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Differences in Sleep Disturbance and Fatigue Between Patients with Breast and Prostate Cancer at the Initiation of Radiation Therapy

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Abstract

Context—Little is known about the occurrence and severity of sleep disturbance and fatigue between patients with common cancer diagnoses.

Objectives—Study purposes were to: evaluate for differences in the occurrence rates of sleep disturbances and fatigue; evaluate for differences in the severity of sleep disturbance using both subjective and objective measures; and evaluate for differences in the severity of self-reported fatigue in patients with breast and prostate cancer at the initiation of radiation therapy (RT).

Methods—Patients with breast (n=78) and prostate (n=82) cancer were evaluated prior to the initiation of RT using the Pittsburgh Sleep Quality Index (PSQI), General Sleep Disturbance Scale (GSDS), Lee Fatigue Scale (LFS), and wrist actigraphy. Differences in sleep disturbance and fatigue between groups were evaluated using independent sample t-tests and Chi-square analyses.

Results—Occurrence rates for sleep disturbance (P<0.0001) and fatigue (P=0.03) were significantly higher in patients with breast compared to prostate cancer. Patients with breast cancer self-reported significantly higher levels of sleep disturbance (P=0.008) and fatigue (P=0.005) than patients with prostate cancer. However, using actigraphy, patients with prostate cancer had poorer sleep efficiency (P=0.02) than patients with breast cancer.

Conclusions—Based on self-report, patients with breast cancer experience sleep disturbance more frequently and with greater severity than patients with prostate cancer. Objective measures of sleep disturbance suggest that prostate cancer patients have more severe sleep disturbance than breast cancer patients. All of the patients experienced poor sleep quality and fatigue which suggests that oncology patients need to be assessed for these symptoms.

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The authors declare no conflicts of interest.

Keywords

Sleep disturbance; fatigue; radiation therapy; breast cancer; prostate cancer; actigraphy

Introduction

Recent evidence suggests that sleep disturbance is a common symptom in cancer patients. In fact, 30% to 70% of adult oncology patients report experiencing sleep disturbance,[1,2] which is twice as high as rates reported by the general population.[3,4] Sleep disturbance in cancer patients is associated with increased levels of fatigue[5] and decreased quality of life (QOL).[6]

Fatigue is the most common and distressing symptom reported by cancer patients[7.8] and increased fatigue is associated with decreases in patients' functional status and QOL.[9-11] In addition, fatigue may reduce the duration of recurrence free periods and decrease overall survival.[12] A number of studies have documented that 30% to 60% of cancer patients report moderate to severe fatigue while undergoing radiation therapy (RT).[13-17] While sleep disturbance and fatigue impose a large portion of the symptom burden on patients with cancer, few studies have examined these two symptoms simultaneously or compared these two symptoms in patients with different cancer diagnoses. This approach could assist clinicians to identify groups of patients who are at higher risk for more severe symptoms and who warrant interventions to reduce symptoms prior to the initiation of cancer treatment.

Breast and prostate cancer are the two most common cancers in women and men, respectively. In fact, in 2010, in the United States, over 207,000 women were diagnosed with breast cancer and over 217,000 men were diagnosed with prostate cancer.[18] Several studies have documented that sleep disturbance and fatigue are common problems in patients with breast[19,20] and prostate[21,22] cancer and that these two symptoms are associated with deleterious effects on patients' QOL.[21,23] While sleep disturbance and fatigue are common in patients with breast and prostate cancer, only one study was found that evaluated for sleep disturbance in patients with these two diagnoses during and after RT.[24] However, no studies were found that compared the occurrence or severity of both sleep disturbance and fatigue in patients with breast and prostate cancer. In addition, no studies were found that evaluated for differences in sleep disturbance between patients with breast and prostate cancer using both subjective and objective measures. Given the paucity of research on sleep disturbance and fatigue and the lack of comparisons between gender-specific cancer diagnoses, the purposes of this study in a sample of patients with breast and prostate cancer at the initiation of RT were to evaluate for differences in the occurrence rates of sleep disturbances and fatigue; to evaluate for differences in the severity of sleep disturbance using both subjective and objective measures; and to evaluate for differences in the severity of self-reported fatigue. Information on the occurrence and severity of these two symptoms at the initiation of RT might lead to better case finding and the initiation of interventions to improve sleep and decrease fatigue.

Methods

Participants and Settings

This descriptive, correlational study was part of a larger, longitudinal study that evaluated multiple symptoms in patients who underwent primary or adjuvant RT.[16.25] Patients were recruited from two RT departments located in a comprehensive cancer center and a community-based oncology program at the time of the patient's simulation visit.

Patients were eligible to participate if they were ≥18 years of age; were scheduled to receive primary or adjuvant RT for breast or prostate cancer; were able to read, write, and understand English; gave written informed consent; and had a Karnofsky Performance Status (KPS) score of ≥ 60. Patients were excluded if they had metastatic disease; more than one cancer diagnosis; or a diagnosed sleep disorder (e.g., narcolepsy, obstructive sleep apnea, restless leg syndrome).

Instruments

The study instruments included a demographic questionnaire, the KPS scale,[26] the Pittsburgh Sleep Quality Index (PSQI),[27] the General Sleep Disturbance Scale (GSDS),[28] and the Lee Fatigue Scale (LFS).[29] To compare subjective responses with a more objective measure of sleep, objective data on sleep-wake circadian activity rhythms were obtained by continuous noninvasive monitoring of activity over 48 hours using a wrist motion sensor (Mini Motionlogger Actigraph, Ambulatory Monitoring, Inc., Ardsley, NY).[30-32]

The demographic questionnaire obtained information on age, gender, marital status, education, ethnicity, employment status, and the presence of a number of comorbid conditions.

The PSQI consists of 19 items designed to assess sleep quality in the past month. The global PSQI score is the sum of the seven component scores (i.e., subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, daytime dysfunction). Each component score ranges from 0 to 3 and the global PSQI score ranges from 0 to 21. Higher global and component scores indicate more severe complaints and a higher level of sleep disturbance. A global PSQI score of >5 indicates a significant level of sleep disturbance.[27] The PSQI has established internal consistency, test-retest reliability, and construct validity.[27,33,34] In this study, the Cronbach's alpha for the global PSQI score was 0.72.

The GSDS consists of 21-items designed to assess the quality of sleep in the past week. Each item was rated on a 0 (never) to 7 (every day) numeric rating scale (NRS). The GSDS total score is the sum of the seven subscale scores (i.e., quality of sleep, quantity of sleep, sleep onset latency, mid-sleep awakenings, early awakenings, medications for sleep, excessive daytime sleepiness) that can range from 0 (no disturbance) to 147 (extreme sleep disturbance). Each mean subscale score can range from 0 to 7. Higher total and subscale scores indicated higher levels of sleep disturbance. GSDS subscales scores of ≥ 3 and a total score of ≥ 43 indicate a significant level of sleep disturbance.[35] The GSDS has well-established validity and reliability in shift workers, pregnant women, and patients with cancer and HIV.[28.36.37] In the current study, the Cronbach's alpha for the GSDS total score was 0.84.

The LFS consists of 13 items designed to assess fatigue severity.[29] Each item was rated on a 0 to 10 NRS. Total fatigue scores were calculated as the mean of the 13 items, with higher scores indicating greater fatigue severity. Respondents were asked to rate each item based on how they felt “right now,” within 30 minutes of awakening (i.e., morning fatigue), and prior to going to bed (i.e., evening fatigue). The LFS has been used with healthy individuals[29,38] and in patients with cancer and HIV.[16,37,39,40] Cutoff scores of ≥3.2 and ≥5.6 indicated high levels of morning and evening fatigue, respectively.[35] The LFS was chosen for this study because it is relatively short, easy to administer, and has well established validity and reliability. In this study, Cronbach's alphas for evening and morning fatigue were 0.96 and 0.95, respectively.

Objective data on sleep-wake circadian activity rhythms were obtained by continuous noninvasive monitoring of activity over 48 hours using wrist actigraphy. Seven nocturnal sleep/rest, four daytime wake/activity, and six circadian activity rhythm parameters were selected that were identified by a National Cancer Institute sponsored conference,[1] an expert panel that recommended a standard set of research assessments in insomnia,[41] and recently published studies.[42,43] Wrist actigraphy was validated with EEG measures of sleep and awakenings in men and women with both healthy and disturbed sleep patterns.[31.32.41] It provides continuous motion data using a battery-operated wristwatch-size microprocessor that senses motion with a piezo-electric beam and detects movement in all three axes. The accompanying Action 4® software (Ambulatory Monitoring, Inc., Ardsley, NY) allows analysis of activity and nonactivity as well as automatic scoring of sleep and wake in one minute intervals.

Study Procedures

The study was approved by the Committee on Human Research at the University of California, San Francisco and at the second site. At the time of the simulation visit (i.e., approximately one week prior to the initiation of RT), patients were approached by a research nurse to discuss participation in the study. After obtaining written informed consent, patients completed the demographic questionnaire, KPS scale,[26] PSQI,[27] and GSDS.[28] Medical records were reviewed for disease and treatment information.

In addition, patients were taught to complete the LFS[29] before going to bed each night (i.e., evening fatigue) and upon arising each morning (i.e., morning fatigue) for two consecutive days. Patients wore the wrist actigraph on their nondominant wrist to monitor sleep and activity continuously for two consecutive days. Two week days were used to avoid the potential variance on weekends and to minimize patient burden, as well as missing data. The epoch length for the wrist actigraph was set at 30 seconds. Patients were asked to use the event marker on the wrist actigraph to indicate “lights out” and “lights on” time. Patients reported no difficulties wearing the wrist actigraph. Since the actual time is important in the calculation of the amount of sleep obtained in the amount of time designated for sleep, having an additional source of information about nap times, bed times, and wake times is important. This information was recorded by patients in a two-day diary. Upon awakening, the patients used the diary to indicate the number of awakenings during the night. Patients returned the questionnaires and actigraphs to the research nurse in the RT department at the completion of data collection.

Data Analysis

Data were analyzed using SPSS version 15 (SPSS, Inc., Chicago, IL). Descriptive statistics and frequency distributions were generated for the sample characteristics and symptom data.

Actigraphy files, programmed in zero-crossing mode with 30 second intervals, were analyzed using the Cole-Kripke algorithm[44] in the Action 4® software (Ambulatory Monitoring, Inc., Ardsley, NY) by two of the researchers (KL and CW). The file was first scanned for missing data. Time limits were set for the 48-hour period. The file was reviewed and intervals were individually set for each day and night period using, in order of priority as decision guides, the event marker, diary data, channel data, and cascading movement data.

To determine circadian rhythms, cosinor analysis fit a cosine and sine wave to the wrist actigraphy data using a least-squares cosinor regression model. The mesor (24-hour adjusted mean value, or y-intercept) amplitude, acrophase (time of day for peak activity), and autocorrelation for a 24-hour rhythm were the circadian rhythm parameters obtained from

the Action 4® software program. If more than four hours of day data or two hours of night data were missing, that day's or night's data were not used in the analyses of circadian rhythm parameters. Because no differences were found in the various actigraphy parameters between the two days of data collection and total sleep time (TST) scores were highly correlated between the two nights, mean values were calculated and used in the subsequent analyses.

Differences between patients with breast and prostate cancer in the occurrence rates for sleep disturbance based on clinically significant cutpoint scores (i.e., PSQI total score >5; GSDS total score ≥ 43, TST < 420 minutes), evening fatigue (≥ 5.6), and morning fatigue (≥ 3.2), were evaluated using Fisher Exact test analyses. In addition, independent sample *t*-tests, as well as Chi-square and Fisher Exact test analyses were used to evaluate for differences in demographic and clinical characteristics between patients with breast and prostate cancer.

Based on the analyses of demographic characteristics, the patients with breast cancer were found to be significantly younger than the patients with prostate cancer. Based on reported age-related differences in sleep disturbance[45] and fatigue,[46] age was added as a covariate in the subsequent analyses of symptom severity scores. An analysis of covariance (ANCOVA), controlling for the effect of age, was used to evaluate for differences in symptom severity scores between patients with breast and prostate cancer.

All calculations used actual values. Adjustments were not made for missing data. Therefore, the cohort for each analysis was dependent on the largest set of available data across groups. Based on the recommendations of Rothman,[47] no adjustments were made for multiple testing. A *P*-value of <0.05 was considered statistically significant.

Results

Patient Characteristics

One hundred sixty patients with breast (n=78) and prostate (n=82) cancer were recruited to participate at the time of the RT simulation visit. Differences in demographic and clinical characteristics between patients with breast and prostate cancer are summarized in Table 1. Patients with breast cancer were significantly younger (P<0.001), more likely to live alone (P=0.03), less likely to be married (P<0.001), and more likely to have children at home (P=0.03), than patients with prostate cancer. Patients with breast cancer had a significantly lower KPS score (P<0.001) and a shorter time since diagnosis (P=0.01) than patients with prostate cancer.

Occurrence of Symptoms

As shown in Fig. 1, patients with breast cancer reported significantly higher occurrence rates for self-reported sleep disturbance using both the PSQI (p=0.003) and the GSDS (P<0.0001) than patients with prostate cancer. No difference in the occurrence of sleep disturbance was found using the TST determined by actigraphy (i.e., < 420 minutes). Patients with breast cancer reported significantly higher occurrence rates for evening (P=0.03) and morning fatigue (P=0.04).

Subjective Sleep Parameters

As shown in Fig. 2, after controlling for age, significant differences were found between the patients with breast and prostate cancer in several PSQI subscale scores as well as in the PSQI Global Score. Patients with breast cancer reported significantly longer sleep onset latency (P=0.02), significantly more sleep disturbances (p<0.001), and significantly greater

daytime dysfunction (P=0.003) than patients with prostate cancer. The mean PSQI Global Score was significantly higher in the patients with breast cancer than in the patients with prostate cancer (P=0.008).

Differences in GSDS subscale and total scores between patients with breast and prostate cancer are listed in Table 2. After controlling for age, patients with breast cancer reported significantly longer sleep onset latency (P=0.02) and greater daytime sleepiness (P<0.001), as well as significantly higher total GSDS scores (P=0.007) than patients with prostate cancer.

Objective Nocturnal Sleep/Rest, Daytime Wake/Activity, and Circadian Activity Rhythm Parameters

Objective sleep/wake parameter data were available from 148 of the patients. Circadian activity rhythm data were available for the 88 patients who had not removed their actigraph from their wrist for more than four hours of a day or night period. This approach was necessary to be able to accurately determine the various circadian rhythm parameters. As shown in Table 3, in terms of the sleep parameters, after controlling for age, patients with prostate cancer had a significantly higher percentage of time awake after sleep onset (P=0.03), less total sleep time (P=0.006), and a lower sleep efficiency (P=0.02) compared to patients with breast cancer. No differences were found in any of the daytime wake/activity or circadian activity rhythm parameters between the patients with breast and prostate cancer.

Subjective Ratings of Morning and Evening Fatigue

As show in Fig. 3, after controlling for age, patients with breast cancer reported significantly higher levels of evening fatigue (P=0.005) than patients with prostate cancer while no differences were found in patients' ratings of morning fatigue using the LFS.

Discussion

This study is the first to evaluate for differences in the occurrence rates of clinically significant levels of sleep disturbance and fatigue, as well as in the severity of these symptoms in patients with breast and prostate cancer at the initiation of RT. Consistent with previous reports, occurrence rates for both symptoms calculated using clinically meaningful cutoffs were high for both groups of patients.[20,48] However, for both symptoms almost twice as many patients with breast cancer reported clinically meaningful levels of sleep disturbance and fatigue compared to patients with prostate cancer. Since no studies have directly compared differences in sleep disturbance between patients with breast and prostate cancer, the findings from this study need to be examined within the context of gender differences in the general population. Findings from this study are consistent with several population-based studies which documented that insomnia is more prevalent[49-51] and more severe[52-53] in women compared to men.

Of note, the findings from this study may provide new insights into an evaluation of sleep disturbance in these two diagnostic groups when the subjective and objective data are compared. An evaluation of breast cancer patients' self-report of sleep disturbance, revealed that these patients reported higher total scores on both the PSQI and the GSDS. In contrast, when the objective data on the various sleep-wake parameters were evaluated, compared to the patients with breast cancer, patients with prostate cancer had significantly lower total sleep times (i.e., 41 minutes less) despite an equivalent amount of time in bed. In addition, patients with prostate cancer had a lower sleep efficiency index and a higher percentage of wake time during the night than patients with breast cancer.

These findings are consistent with several studies that evaluated for gender differences in a number of sleep parameters. For example, in a study of elderly patients, while women reported higher sleep disturbance scores, actigraphy data revealed that women had longer and less fragmented sleep than men.[53] In another study of patients with multiple cancer diagnoses, while insomnia was prevalent in the entire sample, patients were breast cancer had the greatest insomnia severity, while patients with prostate cancer had the lowest insomnia severity.[48] Finally, sleep disturbance rates in another study were significantly higher in patients with breast cancer compared to patients with prostate cancer and comparable to the rates found in this study.[54]

While the exact reason for this paradox in subjective and objective sleep parameters between groups is not completely understood several explanations are plausible. First, previous findings suggest that women report and experience more symptoms than men.[55,56] Second, it is possible that the cancer diagnosis and not gender is responsible for the differences in the subjective and objective measures of sleep disturbance. Differences in treatments and associated symptoms that are experienced by patients with breast cancer and prostate cancer may explain some of the differences observed between the groups. For example, patients with prostate cancer typically report nocturia as well as urinary frequency and urgency as some of the most distressing symptoms associated with prostate cancer and its treatment.[57] Additional research on the gender and disease-specific parameters associated with sleep disturbance in oncology patients is warranted to be able to design tailored interventions for this symptom. One approach that could be used to “tease out” the gender from the cancer diagnosis effects on symptom occurrence and severity would be to evaluate for differences between men and women with the same cancer diagnosis (e.g., lung cancer, colon cancer).

Needless to say, regardless of gender or cancer diagnosis, clinically significant levels of sleep disturbance based on both subjective and objective sleep measurements were common in this sample. The average PSQI scores for patients with breast (7.3) and prostate (5.5) cancer were above the PSQI cutpoint of 5. In addition, the actigraphy data demonstrated significantly poor sleep quality. Both groups of patients slept less than the 7 to 9 hours recommended per night[58] and experienced 15 (breast) to 17 (prostate) awakenings per night. These findings are consistent with previous studies in oncology patients.[1,3] However, when compared to the sleep patterns of healthy controls,[51] the severity of sleep disturbance in these patients is significant.

While the analyses for differences in the various subjective and objective measures of sleep disturbance between patients with breast and prostate cancer controlled for age, differences in other demographic and clinical characteristics were not controlled for in these analyses due to sample size limitations. While some of the differences between the two diagnostic groups were likely related to their cancer diagnosis (e.g., patients with prostate cancer usually do not receive chemotherapy prior to RT) or resulted because of age differences (e.g., younger patients are more likely to have children at home), additional research is warranted with larger samples of patients with breast and prostate cancer to determine which demographic and clinical characteristics are associated with the occurrence and severity of sleep disturbance in these patients.

Another factor that may have contributed to the high levels of sleep disturbance in both groups of patients is that the measures were done prior to the initiation of RT. The start of a new treatment may be associated with increased levels of anxiety which is known to be associated with increased sleep disturbance.[48]

With regard to fatigue, the higher occurrence rates and severity scores for evening fatigue in breast cancer patients is consistent with previous reports regarding fatigue in patients with

breast and prostate cancer,[54,59] with previous studies of oncology patients,[60,61] as well as in other populations.[62,63] However, no differences were found in the severity of morning fatigue in these two groups. While the two morning fatigue scores were below the clinically significant cutoff of >3.2 (i.e., 2.51 ± 0.24 for breast and 2.21 ± 0.23 for prostate), the lack of between group differences in morning fatigue may be explained by the fact that the majority of the patients in this study reported a significant amount of sleep disturbance.

In contrast, patients with breast cancer reported significantly higher evening fatigue severity scores than patients with prostate cancer. In fact, these evening fatigue scores were in the moderate range at the initiation of RT. Several possible explanations may account for the differences in evening fatigue severity and occurrence rates between the two groups. Because patients with breast cancer were on average 15 years younger than patients with prostate cancer, they were more likely to be caring for children or elderly parents. The added responsibilities of being a care provider and having greater household responsibilities may have contributed to the increased prevalence and severity of evening fatigue in the patients with breast cancer. In addition, these patients with breast cancer were more likely to be single and to live alone which might have increased their household responsibilities. Finally, the patients with breast cancer in this study had a lower KPS which suggests they had a poorer level of physical functioning than the patients with prostate cancer. Future research studies, with larger samples, are warranted to determine how various demographic characteristics contribute to the severity of fatigue in patients with cancer within the context of their cancer diagnosis and their gender.

Several study limitations need to be acknowledged. While the overall sample size is relatively large, additional between group differences may emerge with larger samples of patients with breast and prostate cancer. The cross-sectional study design does not allow for an evaluation of how the symptoms change over the course of RT. Because the cancer diagnoses were gender specific, it is not possible to determine if the differences in symptom occurrence and severity found in this study are attributable to the patients' gender or to factors associated with the disease and its treatment. Additional research is warranted to explore these relationships in more detail in patients with cancer diagnoses that affect both genders (e.g., lung cancer). Finally, the data on circadian rhythm parameters warrant replication because the patients in this study wore the wrist actigraph for only 48 hours, to capture at least one and a half period lengths for a 24-our rhythm (i.e., 36 hours for a 24-hour period); in order to decrease the potential for missing data; and to be mindful of respondent burden.

Despite these limitations, findings from this study suggest that sleep disturbance and fatigue are significant problems for both groups of patients prior to receiving any RT and warrant assessments by oncology clinicians. Additional research is warranted to determine the cause for the differences in severity and occurrence rates of these symptoms in patients with breast and prostate cancer. This research may lead to disease-specific and gender-specific interventions to improve sleep and decrease fatigue.

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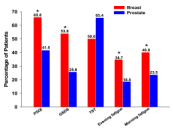

Fig. 1.

Differences in occurrence rates of sleep disturbance using the Pittsburgh Sleep Quality Index (PSQI) Global Score (**P*=0.003), the total score on the General Sleep Disturbance Scale (GSDS; **P*<0.0001), and total sleep time (TST) by actigraphy, as well as evening (**P*=0.03) and morning (**P*=0.04) fatigue between patients with breast and prostate cancer.

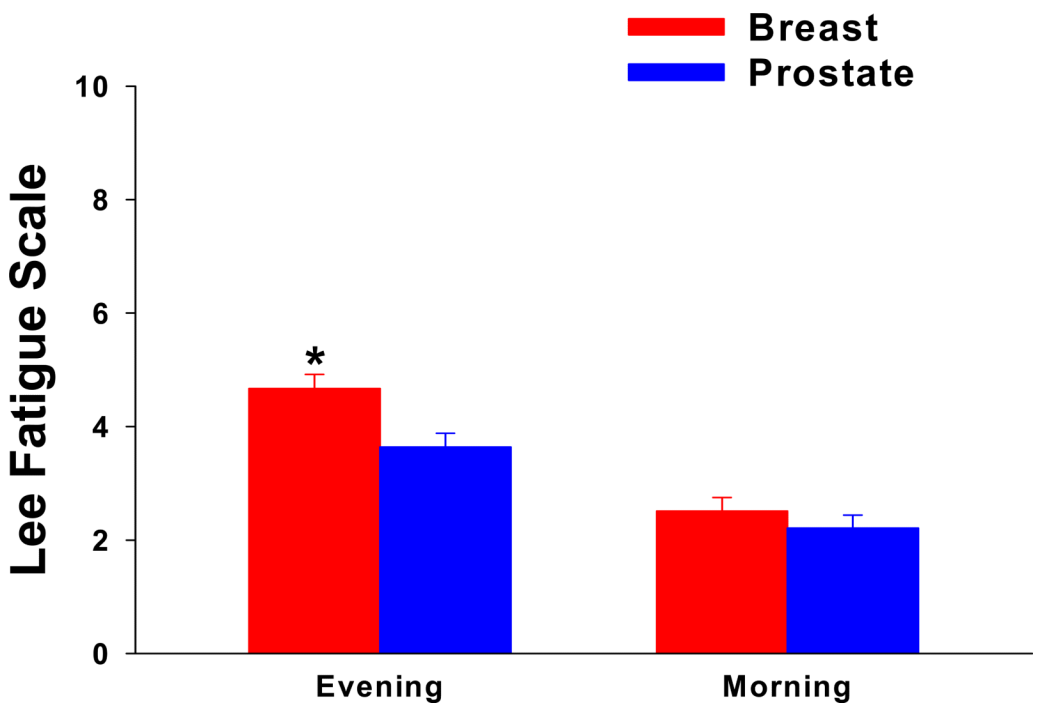

Fig. 2.

Differences in Pittsburgh Sleep Quality Index (PSQI) age-adjusted subscale and global scores between patients with breast and prostate cancer. All values are plotted as means ± standard errors of the mean. *All *P*-values are <0.05.

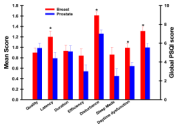

Fig. 3.

Differences in age-adjusted evening (*P=0.005) and morning Lee Fatigue Scale scores between patients with breast and prostate cancer. All values are plotted as means ± standard errors of the mean.

Table 1

Differences in Demographic and Clinical Characteristics Between Patients with Breast (*n*=78) and Prostate (*n*=82) Cancer

Characteristic	Breast Cancer Mean (SD)	Prostate Cancer Mean (SD)	Statistics
Age (years)	54.70 (11.41)	67.13 (7.76)	t=-8.02, *P*<0.0001
Education (years)	16.18 (2.65)	16.04 (3.20)	t=0.31, *P*=0.76
Karnofsky Performance Status	88.93 (11.10)	95.63 (6.91)	t=-4.47, *P*<0.0001
Number of Comorbidities	5.15 (2.57)	4.59 (2.54)	t=1.41, *P*=0.16
Time since diagnosis (months)	5.18 (2.70)	8.88 (12.66)	t=-2.58, *P*=0.01
	n (%)	*n*(%)	
Ethnicity			
White	52 (68.4)	63 (76.8)	*P*=0.28
Non-White	24 (31.6)	19 (23.2)	
Lives alone			
Yes	31 (39.7)	19 (23.2)	*P*=0.03
No	47 (60.3)	63 (76.8)	
Marital status			
Married/partnered	29 (38.7)	59 (72.0)	*P*<0.0001
Not married	46 (61.3)	23 (28.0)	
Work for pay			
Yes	33 (43.4)	36 (45.6)	*P*=0.87
No	43 (56.6)	43 (54.4)	
Have children at home			
Yes	18 (25.7)	8 (11.3)	*P*=0.03
No	52 (74.3)	63 (88.7)	
Have parents living at home			
Yes	5 (7.0)	1 (1.4)	P=0.21
No	66 (93.0)	69 (98.6)	
Stage of disease	0=9.2 I=44.7 II=10.5 IIA=13.2 IIB=11.8 IIIA=5.3 IIIB=5.3	T1=48.8 T2=42.5 T3=8.8	
Surgery prior to radiation therapy	100%	9.8%	*P*<0.0001
Chemotherapy prior to radiation therapy	55.8%	-----	
Hormonal therapy prior to radiation therapy	43.8%	52.5%	*P*=0.27

SD = standard deviation.

Table 2

Differences in General Sleep Disturbance Scale Subscale and Total Scores Between Patients with Breast (*n*=77) and Prostate (*n*=82) Cancer

General Sleep Disturbance Scale Scores	Breast Cancer Mean (SE)	Prostate Cancer Mean (SE)	Statistics
Quality of sleep	2.59 (0.23)	2.21 (0.23)	F(1,157)=1.18, *P*=0.28
Quantity of sleep	4.43 (0.15)	4.39 (0.14)	F(1,156)=0.05, *P*=0.83
Sleep onset latency	2.16 (0.25)	1.29 (0.24)	F(1,156)=5.47, *P*=0.02
Mid sleep wakes	4.62 (0.33)	4.41 (0.31)	F(1,154)=0.17, *P*=0.68
Early awakenings	2.81 (0.27)	2.01 (0.26)	F(1,155)=3.78, *P*=0.054
Excessive daytime sleepiness	2.29 (0.16)	1.40 (0.16)	F(1,157)=13.25, *P*<0.0001
Medications for sleep	0.37 (0.07)	0.26 (0.07)	F(1,157)=1.04, *P*=0.31
Total Score	44.34 (2.39)	34.48 (2.32)	F(1,157)=7.47, *P*=0.007

SE = standard error.

Table 3

Differences in Sleep/Wake, Activity/Rest, and Circadian Rhythm Parameters Between Patients with Breast and Prostate Cancer

Parameter and Definition	Breast Cancer Mean (SE)	Prostate Cancer Mean (SE)	Statistics
Sleep/Wake			
Sleep onset latency (minutes) – Number of minutes between when someone lays down to bed and actually goes to sleep	15.06 (1.68)	13.64 (1.61)	F(1,147)=0.31, *P*=0.58
Percent wake at night (% TST) – Percentage of time awake after sleep onset during a sleep period	11.39 (1.47)	16.33 (1.40)	F(1,147)=4.99, *P*=0.03
Number of awakenings – Number of awakenings during a sleep period	15.61 (1.12)	17.95 (1.07)	F(1,147)=1.92, *P*=0.17
Wake duration (minutes) – Length of time in minutes of each awakening	3.37 (0.38)	4.31 (0.37)	F(1, 147)=2.67, *P*=0.10
Total sleep time (TST, minutes) – Number of minutes of sleep while in bed	421.46 (9.87) 7.02 (hours)	380.05 (9.41) 6.33 (hours)	F(1,147)=7.81, *P*=0.006
Sleep period time (minutes) – Number of minutes in bed	497.98 (8.56) 8.30 (hours)	473.81 (8.17) 7.90 (hours)	F(1,147)=3.53, *P*=0.06
Sleep efficiency (%) – Number of minutes of sleep divided by the total number of minutes in bed × 100	85.17 (1.58)	79.76 (1.51)	F(1,147)=5.17, *P*=0.02
Activity/Rest			
Total sleep time (minutes) – Number of minutes asleep during the day from 9:00 to 20:59	49.54 (13.35)	51.09 (12.64)	F(1,129)=0.01, *P*=0.94
Total wake time (minutes) Number of minutes awake during the day from 9:00 to 20:59	670.46 (13.35) 11.17 (hours)	668.91 (12.64) 11.15 (hours)	F(1,129)=0.01, *P*=0.94
Sleep percent day (% 720 minutes from 9:00-20:59) – Percentage of time asleep during the day from 9:00 to 20:59	6.88 (1.85)	7.10 (1.76)	F(1,129)=0.01, *P*=0.94
Wake percent per day – Percentage of time awake during the day from from 9:00 to 20:59	93.12 (1.85)	92.91 (1.76)	F(1,129)=0.01, *P*=0.94
Circadian Rhythm			
Mesor – 24-hour rhythm adjusted for mean of the activity counts	63.31 (1.98)	67.31 (1.86)	F(1,88)=1.85, *P*=0.18
Amplitude – Peak (or trough) value of the cosine curve minus the mesor	50.08 (1.80)	50.18 (1.69)	F(1,88)=0.00, *P*=0.97
Acrophase – Actual clock time of the peak amplitude	15:00 (1:19)	14:39 (1:14)	F(1,88)=0.02, *P*=0.88
Circadian quotient - Strength of the circadian rhythm that is determined by dividing the amplitude by the mesor	0.80 (0.02)	0.75 (0.02)	F(1,88)=2.21, *P*=0.14
Auto correlation – Comparison of the regularity and consistency of the rhythm from one day to the next	0.46 (0.03)	0.47 (0.03)	F(1,89)=0.04, *P*=0.84

TST = total sleep time.