

Brief Report

Sleep dysfunction and psychosocial adaptation among women undergoing treatment for non-metastatic breast cancer

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Abstract

Objective: The current study aimed to determine the frequency of sleep disturbances in women prior to adjuvant therapy for breast cancer (BCa), and whether greater sleep dysfunction uniquely predicts poorer functional outcomes.

Method: We assessed subjective sleep reports and associated them with multiple indicators of psychosocial adaptation in 240 women with Stage I–III BCa before they had begun adjuvant treatment.

Results: The average global score on the Pittsburgh Sleep Quality Index (PSQI) was 8.49 (SD = 4.16); 54% scoring above the suggested adjusted cutoff for cancer populations of 8.0. Controlling for various medical, sociodemographic, and psychosocial covariates, multiple regression analyses revealed that higher global PSQI score was significantly associated with poorer functional well-being, greater fatigue intensity, greater disruptions in social interactions, and lower positive states of mind. Specifically, a poorer ‘sleep efficiency’ PSQI component was associated with poorer functional quality of life and the SIP–Social Interactions subscale, while a poorer ‘sleep quality’ (SQ) PSQI component was associated with all of the outcomes except for the SIP–Recreations and Pastimes subscale.

Conclusions: Results indicate consistent associations between a clinical indicator of sleep dysfunction, particularly those subscales of the PSQI comprising the ‘SQ’ component, and multiple indicators of psychosocial adaptation among women treated for BCa, independent of anxiety and depression, and suggest the value of comprehensive psychosocial interventions that consider sleep problems.

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Sleep disturbances are common among women diagnosed with breast cancer (BCa) [1]. Ancoli-Israel *et al.* [2] showed that sleep disturbances were associated with fatigue and daytime dysfunction prior to adjuvant treatment for the disease. The authors emphasized the importance of understanding sleep patterns before cancer treatment in order to optimally intervene to improve sleep disturbances related to BCa diagnosis. A limitation of the analyses conducted by Ancoli-Israel *et al.* is the dearth of statistical control for variables such as pain, depression and anxiety that may impact the relationship between sleep and psychosocial and functional outcomes. Determining the independent role of sleep as it relates to symptoms such as fatigue and other quality of life indicators may aid in the identification of specific intervention

treatment targets to improve the outcomes for cancer patients.

The present study examined women with BCa in the weeks after surgery (i.e. lumpectomy or mastectomy) and before adjuvant treatment had begun. At this point, physical symptoms and interference in daily life were quite high. Post-surgical issues included reduced satisfaction with physical appearance (particularly the chest), physical sensations (e.g. numbness, tightness, and swelling), reduced energy levels, pain, sleep problems, and decreased quality of life [3–5]. Many of the women in the present study were also preparing to undergo adjuvant treatment (e.g. chemotherapy, radiation, or tamoxifen), and may have been experiencing anticipatory anxiety [6].

Although sleep has been investigated in a similar sample of women with BCa before chemotherapy [2], it has not, to our knowledge, been systematically related to a theoretically derived set of indicators of psychosocial adaptation while controlling for a range of relevant covariates. The current study aimed to (a) determine the frequency of sleep disturbances in women prior to adjuvant therapy for BCa and (b) determine whether greater sleep dysfunction uniquely predicts poorer functional outcomes. With a larger sample than previously studied [2], the current study is powered to examine the unique contribution of sleep to function.

Method

Participants and procedures

Participants were 240 non-metastatic BCa patients participating in a clinical trial of a cognitive behavioral stress management (CBSM) intervention recruited through local oncology practices. Participants were required to have been diagnosed with BCa at Stage III or below and to have had surgery prior to enrollment. Once screened for eligibility and enrolled, they completed self-report questionnaires that assessed sociodemographic, sleep, and psychosocial measures before beginning the CBSM intervention or the one-day control. Interviewer ratings of depression and anxiety were collected when the women came in for a baseline blood draw. For detailed information on this IRB-approved protocol, see Antoni *et al.* [7].

Predictor measures

Sleep variables

The Pittsburgh Sleep Quality Index (PSQI) is a 19-item, 30-day retrospective self-report questionnaire that measures SQ and disturbances. A global score is calculated in addition to multiple subscale scores, including subjective SQ, sleep latency, sleep duration, habitual sleep efficiency (SE), sleep disturbances, use of sleep medications, and daytime dysfunction. A global score greater than 5.0 has been shown to be a sensitive clinical criterion for distinguishing poor sleepers from good sleepers [8]. Studies show that a score greater than 8.0 is a more useful cutoff for cancer populations [9]. The PSQI has been found to have good psychometric properties in patients with cancer, including women with BCa [9]. In the current sample, the seven subscales had a Cronbach's alpha of 0.73.

Buyse *et al.* performed a principle component analysis on the PSQI and found that the measure could be divided into three component scores [10]. The first component score consisted of the sleep duration and SE subscales, which will be referred to as the 'SE' component. The second component

score consisted of the sleep disturbances, sleep latency, daytime dysfunction, and SQ subscales, which will be referred to as the 'SQ' component. The third, and final, component score consisted of the use of sleep medications. Since sleep medication serves as a control for the current analysis, the sleep medications component score was eliminated from the analysis.

Control variables

Medical variables included cancer stage (I, II, or III), type of surgery (mastectomy versus lumpectomy), days since surgery, if they had breast reconstruction surgery, menopausal status (pre-menopausal, peri-menopausal, or post-menopausal), and the use of prescription medication for sleep, pain, depression, and anxiety. Additionally, pain was measured by a single item from the Brief Pain Inventory [11]. The item asked the respondent to choose their average level of pain in the past 24 h on a 9-point Likert scale from 'no pain' to 'pain as bad as you can imagine.' Sociodemographic variables were age in years, race/ethnicity (non-Hispanic Black, non-Hispanic White, or Hispanic), partnership status (partnered or not partnered), employment (employed or not employed), and education (highest educational level attained). Depression and anxiety were measured using the Hamilton Rating Scale for Depression (HAM-D) [12] and the Hamilton Rating Scale for Anxiety (HAM-A) [13], respectively. The Hamilton scales are structured interviews that were conducted by a clinical psychology graduate student who was trained in the use of the measure. The Cronbach's alphas for the HAM-D and the HAM-A were 0.78 and 0.79, respectively.

Criterion measures

The measures used to conceptualize psychosocial adaptation are based upon a model comprising indicators of negative and positive adaptation to the BCa experience [14].

Cancer-specific functional quality of life

Daily functioning related to cancer diagnosis and treatment was measured for the past seven days by the 7-item, Functional Well-Being subscale of the Functional Assessments of Cancer Therapy—Breast Cancer (FWB) [15]. Respondents were asked to indicate how much a series of statements applied to them on a 5-point Likert scale from 'not at all' to 'very much' ($\alpha = 0.75$).

Fatigue

Fatigue was measured using the 14-item Fatigue Symptom Inventory [16]: fatigue intensity (FSI-I) and fatigue disruption (FSI-D). The FSI-I measures the most, least, and the average levels

of fatigue in the past week, and the level of fatigue at the time of the assessment ($\alpha = 0.83$). The FSI-D measures how much fatigue interferes in a number of domains, including normal activities, interactions with others, life enjoyment, and mood ($\alpha = 0.93$). Respondents are asked to indicate their level of fatigue and interference on 9-point Likert scales from 'not at all fatigued' to 'as fatigued as I could be' and from 'no interference' to 'extreme interference,' respectively.

Interpersonal disruption

A 16-item questionnaire comprised of two subscales of The Sickness Impact Profile was used to assess the impact of cancer and cancer treatment on social interactions (SIP-S, $\alpha = 0.81$) and on recreations and pastimes (SIP-R, $\alpha = 0.71$) over the past few weeks [17]. Respondents were asked whether or not a series of statements applied to them and were asked to indicate either 'no' or 'yes, this applies to me.'

Positive states of mind

Perceptions of positive life experiences were assessed by the 7-item, self-report Positive States of Mind (PSOM) questionnaire [18]. Respondents were asked to indicate how frequently they had been able to have a number of satisfying states of mind in the past seven days on a 4-point Likert scale from 'unable to have it' to 'have it well.' Domains assessed are focused attention, productivity, responsible caretaking, restful repose, sensuous non-sexual pleasure, sharing, and sensuous sexual pleasure ($\alpha = 0.78$).

Statistical analyses

Descriptive statistics were computed for all variables. We hypothesized that global PSQI score, as well as the SE and SQ components, would be associated with psychosocial adaptation variables, after controlling for numerous medical, socio-demographic, and affective variables. First, separate multiple regressions were conducted to determine whether the PSQI Global score was significantly independently associated with each of the psychosocial outcomes of interest. Then, similar multiple regressions were conducted to determine which of the PSQI components (i.e. SE or SQ) was a better predictor of the psychosocial outcomes. For each set of analyses, the control variables were entered into the regression equation first, and then the predictor variable of interest (i.e. PSQI Global score, SE component, or the SQ component) was added in the second step.

Results

Sample characteristics

The average age of the sample was 50.34 years (SD = 9.03). The sample was predominantly White ($n = 162$; 68%), employed ($n = 178$; 75%), and partnered ($n = 150$; 63%). Descriptive statistics for these and other variables are presented in Table 1.

Effects of sleep variables on psychosocial adaptation

Correlations among the set of predictors ranged from $r = 0.61$ to 0.90 . Results are presented in text for the PSQI Global score, the SE component, and the SQ component as separate independent predictors, and, thus, the values presented in text are the R^2 and F change values. For information

Table 1. Descriptive statistics for the variables at baseline

	M	SD
Days from surgery to self-report outcomes	40.13	22.70
Average pain rating*	2.28	1.62
Age (years)	50.34	9.03
Education (years)	15.58	2.38
Hamilton-Depression*	7.52	5.46
Hamilton-Anxiety*	7.57	5.61
Global PSQI score*	8.49	4.16
FWB*	18.38	5.77
FSI-Intensity*	4.38	1.63
FSI-Disruption*	3.63	1.97
SIP-Social interactions*	893.75	161.72
SIP-Recreations and pastimes*	322.03	67.54
PSOM*	21.62	3.93
	N	Percentage
<i>Stage</i>		
0	38	16.0
I	90	37.8
II	91	38.2
III	19	8.0
<i>Surgical procedure</i>		
Mastectomy	118	49.2
Lumpectomy	122	50.8
Had reconstructive surgery	71	29.6
<i>Menopausal status</i>		
Pre-menopausal	107	44.6
Peri-menopausal	30	12.5
Post-menopausal	103	42.9
Prescribed sleep medication	43	17.9
Prescribed pain medication	60	25.0
Prescribed antidepressants	26	10.8
Prescribed anti-anxiety medication	42	17.5
<i>Race/Ethnicity</i>		
Black	18	7.5
White	162	67.5
Hispanic	60	25.0
Partnered	150	62.5
Employed	178	74.5

*Possible score ranges: Average Pain Rating = 1-9; Hamilton Depression = 0-54; Hamilton Anxiety = 0-56; Global PSQI Score = 0-21; FWB 0-28; FSI-Intensity = 1-9; FSI-Disruption 1-9; SIP-Social interactions = 751-1502; SIP-Recreations and pastimes = 251-502; PSOM = 7-28.

Table 2. Adjusted proportion of variance explained by the final model (controls+selected sleep variable) for each outcome

	A PSQI Global Score	B PSQI-Sleep efficiency	C PSQI-Sleep quality
FWB	39.8	36.1	41.5
FSI-I	24.2	18.6	25.2
FSI-D	36.0	35.1	37.7
SIP-S	23.3	21.9	26.5
SIP-R	14.1	13.4	15.8
PSOM	20.9	19.4	22.0

All models were significant at the $\alpha = 0.01$ level.

regarding the final regression models, including both controls and the sleep variables of interest, see Table 2.

Global sleep score

PSQI Global score explained a significant proportion of the variance in FWB ($R^2 = 0.058$, $F(1, 174) = 18.38$, $p < 0.01$), FSI-I ($R^2 = 0.056$, $F(1, 174) = 14.05$, $p < 0.01$), SIP-S ($R^2 = 0.029$, $F(1, 171) = 7.23$, $p < 0.01$), and the PSOM ($R^2 = 0.024$, $F(1, 174) = 5.77$, $p < 0.05$). The PSQI global score was not significantly associated with FSI-D or the SIP-R.

Sleep efficiency

The SE component score explained a significant proportion of the variance in FWB ($R^2 = 0.027$, $F(1, 175) = 8.04$, $p < 0.01$), as well as the SIP-S ($R^2 = 0.016$, $F(1, 172) = 3.95$, $p < 0.05$). The SE component score was not significantly associated with FSI-I, FSI-D, SIP-R, or the PSOM.

Sleep quality

The SQ component score explained a significant proportion of the variance in FWB ($R^2 = 0.079$, $F(1, 182) = 27.08$, $p < 0.01$), the FSI-I ($R^2 = 0.080$, $F(1, 182) = 21.29$, $p < 0.01$), FSI-D ($R^2 = 0.025$, $F(1, 182) = 8.00$, $p < 0.01$), SIP-S ($R^2 = 0.052$, $F(1, 179) = 13.94$, $p < 0.01$), and the PSOM ($R^2 = 0.045$, $F(1, 182) = 11.54$, $p < 0.01$). The SQ component score was not significantly associated with SIP-R.

Discussion

Participants in this study reported poor SQ and high levels of sleep disruption on the PSQI. Most of the women (70.8%) had PSQI global scores above the established cutoff of 5.0. Additionally, more than half of the women scored above the suggested adjusted cutoff of 8.0 ($M = 8.49$) for cancer patients [9]. This is higher than had previously been found among women with BCa prior to adjuvant treatment, where the mean score was 7.0 [2]. It is, however, nearly the same as the

average score of 8.45 found among women who were, on average, one-year post-diagnosis [19].

Higher PSQI Global score was significantly associated with the poorer functional well-being, greater fatigue intensity, greater disruptions in social interactions, and lower PSOM. Not surprisingly, the component scores were highly correlated with the global score, but the correlation between the SE and SQ component scores was 0.61. Examination of the component scores showed that lower SQ was associated with all of the outcomes except the SIP-R, while the poorer SE was associated with the poorer functional quality of life and the SIP-S. Based on these findings, it seems that the SQ subscales (i.e. sleep disturbances, sleep latency, daytime dysfunction, and SQ) have a greater impact on psychosocial outcomes than the actual amount of hours spent in bed and sleeping, and may be a more salient sleep intervention target. These results are similar to those previously reported [2]; however, with the addition of relevant controls, we now have a clearer picture of the unique contribution of sleep features to psychosocial adaptation. While these contributions are small in some cases, they reached statistical significance in the context of an intervention that was not specifically focused on sleep.

Several limitations should be noted. First, these analyses were exploratory and specific sleep analyses were not planned prior to data collection. Second, sleep variables were limited to the PSQI, a retrospective, self-report measure that covers a one-month time period. Biases related to self-report measures and recall biases may have influenced the data. Also, the measures used in these analyses had varying time frames, from 24 h (e.g. pain item) to the entire experience of having BCa (e.g. FWB), and it is possible that this attenuated relationships between sleep and the psychosocial outcomes. Third, no data were available for participant's sleep habits prior to enrollment. Fourth, this study was conducted with women diagnosed with stage I-III BCa before adjuvant treatment and therefore, may not generalize to women diagnosed with metastatic BCa or at other phases of treatment. Finally, it is not clear whether there was sufficient variance in the measures as is needed to detect possible correlations between measures and associations between variables may be underestimated.

Choosing the most expeditious intervention to improve either sleep (cognitive behavioral sleep therapy) [20] or psychosocial adaptation (CBSM) [7] may actually bring about benefits in both sleep and psychosocial adaptation. There is emerging evidence to suggest that sleep and stress may share common neuroendocrine mechanisms in the context of cancer treatment [21]. These data suggest that combining sleep-specific interventions with stress management may be a highly efficient approach in women under treatment for BCa.

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