hemoglobin, and medications. Treatment-related side effects and cumulative radiation dose were obtained from the radiation therapy patient care record currently used in the hospital's radiation therapy department. The tool graded side effects on a 0–4 scale consistent with the Common Toxicities Scoring Scale used in oncology (National Cancer Institute, 2003).

## Procedures

Following approval by the community hospital and the University of Massachusetts Boston institutional review boards, potential study participants were identified by the attending radiation oncologist or primary nurse and referred to the investigator. Those who agreed to participate in the study signed a written informed consent and authorization for use of protected health information. Demographic information, availability of sick leave benefits, employment status, and fatigue were measured at baseline and reevaluated at each of five weekly nursing visits and a one month follow-up visit. Risks to study participants were minimal. An additional 10–20 minutes of time were added to each visit to obtain study data.

## Data Analysis

Stata version 7.0 (StataCorp LP, College Station, TX) was used to conduct cross-sectional analyses and regression diagnostics. SAS Learning Edition 2.0 (SAS Institute, Inc., Cary, NC) was used to conduct longitudinal analyses. Mean total

**Table 1. Sample Characteristics**

| Characteristic | n | % |
|---|---|---|
| **Age (years)** | | |
| Range = 29–67 | – | – |
| $\bar{X}$ = 53.95 | – | – |
| SD = 8.44 | – | – |
| **Education (years)** | | |
| Range = 8–18 | – | – |
| $\bar{X}$ = 14 | – | – |
| SD = 2.21 | – | – |
| **Gender** | | |
| Male | 32 | 42 |
| Female | 45 | 58 |
| **Race or ethnicity** | | |
| Non-Hispanic white | 73 | 95 |
| Non-Hispanic black | 2 | 3 |
| Hispanic white | 2 | 3 |
| **Living situation** | | |
| Alone | 18 | 23 |
| Family or significant other | 59 | 77 |
| **Stage of disease** | | |
| I | 27 | 35 |
| II | 21 | 27 |
| III | 16 | 21 |
| IV | 8 | 10 |
| Other | 5 | 7 |
| **Medical conditions** | | |
| None | 21 | 27 |
| 1–2 | 39 | 51 |
| > 2 | 17 | 22 |
| **Surgery** | | |
| Major | 21 | 27 |
| Minor | 29 | 38 |
| Biopsy only or none | 27 | 35 |
| **Medications** | | |
| None | 23 | 30 |
| 1–2 | 33 | 43 |
| > 2 | 21 | 27 |
| **Treatment site** | | |
| Chest | 13 | 17 |
| Abdomen or pelvis | 9 | 12 |
| Head or neck | 10 | 13 |
| Prostate | 11 | 14 |
| Breast | 34 | 44 |
| **Chemotherapy** | | |
| Prior only | 19 | 25 |
| Concurrent only | 3 | 4 |
| Both | 17 | 22 |
| None | 38 | 49 |

N = 77

*Note.* Because of rounding, not all percentages total 100.

fatigue scores for the entire sample and for groups categorized by treatment site were graphed for each measurement point. Paired t tests were used to test for significant differences in mean fatigue scores at each time point. Shi (1997) recommended that at least three measures on the same instrument be used to draw conclusions regarding trends over time. The present study measured fatigue at a minimum of six points in time.

Cross-sectional and longitudinal regression analyses were used to model fatigue as a function of individual characteristics and employment. Because the study consisted of repeated observations of fatigue over time for the same set of participants, longitudinal analysis would be able to capture changes with time as the single within-subjects factor (Der & Everitt, 2002). Confirmatory regression analysis was conducted using the simultaneous regression procedure (Burns & Grove, 2001). All independent variables supported by the integrated literature review were entered into the regression model at the same time. Variables were retained or eliminated based on individual probability levels, $R^2$ and adjusted $R^2$ of the model, results of regression diagnostic tests, and the strength of the supporting literature.

## Results

Table 1 summarizes the individual characteristics for the sample. Comorbidities in this study were evenly distributed across treatment sites and primarily consisted of hypertension, hypercholesterolemia, and osteoarthritis. Participants who currently were working or not working were recruited into the study if they had been working prior to their cancer diagnosis.

### Fatigue

As seen in Table 2, 48% of the 77 study participants reported some fatigue at baseline, increasing to 97% at the completion of therapy, and diminishing to 55% at the one-month follow-up visit. Interestingly, 50 (65%) of the 77 study participants reported mild or no distress as a result of fatigue. At the one-month follow-up visit, 35% of the 76 study participants reported that a substantial increase in fatigue had occurred at one-and-a-half to two weeks post-treatment but began to resolve by the one-month follow-up visit. Mean total fatigue scores and mean subscale fatigue scores increased during the course of treatment, reaching peak levels at the end of treatment and diminishing by one month post-treatment. Figures 2 and 3 graphically display composite mean total fatigue scores over time, mean fatigue scores by treatment site, and mean fatigue scores by subscale. Fatigue began to increase after one week of treatment, peaked at the end of treatment, and returned close to baseline by the one-month follow-up visit.

**Table 2. Overall Summary of Reported Fatigue**

| Measure | n | % |
|---|---|---|
| **Mean fatigue at baseline (N = 77)** | | |
| None | 40 | 52 |
| Mild (< 4) | 36 | 47 |
| Moderate (4–6.9) | 1 | 1 |
| Severe (≥ 7) | – | – |
| **Mean fatigue at end of treatment (N = 77)** | | |
| None | 2 | 3 |
| Mild | 53 | 69 |
| Moderate | 15 | 19 |
| Severe | 7 | 9 |
| **Mean fatigue at one-month follow-up (N = 76)** | | |
| None | 34 | 45 |
| Mild | 39 | 51 |
| Moderate | 3 | 4 |
| Severe | – | – |
| **Maximum fatigue distress score (N = 77)** | | |
| Mild or none | 50 | 65 |
| Moderate | 15 | 19 |
| Severe | 12 | 16 |

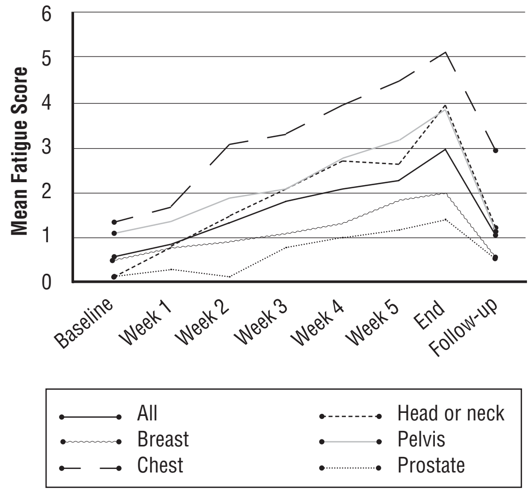


**Figure 2. Mean Total Fatigue Score by Treatment Site**

Table 3 presents a summary of differences in mean total fatigue scores at baseline compared to each point during treatment and at one month post-treatment. Differences in mean total fatigue scores at baseline compared to the end of treatment were statistically significant for all treatment sites. Study participants receiving radiation therapy to the head and neck area or chest continued to have significantly increased fatigue at the one-month follow-up visit compared to baseline. Study participants receiving radiation therapy to the chest had statistically higher mean fatigue scores than those receiving radiation therapy to other sites at baseline ($t[75] = –3.36$, $p < 0.0001$) and at the end of treatment ($t[75] = –4.64$, $p < 0.0001$).

### Individual Characteristics

Individual characteristics of treatment-related side effects, sleep disturbances, and pain were univariately evaluated for their relationship to radiation therapy–related fatigue. Sleep disturbances and pain were only moderately correlated with fatigue by the end of treatment ($r = 0.38$, $p = 0.0007$ and $r = 0.43$, $p < 0.0001$, respectively). Treatment-related side effects, however, were substantially correlated with fatigue beginning in week two ($r = 0.52–0.59$, $p < 0.001$). Side effects increased over the course of treatment from a range of 0–7 ($\bar{X} = 1.14$, SD = 1.56) by week two to a range of 0–15 at the end of treatment ($\bar{X} = 3.71$, SD = 3.00) on the Common Toxicities Scoring Scale (National Cancer Institute, 2003). Study participants

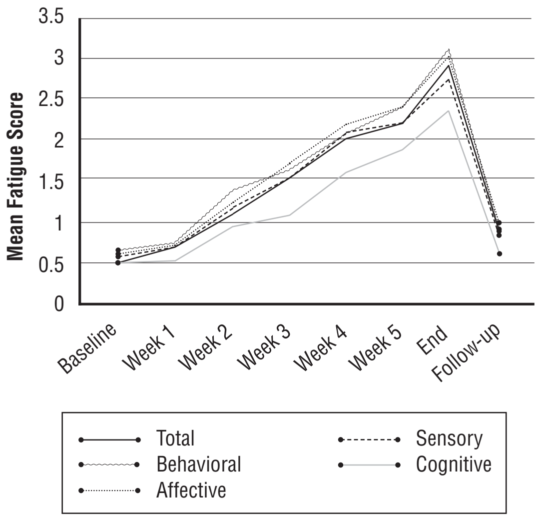


**Figure 3. Mean Fatigue Score by Subscale**

receiving radiation to the breast ($\bar{X}$ = 2.21, SD = 1.38) or prostate ($\bar{X}$ = 2.77, SD = 1.58) had the lowest maximum side effect scores, followed by study participants receiving radiation to the pelvis ($\bar{X}$ = 4.89, SD = 2.57), chest ($\bar{X}$ = 5.0, SD = 2.93), or head and neck region ($\bar{X}$ = 7.45, SD = 4.36).

Several individual characteristics were eliminated from the analyses, including race and ethnicity because of a lack of a culturally diverse population, baseline hemoglobin because of unavailability of data, and exercise because few study participants reported exercising. As radiation efficacy and toxicity are specific to the anatomic region treated rather than to the actual disease, radiation treatment site rather than disease site was used in data analysis. A variable, visit, was created to represent the different measurement points for longitudinal analyses. Thus, the individual characteristics included in the final analyses were age, gender, education, living situation, stage of disease, extent of surgery, previous or concurrent chemotherapy, radiation treatment site, comorbidities, medications, treatment-related side effects, visit, pain, and sleep disturbances.

Regression analyses revealed that 57% of the variance in mean fatigue at the end of treatment and 32% of the variance in mean fatigue along the trajectory of radiation was accounted for by hours of work, side effects, age, living situation, education, treatment site, and visit (radiation dose) (see Tables 4 and 5). Hours of work were negatively associated with fatigue. Increased side effects, younger age, higher education, and living alone were associated with increased fatigue at each point in treatment. Study participants who received radiation therapy to the chest had higher fatigue scores than participants who received radiation to other treatment sites. Visit was positively associated with fatigue: as the number of visits increased (and as radiation doses increased), fatigue increased.

### Employment Patterns

All 77 study participants were employed at the time of their cancer diagnoses. Fifty-six (73%) participants were working at the beginning of their radiation therapy. Forty-five percent of the 56 study participants who were employed at the beginning of radiation therapy made some changes in their employment during radiation. Changes included stopping work altogether (n = 14), changing the type of duties performed, working from home (n = 4), decreasing the number of hours worked per week (n = 2), and taking an occasional day or half-day off during therapy (n = 5). In addition, four participants who were not working at the start of radiation therapy resumed employment during radiation. In total, 45 (58%) of the study participants were working full- or part-time at the end of radiation and 32 (42%) were not working at the end of radiation. Study participants who were working at the end of radiation had lower fatigue scores than those who were not working ($t[75] = 4.85$, $p < 0.0001$). Sixty-two (82%) of the 76 study participants assessed at one month post-treatment had continued or resumed their previous employment. Employment patterns are summarized in Table 6.

Only 38 (49%) of the 77 study participants had any paid sick leave benefits (i.e., sick time, vacation time, earned time off, or short-term disability) available at the beginning of their radiation therapy. Study participants with sick leave benefits were more likely to be working at the beginning of treatment than those without sick leave benefits ($t[75] = –3.33$, $p = 0.001$). Of the 21 study participants not working at the beginning of radiation therapy, only nine (43%) received any income (e.g., sick leave benefits, retirement pension, or unemployment compensation).

## Discussion

The study findings are in keeping with the literature that specific individual characteristics (e.g., age, education, living

**Table 3. P Values of Paired T Tests of the Differences in Mean Fatigue Scores at Baseline to Each Data Collection Point**

| Treatment Site | n | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | End | Follow-Up |
|---|---|---|---|---|---|---|---|---|
| Total sample | – | 0.004 | < 0.0004 | < 0.0001 | < 0.0001 | < 0.0001 | < 0.0001 | 0.004[a] |
| Breast | 34 | 0.01 | 0.003 | < 0.0001 | < 0.0001 | < 0.0001 | < 0.0001 | 0.56 |
| Pelvis | 9 | 0.03 | 0.003 | 0.001 | 0.001 | 0.001 | 0.0004 | 0.78 |
| Head and neck | 10 | 0.23 | 0.02 | 0.008 | 0.004 | 0.001 | 0.0007 | 0.04 |
| Chest | 13 | 0.06 | 0.007 | 0.0002 | 0.0001 | < 0.0001 | < 0.0001 | 0.04[b] |
| Prostate | 11 | 0.19 | 0.24 | 0.08 | 0.05 | 0.05 | 0.05 | 0.30 |

N = 77

[a] N = 76

[b] n = 12

**Table 4. Summary of Linear Regression of Mean Fatigue at End of Treatment**

| Characteristic | Coefficient, Unstandardized | T | p | β[a] |
|---|---|---|---|---|
| **Hours of work per week at the end of treatment** | –0.03 | –2.27 | 0.027 | –0.20 |
| **Maximum side effects** | 0.20 | 2.19 | 0.032 | 0.23 |
| **Age** | –0.06 | –2.50 | 0.015 | –0.21 |
| **Living situation** | –1.85 | –3.90 | 0.0008 | –0.32 |
| **Years of education** | 0.17 | 1.97 | 0.05 | 0.16 |
| **Treatment site** | | | | |
| Breast | –3.01 | –4.99 | < 0.0001 | –0.62 |
| Prostate | –2.49 | –3.39 | 0.001 | –0.36 |
| Head and neck | –2.52 | –3.55 | 0.001 | –0.35 |
| Pelvis | –1.43 | –2.00 | 0.05 | –0.19 |
| Chest (reference) | – | – | – | – |

N = 77

[a] Standardized beta coefficient

*Note.* $R^2 = 0.6195$; adjusted $R^2 = 0.5684$

situation, treatment site, radiation dose [visit], and site-specific treatment-related side effects), as well as work, are associated with radiation therapy–related fatigue (Ackechi et al., 1999; Bansal et al., 2004; Barsevick, Whitmer, Sweeney, & Nail, 2002; Bower et al., 2000; King, Nail, Kreamer, Strohl, & Johnson, 1985; Wang et al., 2001; Woo, Dibble, Piper, Keating, & Weiss, 1998). The present study did not yield evidence of any association among gender, surgery, chemotherapy, stage, comorbidities, medications, pain, or sleep disturbances and radiation therapy–related fatigue.

Several researchers have reported increased fatigue in women receiving cancer therapy compared to men (Akechi et al., 1999; Anderson et al., 2003). No evidence was found in the present study of increased fatigue in women. One explanation may be the distribution of the sample across treatment sites. Although women comprised 58% of the study sample, they comprised only 37% of the high-fatigue treatment sites (i.e., chest, pelvis, head and neck). In contrast, men comprised only 42% of the total sample but 63% of high-fatigue sites.

Study participants reported lower fatigue distress than had been reported previously (Munro & Potter, 1996; Williams et al., 2001). Although the present study was not designed as an intervention, the possibility exists that participation in the study served as an intervention. Allowing participants the opportunity to fully explore and address their fatigue may have helped reduce distress. Another possible explanation is the Hawthorne effect, whereby study participants change their behavior simply because they are part of a study (Burns & Grove, 2001).

## Implications for Nursing Practice

The study confirmed previous findings that radiation therapy–related fatigue increases during the course of treatment and returns nearly to baseline by one month post-treatment (Greenberg et al., 1992; Irvine et al., 1998). Preventive interventions such as moderate exercise can be initiated at the beginning of treatment (National Comprehensive Cancer Network, 2003; Stricker, Drake, Hoyer, & Mock, 2004). Other interventions can then be tailored to the degree of fatigue anticipated. An unexpected finding in the current study was that approximately 35% of study participants who reported only mild to moderate fatigue at the completion of radiation therapy noted a dramatic increase in fatigue two weeks post-treatment. One possible explanation for this might be that many patients experience a let down at the end of a course of treatment. Patients receive daily support from nurses and radiation therapists during treatment that is suddenly withdrawn when treatment ends. Symptoms such as fatigue may then become more apparent. Perhaps the withdrawal of support may precipitate mild depression. Nurses can conduct assessments and offer interventions via telephone at two weeks post-treatment.

Mean fatigue scores for the entire sample increased from 0.46 at baseline to 2.91 at the end of treatment. However, for study participants receiving radiation therapy to the chest, head and neck, and pelvic areas, mean fatigue scores at the end of treatment increased to 5.45, 4.04, and 3.89, respectively. According to the National Comprehensive Cancer Network (2003) and the Oncology Nursing Society (2005), fatigue scores higher than three require intensive nursing assessment and intervention. Nursing interventions to manage radiation therapy–related fatigue need to be tailored to treatment site, anticipating the greater fatigue experienced by patients receiving radiation to the chest, head and neck, and pelvis.

Study participants who were younger, more educated, and living alone experienced higher levels of fatigue than other study participants. Younger patients may have greater demands on their time and, thus, may benefit from assistance with time management and prioritization. Patients with higher levels of education may work in more stressful jobs and have higher expectations of themselves and, thus, may be more affected by cancer-related fatigue. Nurses can anticipate increased fatigue in highly educated patients and offer additional resources such as Internet sites for education and support. Patients living alone may have no one to assist with household chores and other activities of daily living. Nurses need to conduct an in-depth assessment of how these activities might be influenced by increasing levels of fatigue and offer appropriate interventions such as Meals on Wheels.

**Table 5. Summary of Longitudinal Regression of Mean Fatigue at Each Point in Treatment**

| Characteristic | Coefficient | T | p |
|---|---|---|---|
| **Side effects** | 0.30 | 10.36 | < 0.0001 |
| **Education** | 0.16 | 2.34 | 0.02 |
| **Living situation** | –0.76 | –2.16 | 0.031 |
| **Age** | –0.04 | –1.90 | 0.05 |
| **Treatment site** | | | |
| Head and neck | –1.76 | –3.45 | 0.0006 |
| Prostate | –1.54 | –3.04 | 0.002 |
| Breast | –1.65 | –4.16 | < 0.0001 |
| Pelvis | –0.90 | –1.74 | 0.08 |
| Chest (reference) | – | – | – |
| **Hours of work** | –0.03 | –6.91 | < 0.0001 |
| **Visit** | 0.21 | 2.59 | 0.01 |

N = 77

*Note.* $R^2 = 0.3312$; adjusted $R^2 = 0.32$

**Table 6. Summary of Employment Patterns**

| Employment Status | n | % |
|---|---|---|
| **Working, full- or part-time** | | |
| At diagnosis | 77 | 100 |
| At start of treatment | 56 | 73 |
| At end of treatment | 45 | 58 |
| At follow-up | 62 | 82 |
| **Full-time (≥ 36 hours per week)** | | |
| At diagnosis | 44 | 57 |
| At start of treatment | 36 | 47 |
| **Part-time (12–35 hours per week)** | | |
| At diagnosis | 20 | 26 |
| At start of treatment | 10 | 13 |
| **Self-employed, currently working** | | |
| At diagnosis | 13 | 17 |
| At start of treatment | 10 | 13 |

| | Hours Worked Per Week | | |
|---|---|---|---|
| Point in Time | Range | $\bar{X}$ | SD |
| Diagnosis | 12–60 | 37 | 7.99 |
| Baseline | 0–60 | 26 | 18.19 |
| End of treatment | 0–48 | 19 | 17.85 |
| Follow-up | 0–48 | 28 | 15.30 |

N = 77

Nurses working in radiation oncology are in a unique position to provide emotional support to patients who live alone and may not have outside sources of support, especially those who are not working.

Increase in treatment-related side effects led to an increase in fatigue and a decreased likelihood of working during treatment. Aggressive side-effect management, a major role of nurses in radiation oncology (Moore-Higgs et al., 2003), has the potential for reducing radiation therapy–related fatigue and helping to keep patients in the workforce. Surprisingly, previous or concurrent chemotherapy was not associated directly with radiation therapy–related fatigue in this study. Eighty-four percent of participants receiving radiation to the chest received concurrent chemotherapy, as did 30% of participants receiving radiation to the head and neck and 67% of participants receiving radiation to the pelvis. Fifty-three percent of participants receiving radiation to the breast received chemotherapy prior to radiation. A difference in fatigue among those who received chemotherapy compared to those who did not was noted only in participants who received radiation to the pelvis. However, concurrent chemotherapy was associated with an increase in side effects and, thus, may indirectly contribute to radiation therapy–related fatigue. Early symptom assessment and intervention in patients receiving combined chemotherapy and radiation therapy can help reduce the impact and severity of radiation therapy–related fatigue.

## Policy Implications

Forty-five percent of the study participants employed at the start of radiation needed to make changes in their employment during treatment, primarily because of side effects such as fatigue. Interestingly, contrary to what was expected, study participants with paid sick leave benefits were more likely to be working at the beginning of radiation therapy and more likely to make changes to employment during treatment than those without sick leave benefits. Changes included not only stopping work altogether but also less drastic measures such as working from home, decreasing hours worked per week, and taking an occasional sick day during treatment. Participants with paid sick leave may have more flexibility in adjusting their schedules to meet the needs of their treatment. Thus, the availability of paid sick leave appears to support continuing to work during radiation therapy as well as stopping work if necessary. In this sample, only 49% of study participants had any paid benefits remaining at the beginning of radiation therapy. A change in policies, such as mandatory temporary disability insurance (currently in place in only five states), would increase the options for receiving income during cancer treatment (Social Security Administration, 2005).

## Limitations of the Study

A major limitation of the study was the small number of participants receiving treatment to sites other than the breast, which limits the generalizability of findings to other treatment sites. Another limitation of the study was the homogeneous racial and ethnic makeup of the sample, which limited the ability to generalize to populations other than non-Hispanic white men and women. Use of one geographic region also may have biased findings. Employment patterns and sick leave benefits may differ by geographic region. For example, results of the study might have been quite different if it were conducted in one of the five states with mandatory temporary disability insurance.

## Suggestions for Future Research

Replication of the study using multiple sites from diverse geographic and demographic regions would allow for greater numbers of participants receiving radiation to treatment sites other than breast, greater racial and ethnic diversity, and a greater variety of employment patterns and sick leave benefits. This heterogeneity would allow further exploration of the various factors influencing the association between work and radiation therapy–related fatigue.

Future studies of radiation therapy–related fatigue and employment should consider caregivers as well as patients. Hamilton et al. (2001) suggested that fatigue is a significant issue for caregivers. In large studies conducted in the United States and Ireland, caregivers experienced changes in employment (Curt et al., 2000; Dillon & Kelly, 2003), including losing a business.

Further investigation of the relationship between treatment-related side effects and fatigue is warranted because this is a prime area for nursing intervention. Recruitment of larger numbers of study participants receiving radiation therapy to sites known for distressing side effects would allow for better examination of the relationship between variables. Intervention studies then can be designed to examine the impact of aggressive nursing management of side effects such as diarrhea, esophagitis, and oral mucositis on radiation therapy–related fatigue. These outcome studies will document the affect of nursing care on patients undergoing radiation.

# Conclusion

This study added to the body of knowledge of employment patterns, use of sick leave benefits, and individual characteristics in patients receiving radiation therapy for cancer and their relationship to radiation therapy–related fatigue. The IFM can serve as a guide to researchers and clinicians to identify relevant sociodemographic and medical characteristics, identify possible causes of fatigue, test interventions to reduce cancer-related fatigue, and evaluate outcomes of interventions as recommended by the National Institutes of Health State-of-the-Science Panel (2003).

The Oncology Nursing Society supports nurses as advocates and researchers in healthcare systems issues and policies related to symptom control (Berger et al., 2005; Oncology Nursing Society, 2005). Nurses are in an ideal position to take an active role in policy regarding employment issues and symptom management of patients with cancer.

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## References

Akechi, T., Kugaya, A., Okamura, H., Yamawaki, S., & Uchitomi, Y. (1999). Fatigue and its associated factors in ambulatory cancer patients: A preliminary study. *Journal of Pain and Symptom Management, 17,* 42–48.

American Cancer Society. (2006). *Cancer facts and figures 2006.* Retrieved April 3, 2006, from http://www.cancer.org/downloads/STT/CAFF2006PWSecured.pdf

Anderson, K.O., Getto, C.J., Mendoza, T.R., Palmer, S.N., Wang, X.S., Reyes-Gibby, C.C., et al. (2003). Fatigue and sleep disturbance in patients with cancer, patients with clinical depression, and community-dwelling adults. *Journal of Pain and Symptom Management, 25,* 307–318.

Bansal, M., Mohanti, B.K., Shah, N., Chaudhry, R., Bahadur, S., & Shukla, N.K. (2004). Radiation related morbidities and their impact on quality of life in head and neck cancer patients receiving radical radiotherapy. *Quality of Life Research, 13,* 481–488.

Barsevick, A.M., Whitmer, K., Sweeney, C., & Nail, L.M. (2002). A pilot study examining energy conservation for cancer treatment-related fatigue. *Cancer Nursing, 25,* 333–341.

Berger, A., & Walker, S.N. (2001). An explanatory model of fatigue in women receiving adjuvant breast cancer chemotherapy. *Nursing Research, 50,* 42–52.

Berger, A.M., Berry, D.L., Christopher, K.A., Greene, A.L., Maliski, S., Swenson, K.K., et al. (2005). Oncology Nursing Society year 2004 research priorities survey. *Oncology Nursing Forum, 32,* 281–290.

Berger, A.M., Von Essen, S., Kuhn, B.R., Piper, B.F., Agrawal, S., Lynch, J.C., et al. (2003). Adherence, sleep, and fatigue outcomes after adjuvant breast cancer chemotherapy: Results of a feasibility intervention study. *Oncology Nursing Forum, 30,* 513–522.

Bower, J.E., Ganz, P.A., Desmond, K.A., Rowland, J.H., Meyerowitz, B.E., & Belin, T.R. (2000). Fatigue in breast cancer survivors: Occurrence, correlates, and impact on quality of life. *Journal of Clinical Oncology, 18,* 743–753.

Burnie, C. (2000). Breast cancer: A study of the psychosocial issues faced by women undergoing radiation therapy. *Canadian Journal of Medical Radiation Technology, 31,* 119–128.

Burns, N., & Grove, S.K. (2001). *The practice of nursing research: Conduct, critique and utilization* (4th ed.). Philadelphia: Saunders.

Cella, D., Lai, J.S., Chang, C.H., Peterman, A., & Slavin, M. (2002). Fatigue in cancer patients compared with fatigue in the general United States population. *Cancer, 94,* 528–538.

Center for Survey Research. (2002). *Boston area survey.* Boston: Author.

Chan, C.W., Molassiotis, A., Yam, B.M., Chan, S.J., & Lam, C.S. (2001). Traveling through the cancer trajectory: Social support perceived by women with gynecological cancer in Hong Kong. *Cancer Nursing, 5,* 387–394.

Cimprich, B. (1998). Age and extent of surgery affect attention in women treated for breast cancer. *Research in Nursing and Health, 21,* 229–238.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

Curt, G., & Johnston, P.G. (2003). Cancer fatigue: The way forward. *Oncologist, 8*(Suppl. 1), 27–30.

Curt, G.A., Breitbart, W., Cella, D., Groopman, J.E., Horning, S.J., Itri, L.M., et al. (2000). Impact of cancer-related fatigue on the lives of patients: New findings from the Fatigue Coalition. *Oncologist, 5,* 353–360.

Der, G., & Everitt, B. (2002). *A handbook of statistical analyses using SAS* (2nd ed.). Boca Raton, FL: Chapman and Hall.

Dillon, E., & Kelly, J. (2003). The status of cancer fatigue on the island of Ireland: AIFC professional and interim patient surveys. *Oncologist, 8*(Suppl. 1), 22–26.

Donovan, K.A., Jacobsen, P.B., Andrykowski, M.A., Winters, E.M., Balducci, L., Malik, U., et al. (2004). Course of fatigue in women receiving chemotherapy and/or radiotherapy for early stage breast cancer. *Journal of Pain and Symptom Management, 28,* 373–380.

Geinitz, H., Zimmermann, F.B., Stoll, P., Thamm, R., Kaffenberger, W., Ansorg, K., et al. (2001). Fatigue, serum cytokine levels, and blood cell counts during radiotherapy of patients with breast cancer. *International Journal of Radiation Oncology, Biology, Physics, 51,* 691–698.

Gift, A.G., Stommel, M., Jablonski, A., & Given, W. (2003). A cluster of symptoms over time in patients with lung cancer. *Nursing Research, 52,* 393–400.

Greenberg, D., Sawicka, J., Eisenthal, S., & Ross, D. (1992). Fatigue syndrome due to localized radiation. *Journal of Pain and Symptom Management, 7,* 38–45.

Hamilton, J., Butler, L., Wagenaar, H., Sveinson, T., Ward, K.A., McLean, L., et al. (2001). The impact and management of cancer-related fatigue on patients and families. *Canadian Oncology Nursing Journal, 11,* 192–198.

Haylock, P.J., & Hart, L.K. (1979). Fatigue in patients receiving localized radiation. *Cancer Nursing, 2,* 461–467.

Hilderly, L. (1997). Principles of teletherapy. In K.H. Dow, J.D. Bucholtz, R. Iwamoto, V. Fieler, & L. Hilderly (Eds.), *Nursing care in radiation oncology* (2nd ed., pp. 6–20). Philadelphia: Saunders.

Hwang, S.S., Chang, V.T., Rue, M., & Kasimis, B. (2003). Multidimensional independent predictors of cancer-related fatigue. *Journal of Pain and Symptom Management, 26,* 604–614.

Irvine, D., Vincent, L., Graydon, J., & Bubela, N. (1998). Fatigue in women with breast cancer receiving radiation therapy. *Cancer Nursing, 21,* 127–135.

King, K.B., Nail, L.M., Kreamer, K., Strohl, R.A., & Johnson, J.E. (1985). Patients' descriptions of the experience of receiving radiation therapy. *Oncology Nursing Forum, 12,* 55–61.

Magnan, M.A., & Mood, D.W. (2003). The effects of health state, hemoglobin, global symptom distress, mood disturbance, and treatment site on fatigue onset, duration, and distress in patients receiving radiation therapy. [Online exclusive]. *Oncology Nursing Forum, 30,* E33–E39. Retrieved March 29, 2006, from http://www.ons.org/publications/journals/ONF/Volume30/Issue2/pdf/222.pdf

Mock, V., Pickett, M., Ropka, M.E., Muscari, E.L., Stewart, K.J., Rhodes, V.A., et al. (2001). Fatigue and quality of life outcomes of exercise during cancer treatment. *Cancer Practice, 9,* 119–127.

Moore-Higgs, G.J., Watkins-Bruner, D., Balmer, L., Johnson- Doneski, J., Komarny, P., Mautner, B., et al. (2003). The role of licensed nursing personnel in radiation oncology part A: Results of a descriptive study. *Oncology Nursing Forum, 30,* 51–58.

Munro, A.J., & Potter, S. (1996). A quantitative approach to the distress caused by symptoms in patients treated with radical radiotherapy. *British Journal of Cancer, 74,* 640–647.

National Cancer Institute. (2003). *Common terminology criteria for adverse events v3.0.* Retrieved March 29, 2006, from http://ctep.cancer.gov/forms/CTCAEv3.pdf

National Comprehensive Cancer Network. (2003). *Cancer-related fatigue.* Retrieved September 28, 2003, from http://www.ncn.org/professionals/physician_gls/PDF/fatigue.pdf

National Institutes of Health State-of-the-Science Panel. (2003). National Institutes of Health state-of-the-science conference statement: Symptom management in cancer: Pain, depression, and fatigue, July 15–27, 2002. *Journal of the National Cancer Institute, 95,* 1110–1117.

Oberst, M.T., Hughes, S.H., Chang, A.S., & McCubbin, M.A. (1991). Self-care burden, stress appraisal, and mood among persons receiving radiotherapy. *Cancer Nursing, 14,* 71–78.

Oncology Nursing Society. (2005). *Measuring oncology nursing-sensitive patient outcomes: Evidence-based summary: Fatigue.* Retrieved February 17, 2005, from http://onsopcontent.ons.org/toolkits/evidence/Clinical/pdf/FatigueSummary.pdf

Passik, S.D., Kirsh, L.L., Donaghy, K., Holtsclaw, E., Theobald, D., Cella, D., et al. (2002). Patient-related barriers to fatigue communication: Initial validation of the fatigue management barriers questionnaire. *Journal of Pain and Symptom Management, 24,* 481–493.

Piper, B.F., Dibble, S.L., Dodd, M.J., Weiss, M.C., Slaughter, R.E., & Paul, S.M. (1998). The revised Piper Fatigue Scale: Psychometric evaluation in women with breast cancer. *Oncology Nursing Forum, 25,* 677–684.

Piper, B.F., Lindsey, A.M., & Dodd, M.J. (1987). Fatigue mechanisms in cancer patients: Developing nursing theory. *Oncology Nursing Forum, 14*(6), 17–23.

Schwartz, A.H. (2002). Validity of cancer-related fatigue instruments. *Pharmacotherapy, 22,* 1433–1441.

Schwartz, A.L. (1998). Patterns of exercise and fatigue in physically active cancer survivors. *Oncology Nursing Forum, 25,* 485–491.

Schwartz, A.L., Nail, L.M., Chen, S., Meek, P., Barsevick, A.M., King, M.E., et al. (2000). Fatigue patterns observed in patients receiving chemotherapy and radiotherapy. *Cancer Investigations, 18,* 11–19.

Shi, L. (1997). *Health services research methods.* Albany, NY: Delmar.

Sitton, E. (1997). Managing side effects of skin changes and fatigue. In K.H. Dow, J.D. Bucholtz, R. Iwamoto, V. Fieler, & L. Hilderly (Eds.), *Nursing care in radiation oncology* (2nd ed., pp. 79–100). Philadelphia: W.B. Saunders.

Social Security Administration. (2005). Temporary disability insurance. In *Social security programs in the United States* (pp. 44–50). Retrieved April 3, 2006, from http://www.ssa.gov/policy/docs/progdesc/sspus/tempdib.pdf

Stone, P., Hardy, J., Huddart, R., A'Hern, R., & Richards, M. (2000). Fatigue in patients with prostate cancer receiving hormone therapy. *European Journal of Cancer, 36,* 1134–1141.

Stone, P., Ream, E., Richardson, A., Thomas, H., Andrews, P., Campbell, P., et al. (2003). Cancer-related fatigue—A difference of opinion? Results of a multicentre survey of healthcare professionals, patients, and caregivers. *European Journal of Cancer Care, 12,* 20–27.

Stricker, C.T., Drake, D., Hoyer, K., & Mock, V. (2004). Evidence-based practice for fatigue management in adults with cancer: Exercise as an intervention. *Oncology Nursing Forum, 31,* 963–976.

Wang, X.S., Janjan, N.A., Guo, H., Johnson, B.A., Engstrom, M.C., Crane, C.H., et al. (2001). Fatigue during preoperative chemoradiation for resectable rectal cancer. *Cancer, 92*(6, Suppl.), 1725–1732.

Wengstrom, Y., Haggmark, C., & Forsberg, C. (2001). Coping with radiation therapy: Strategies used by women with breast cancer. *Cancer Nursing, 24,* 264–271.

Williams, P.D., Ducey, K.A., Sears, A.M., Williams, A.R., Tobin-Rumelhart, S.E., & Bunde, P. (2001). Treatment type and symptom severity among oncology patients by self-report. *International Journal of Nursing Studies, 38,* 359–367.

Woo, B., Dibble, S.L., Piper, B.F., Keating, S.B., & Weiss, M.C. (1998). Differences in fatigue by treatment methods in women with breast cancer. *Oncology Nursing Forum, 25,* 915–920.

Wu, H., & McSweeney, M. (2001). Measurement of fatigue in people with cancer. *Oncology Nursing Forum, 28,* 1371–1384.