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Psychosocial Resources and Sleep Disturbance Prior to Chemotherapy for Gynecologic Cancer

Bryan J. Evans¹, Kristin M. Phillips², Brian D. Gonzalez², Sachin Apte², Brent J. Small¹, Paul B. Jacobsen², and Heather S.L. Jim²

¹University of South Florida, Tampa, FL

²Moffitt Cancer Center, Tampa, FL

Abstract

Personal psychosocial resources (e.g., positive affect, social support, perceived mastery, meaning in life) are associated with better sleep in non-cancer populations but there have been few studies in cancer patients. The current study examined psychosocial resources and sleep in gynecological cancer patients. Prior to chemotherapy, 72 participants completed self-report measures of sleep and psychosocial resources; 63 also completed actigraphic monitoring. Subjective sleep was associated with positive affect, social support, perceived mastery, and meaning in life; objective sleep was associated with social support. Future studies should examine whether interventions to enhance psychosocial resources result in improved sleep in this population.

Keywords

Neoplasms; sleep; actigraphy; social support

Cancer diagnosis and treatment are associated with a variety of physical and psychological side effects which can compromise patients' quality of life. Of these, sleep disturbance is one of the most common (Baker, Denniston, Smith, & West, 2005). Previous research indicates that sleep disturbance is present in 30% to 50% of cancer patients (Fiorentino & Ancoli-Israel, 2007; Savard, Villa, Ivers, Simard, & Morin, 2009). Gynecologic cancer is associated with particularly high rates of sleep disturbance; data suggest that 68% of gynecologic cancer patients report sleep disturbance prior to adjuvant treatment (Savard, Ivers, Villa, Caplette-Gingras, & Morin, 2011), 82.3% during chemotherapy (O. G. Palesh et al., 2010), and 33–36% after treatment completion (Savard et al., 2011). Sleep disturbance in cancer patients co-occurs with other symptoms (Ancoli-Israel et al., 2014; Clevenger et al., 2013; Dean et al., 2013a) and may in fact initiate a cascade of symptoms by contributing to fatigue, which in turn contributes to depression (Jim et al., 2011). Thus, it is important to understand factors that may ameliorate sleep disturbance in this population.

Corresponding author: Heather S.L. Jim, Ph.D., Moffitt Cancer Center, 12902 Magnolia Drive MRC-PSY, Tampa, FL 33612. heather.jim@moffitt.org.

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While there has been a great deal of recent interest in the relationship between positive psychosocial resources (e.g., positive affect, social support, perceived mastery, meaning in life) and health in cancer patients, few studies have examined sleep disturbance specifically. The notion that positive psychological states may influence sleep disturbance in cancer patients is derived from Fredrickson's broaden-and-build theory of positive emotion (Fredrickson, 1998). This theory suggests positive emotions enhance the thought-action repertoire, allowing an individual to develop a broad array of resources (e.g., social support, perceived mastery over one's life, meaning in life). These resources may influence actions such as better sleep. Available research in cancer and non-cancer populations supports the broaden-and-build theory as it applies to sleep. For example, positive mood is associated with better subjective sleep quality, greater objective sleep efficiency, and shorter latency to first rapid eye movement (REM) period in healthy individuals (Berry & Webb, 1983, 1985; McCrae et al., 2008; Norlander, Johansson, & Bood, 2005; Scott & Judge, 2006; Steptoe, O'Donnell, Marmot, & Wardle, 2008), although in lung cancer patients, physical symptomatology was found to be a more important determinant of objectively-measured sleep than positive mood (Dean et al., 2013b). Social support is predictive of better perceived sleep in cancer patients (Bardwell et al., 2008; Price et al., 2009), consistent with studies showing it to be related to better objective sleep in individuals with insomnia as well as healthy controls (Jackowska, Dockray, Hendrickx, & Steptoe, 2011; Troxel, Buysse, Monk, Begley, & Hall, 2010). Perceived mastery and meaning in life have been shown to contribute to longer sleep duration in healthy individuals (Hamilton, Nelson, Stevens, & Kitzman, 2007), although to our knowledge no studies have examined these relationships in cancer patients.

Research examining psychosocial resources and sleep in cancer patients is clinically relevant, as identification of modifiable, protective factors could inform future intervention research to improve sleep in this population. The aim of the current study was to examine relationships between self-reported personal psychosocial resources (i.e., positive affect, social support, perceived mastery, meaning in life) and subjectively- and objectively-assessed sleep. These variables were examined in gynecologic cancer patients prior to starting chemotherapy, a time that is characterized by heightened anxiety and poor sleep (Jim et al., 2011). It was hypothesized that greater positive affect, social support, perceived mastery, and meaning in life would be associated with better subjective and objective sleep.

Methods

Participant Eligibility and Recruitment

Participants were recruited as part of a larger study examining quality of life in women undergoing platinum-based chemotherapy for gynecologic cancer. To be eligible, patients had to be: (1) at least 18 years of age, (2) scheduled to receive intravenous platinum-based chemotherapy for gynecologic cancer at Moffitt Cancer Center, (3) free of chemotherapy for at least 2 months prior to recruitment, (4) free of any documented or observable psychiatric or neurological disorders that could interfere with participation in the study, (5) able to speak and read English, and (6) able to provide written informed consent. Participants were

recruited between September 2007 and July 2009. Analyses were conducted using baseline (i.e., pre-chemotherapy) data.

The study was approved by the Institutional Review Board at the University of South Florida. Patient eligibility was determined by a review of patients' medical charts in consultation with the attending physician. Women who were eligible and agreed to participate provided written informed consent during an outpatient clinic visit. Participants were asked to continuously wear the actigraph for one week. At the end of the week, they completed self-report measures of sleep quality, positive and negative affect, social support, perceived mastery in life, and meaning in life keyed to the past week.

Of 112 women who were approached for study participation 80 (71%) agreed to participate. Reasons for refusal included: too sick ($n = 2$), too busy ($n = 16$), not interested ($n = 7$), not able to comply with actigraphy/diaries due to work or other obligations ($n = 4$), and no reason given ($n = 3$). Of the 80 patients who signed consent, two did not provide any data (one became ineligible due to a change in treatment plans and the other elected to discontinue study participation prior to completing the first self-report questionnaire). Six participants were excluded from the current analyses because they completed neither self-report nor actigraphy data. Nine patients completed self-report data but did not complete actigraphic monitoring data due to confusion about when to wear the actigraph, medical procedures requiring removal of the actigraph (e.g., paracentesis), or discomfort with the actigraph. Thus, the final sample size for the current analyses was 72 participants; of these, 63 also completed actigraphic monitoring.

Measures

Demographic and Clinical Data—Age, race/ethnicity, marital status, education level, and annual household income were assessed via self-report. Comorbidities were assessed using a self-report version of the Charlson Comorbidity Index (Charlson, Pompei, Ales, & MacKenzie, 1987). Medical chart review was conducted to assess clinical characteristics of the participants including cancer type, disease stage, days since diagnosis, days since surgery, recurrence status, and prescription of sleep medications (i.e., benzodiazepines, barbiturates, sedatives, and hypnotics).

Objective Sleep Disturbance—Objective sleep was assessed using the Actiwatch®-Score (Philips Respironics, Andover, MA) actigraph worn on the non-dominant wrist, counting physical activity in 60-second intervals (epochs). Actigraphy demonstrates approximately 90% agreement with polysomnography (de Souza et al., 2003). In accordance with recommendations (Berger et al., 2008), objective sleep for overnight sleep periods was assessed using the Cole/Kripke algorithm (R. J. Cole, Kripke, Gruen, Mullaney, & Gillin, 1992) with the following variables: (1) time in bed, (2) sleep efficiency (i.e., the percentage of time in bed spent sleeping), (3) minutes awake after sleep onset (WASO) (i.e., minutes awake after an initial period of sleep), and (4) sleep latency (i.e. time to fall asleep). Participants were also asked to document their bedtimes and rising times in a daily diary immediately upon awakening each morning. These times were used to calculate time in bed for the previous night's sleep period.

Subjective Sleep—The Pittsburgh Sleep Quality Index (PSQI) (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) was used to assess perceptions of sleep over the past week. An abbreviated version of the PSQI was used in the current study to reduce participant burden. Five components were assessed (i.e., sleep quality, sleep latency, sleep duration, sleep efficiency, and use of sleep medication). A total score was obtained by summing the five component scores. Component scores ranged from 0 to 3 and the total score ranged from 0 to 15 with higher scores indicating worse sleep. Cronbach's alpha reliability for the abbreviated version of the PSQI in the current sample was 0.75. Previous research has shown the PSQI to be a valid measure of sleep in cancer patients (Beck, Schwartz, Towsley, Dudley, & Barsevick, 2004). The abbreviated version of the PSQI has been used previously in cancer patients (Phillips, Jim, Donovan, Pinder-Schenck, & Jacobsen, 2012).

Positive Mood—A 19-item version of the positive affect subscale of the Positive and Negative Affect Scale (PANAS) was used to assess positive mood (Tugade & Fredrickson, 2004). In addition to the ten items included in the original PANAS scale (Watson, Clark, & Tellegen, 1988), participants were asked to rate nine additional positive feelings and emotions (amused, calm, content, curious, happy, relaxed, relieved, satisfied, surprised) on a 5-point Likert scale (1 = very slightly or not at all, 5 = extremely) over the past week. Ratings were summed to produce a total score ranging from 19 to 95. Higher scores indicate greater positive mood. Cronbach's alpha reliability for positive subscale in the current sample was 0.94. The PANAS has been used previously in cancer patients (B. S. Cole, Hopkins, Tisak, Steel, & Carr, 2008; Voogt et al., 2005).

Social Support—The Interpersonal Support Evaluation List (ISEL) (Cohen & Hoberman, 1983) was used to measure the perceived availability of social resources. The scale consists of fifteen items with three subscales: Tangible Support (e.g., "If I were sick, I would have trouble finding someone to help me with my daily chores"), Appraisal Support (e.g., "There is at least one person I know whose advice I really trust"), and Belonging Support (e.g., "I am usually invited to do things with others"). The items are scored on a four point Likert scale (1 = completely false, 4 = completely true). Items are averaged to produce subscale scores and a total score ranging from 1 to 4. Higher scores indicate a greater level of perceived social support. Cronbach's alpha reliability for the ISEL total score in the current sample was 0.82. The ISEL has been used previously in cancer patients, including gynecologic cancer patients (Carpenter, Fowler, Maxwell, & Andersen, 2010; Fogel, Albert, Schnabel, Ditkoff, & Neugut, 2003).

Perceived Mastery in Life—The Pearlin and Schooler Mastery Scale (PSMS) (Pearlin & Schooler, 1978) was used to assess perceived mastery in life. The PSMS consists of seven items assessing personal beliefs regarding perceived mastery (e.g., "I can do just about anything I really set my mind to" and "What happens to me in the future mostly depends on me"). Items are rated on a 4-point Likert scale (0 = strongly disagree, 3 = strongly agree). Items are summed to produce a total score ranging from 0 to 21 with higher scores indicating greater perceived mastery. The PSMS demonstrated a Cronbach's alpha reliability of 0.79 in the current sample. The PSMS has been used previously in cancer patients and is

associated with biological markers of stress (i.e., cortisol) (Vedhara, Tuinstra, Miles, Sanderman, & Ranchor, 2006).

Meaning in Life—The Meaning in Life Scale (MiLS) (Jim, Purnell, Richardson, Golden-Kreutz, & Andersen, 2006a) was used to assess perceived meaning in life as the result of cancer. The MiLS consist of 21-items assessing four dimensions of meaning: Peace (4 items; e.g., “I feel a sense of harmony within myself” and “I feel peaceful”), Purpose/Goals (7 items; e.g., “I feel more fulfilled and satisfied with life” and “I have found new and more worthwhile goals”), Confusion/Loss of Meaning (7 items; e.g., “I get completely confused when I try to understand life” and “Life has less meaning”), and Spirituality (3 items; e.g., “I find comfort in my faith or spiritual beliefs” and “My illness has strengthened my faith or spiritual beliefs”). A modified version was used in which all items were rated on a six point Likert scale (1=strongly disagree, 6=strongly agree). A mean score is calculated for each subscale. High scores on the Peace, Purpose/Goals, and Spirituality subscales indicate greater meaning while higher scores on the Confusion/Loss of Meaning subscale indicate less meaning. To calculate a total score, the Confusion/Loss of Meaning subscale score is subtracted from the sum of the other three subscale scores. The resulting total score can range from –3 to 17 with higher scores indicating greater meaning. Cronbach’s alpha reliability for the total score in the current sample was 0.71. The validity of the MiLS in cancer patients has previously been established (Jim, Purnell, Richardson, Golden-Kreutz, & Andersen, 2006b).

Statistical Analysis

On average, participants provided actigraphy data for 5.6 days ($SD = 1.7$). Mean values for actigraphy variables (i.e., time in bed, sleep efficiency, sleep latency, and WASO) were obtained via the Actiwatch®-Score software and used in subsequent statistical analyses. Data were analyzed using SAS 9 (Cary, NC). To investigate relationships among psychosocial resources and sleep, Spearman correlations were calculated among the PSQI total score, actigraphy variables, PANAS positive affect, ISEL total score, PSMS total score, and MiLS total score. To reduce Type I error, among measures with both a total score and subscales (i.e., PSQI, ISEL, MiLS), subscales were included in analyses only if the total score was found to be significantly correlated ($p < .05$) with sleep. Relationships among objective and subjective measures of sleep were also examined using Spearman correlations. Because psychosocial resources may be interrelated, sleep outcomes that displayed significant univariate associations with multiple psychosocial resources were examined further using stepwise regression. To investigate the possibility of potential sociodemographic (i.e., age, ethnicity, race, marital status, education, income) and clinical (i.e., comorbidities, time since cancer diagnosis, time since surgery, recurrence status, stage, cancer type) confounds of the relationships between psychosocial resources and subjective and objective sleep, Spearman correlations were first calculated. Potential sociodemographic and clinical confounds (i.e., those correlated with sleep at $p < 0.10$) were forced into the model and psychosocial resources were retained only if they contributed significant variance ($p < 0.05$) to sleep above and beyond the other variables in the model. Sleep and psychosocial resource variables were log-transformed prior to regression analyses to correct for skewness.

Results

Sample Descriptives

Sample descriptives are shown in Table 1. The majority of participants were Caucasian, non-Hispanic, married, and had completed high school. Means and standard deviations of study variables are presented in Table 2.

Correlations Among Psychosocial Resources and Sleep

Significant univariate relationships were found among several psychosocial variables and subjective and objective sleep (see Table 3). Greater positive affect was associated with better perceived sleep quality, longer perceived sleep duration, higher perceived sleep efficiency, less perceived use of sleep medication, and better overall perceived sleep as assessed via the PSQI total score ($ps<0.05$). Positive affect was not significantly related to objective sleep ($ps>0.05$). Greater total social support was associated with better perceived sleep quality, longer perceived sleep duration, and longer objective time in bed ($ps<0.05$). Relationships between social support and sleep were further probed by examining ISEL subscales. Tangible support was associated with longer objective time in bed ($p<0.05$) but not perceived sleep. Appraisal support was not associated with any sleep variables ($ps>0.05$). Belonging support was associated with better perceived sleep quality and longer perceived time in bed ($ps<0.05$), but not objective sleep. Perceived mastery was associated with better perceived sleep quality and better overall perceived sleep ($ps<0.05$), but not objective sleep. Meaning in life was associated with better perceived sleep quality, longer perceived sleep duration, less perceived use of sleep medication, and better overall perceived sleep ($ps<0.05$) but not objective sleep. Relationships between meaning in life and sleep were further examined using MiLS subscale scores. Greater peace was associated with better perceived sleep quality, longer perceived sleep duration, less perceived use of sleep medication, and better overall perceived sleep ($ps<0.05$) but not objective sleep. Spirituality was not associated with subjective or objective sleep ($ps>0.05$). Confusion/loss of meaning was associated with worse perceived sleep quality, shorter sleep duration, lower perceived sleep efficiency, and worse overall perceived sleep ($ps<0.05$) but not objective sleep. Purpose/goals was associated with better overall perceived sleep ($ps<0.05$) but not objective sleep.

Relationships among subjective and objective measures of sleep were also examined (see Table 3). Longer objective time in bed was associated with better perceived sleep quality and longer perceived sleep duration ($ps<0.01$). Greater objective WASO was associated with worse perceived sleep efficiency ($ps<0.05$). No other associations between objective and subjective sleep were statistically significant ($ps>0.05$).

Multivariable Relationships among Psychosocial Resources and Sleep

Potential sociodemographic (i.e., age, race, ethnicity, marital status, education, income) and clinical (comorbidities, time since diagnosis, time since surgery, recurrence status, stage, cancer type) confounds of objective and subjective sleep were examined. Sociodemographic and clinical variables were considered potential confounds if they were associated with sleep at $p<0.10$. Younger age was associated with better perceived sleep quality ($r=-0.41$,

$p < 0.01$), longer perceived sleep duration ($r = -0.35$, $p < 0.01$), better overall perceived sleep ($r = -0.33$, $p < 0.01$), and shorter objective time in bed ($r = 0.40$, $p < 0.01$). Hispanic patients demonstrated shorter objective sleep latency ($r = .21$, $p = 0.10$). Caucasian patients demonstrated longer time in bed ($r = 0.30$, $p = 0.02$). Married patients demonstrated higher objective sleep efficiency ($r = 0.39$, $p < 0.01$) and less WASO ($r = -0.28$, $p = 0.03$). Higher income was associated with better objective sleep efficiency ($r = 0.28$, $p = 0.07$). Greater comorbidities were associated with lower objective sleep efficiency ($r = -0.32$, $p < 0.01$). Longer time since diagnosis was associated with better perceived sleep quality ($r = -0.23$, $p = 0.05$), longer perceived sleep duration ($r = -0.26$, $p = 0.03$), greater perceived sleep efficiency ($r = -0.28$, $p = 0.02$), less perceived sleep medication use ($r = -0.23$, $p = 0.05$), better overall perceived sleep ($r = -0.37$, $p < 0.01$), and less WASO ($r = -0.23$, $p = 0.07$). Longer time since surgery was associated with longer objective sleep latency ($r = 0.24$, $p = 0.06$). Recurrence status was associated with less WASO ($r = -.26$, $p = 0.03$). No other potential confounds (i.e., education, stage, cancer type) were associated with subjective or objective sleep. Sociodemographic and clinical variables were forced into stepwise regressions as control variables if they were correlated with the dependent variable at $p < 0.10$.

Thus, for overall perceived sleep, the predictors examined were: age, time since diagnosis, positive affect, mastery, total meaning in life, peace, confusion/loss of meaning, and purpose/goals. For perceived sleep efficiency, they were: time since diagnosis and confusion/loss of meaning. For perceived sleep duration they were: age, time since diagnosis, positive affect, total social support, belonging support, total meaning in life, peace, and confusion/loss of meaning. For perceived sleep quality, they were: age, time since diagnosis, positive affect, total social support, belonging support, mastery, total meaning in life, peace, and confusion/loss of meaning. For objective time in bed, they were: age, race, total social support, and tangible support. As shown in Table 4, positive affect, perceived mastery, total meaning in life, and confusion/loss of meaning were retained as predictors of subjective sleep. No psychosocial resources were retained as predictors of objective time in bed.

Discussion

The current study examined associations among psychosocial resources and subjective and objective sleep in gynecological cancer patients one week prior to their first chemotherapy treatment. Subjective sleep in this sample as assessed by an abbreviated version of the PSQI was comparable to that reported in a large sample of cancer patients prior to starting chemotherapy using the same measure (Phillips et al., 2012). Objective sleep in the current sample was generally better relative to two studies of breast cancer patients assessed prior to chemotherapy (Liu et al., 2012; Rissling, Liu, Natarajan, He, & Ancoli-Israel, 2011). Significant correlations were evident among several psychosocial resources and subjective sleep, while only social support was associated with objective sleep. These results are intriguing because they suggest that, while psychosocial resources were associated with the perception of better sleep in this sample of gynecologic cancer patients, they were less likely to be associated with objective sleep.

Although there has been a great deal of research interest in the relationship between psychosocial resources and health in cancer patients, the present study is the first to our knowledge to investigate multiple psychosocial resources and sleep in this population. Psychosocial resources associated with better perceived sleep (i.e., overall perceived sleep, sleep efficiency, sleep duration, sleep medication usage, and sleep quality) included positive affect, social support, perceived mastery, total meaning in life, peace, and purpose/goals as well as less confusion/loss of meaning. Psychosocial resources associated with better objective sleep (i.e., time in bed) were total social support and tangible social support. Because psychosocial resources can be highly correlated with one another, we conducted stepwise regression to determine which resources accounted for the most variance in subjective and objective sleep. After controlling for potential confounds such as age and time since cancer diagnosis, several psychosocial resources remained significant predictors of subjective sleep. In contrast, no psychosocial resources significantly predicted objective sleep in stepwise regressions after controlling for potential confounds. This evidence supports the broaden-and-build theory of psychological resources as predictors of better subjective sleep, although provides less support for the theory as it relates to objective sleep.

The current study's use of both subjective and objective sleep allowed for examination of the relationship between the two types of measures. Results showed longer time in bed was related to better perceived sleep quality and longer perceived sleep duration, while greater objective WASO was related to worse perceived sleep efficiency. Thus, our data provide some evidence that patients' reports of sleep quality reflect objective sleep behaviors. Nevertheless, the lack of stronger and more consistent associations between subjective and objective sleep in the current study is consistent with previous literature reporting discrepancies between subjective sleep reporting and objective sleep measures (Ancoli-Israel et al., 2003; Buysse et al., 2008; Jackowska et al., 2011; Rotenberg, Indursky, Kayumov, Sirota, & Melamed, 2000; Tsuchiyama, Nagayama, Kudo, Kojima, & Yamada, 2003; Van Den Berg et al., 2008). To date, literature examining the relationship between psychosocial resources and sleep has relied mostly on the use of subjective sleep measurements. Our data, taken together with the large body of literature suggesting inconsistent associations between subjective and objective sleep, suggest that studies examining only subjective sleep should be interpreted with caution because observed relationships may not generalize to objective sleep. The current findings emphasize the importance of incorporating objective measures of sleep such as actigraphy in future research and clinical settings. While patients' perceptions of sleep should not be discounted, the limitations of accurately evaluating sleep solely via self-report measures have become increasingly evident.

The current study is characterized by several strengths, such as the use of actigraphy, validated measures of psychosocial resources and perceived sleep, and a uniform time of assessment. In addition, the study focused on a population of cancer patients who experience high rates of sleep disturbance. Study limitations should also be noted, however. The cross-sectional nature of the study limits our ability to determine directionality of the effects. For example, it is unclear whether better sleep is due to more psychosocial resources or if patients endorse more resources because they are sleeping well. For example, a recent study reported that among breast cancer patients, poor sleep was associated with worse subsequent

mood but mood did not predict subsequent sleep (Ratcliff, Lam, Arun, Valero, & Cohen, 2014). Alternately, there may exist one or more variables not measured in the current study that contribute to perceptions of both sleep and resources (e.g., optimism) (Lemola, Raikonen, Gomez, & Allemand, 2012; Pinquart, Frohlich, & Silbereisen, 2007). Of the 112 patients approached and eligible for participation, 72 (64%) completed self-report measures. Thus, results from the current study may not generalize to the larger population of gynecologic cancer patients. This sample size may not have been adequate to detect small effects. The current study is also limited by a sample that was relatively homogeneous in terms of race and ethnicity. Consequently, it is unclear if these results are generalizable to the larger population of gynecological cancer patients.

Clinical Implications

The week prior to chemotherapy for gynecologic cancer can be highly stressful for patients. Subjective and objective sleep disruption during this time period is common (Jim et al., 2011). While psychological resources such as positive affect, social support, perceived mastery, and meaning in life can buffer stress (Cohen & Wills, 1985; Krause, 2007), these effects do not appear to translate into improved objective sleep during this time. Clinicians should be aware that causes of sleep disturbance prior to chemotherapy are likely multifactorial and may include stress, distress, anxiety, pain or discomfort due to recent surgery, hot flashes, nocturia, tumor burden, and other causes (Cash et al., 2015; O. Palesh et al., 2012). Because poor sleep is associated with a variety of negative immune outcomes (Clevenger et al., 2012; Faraut, Boudjeltia, Vanhamme, & Kerkhofs, 2012), patients with chronic sleep problems should be referred with their consent to a sleep specialist.

In summary, the current study demonstrates that psychosocial resources are associated with better perceived sleep. Future observational research should examine whether results of the current study also hold true in patients with other types of cancer and at other time points in the cancer continuum. Future intervention research should examine whether intervening to increase psychosocial resources also improves sleep (Breitbart et al., 2012). Ongoing research into psychosocial resources, as well as into objective and subjective indices of symptomatology, is important to foster a better understanding of how to manage patients' symptoms and improve quality of life.

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Table 1**Sociodemographic and Clinical Characteristics of the Sample (N=72)**

Age: M (range)	63.64 (33–87)
Race: n (%) Caucasian	66 (92%)
Ethnicity: n (%) non-Hispanic	70 (97%)
Marital status: n (%) married	47 (65%)
Education: n (%) completed high school	64 (89%)
Annual household income: n (%) greater than \$40,000*	27 (38%)
Cancer type: n (%)	
Ovarian	28 (39%)
Endometrial/uterine	28 (39%)
Other gynecologic	16 (22%)
Stage of disease: n (%)	
Stage I	15 (21%)
Stage II	9 (13%)
Stage III	37 (51%)
Stage IV	11 (15%)
Self-reported comorbidities (top three most common)	
Diabetes	14 (19%)
Heart failure	6 (8%)
Transient ischemic attack	5 (7%)
Days since diagnosis: median (range)	73 (13–4868)
Days since surgery: median (range)	45 (13–4868)
Recurrence status: n (%) recurred	18 (25%)
Prescribed sleep medication: n (%)	23 (32%)

* 21 patients opted not to respond to this item

† 9 patients did not complete actigraphic monitoring

Table 2**Study Variables**

Actigraphy	Mean	Standard Deviation
Time in bed (hours)	8.42	1.18
Sleep efficiency (%)	80.07	8.36
Sleep latency (minutes)	20.65	17.56
WASO (minutes)	65.65	29.85
PSQI (abbreviated)		
Sleep quality	1.08	0.83
Sleep latency	0.93	0.92
Sleep duration	0.68	0.90
Sleep efficiency	0.84	1.13
Sleep medication	0.93	1.30
PSQI total	4.47	3.53
PANAS positive affect subscale	56.37	14.54
ISEL total score	3.72	0.34
Appraisal support	3.75	0.38
Belonging support	3.74	0.37
Tangible support	3.69	0.50
PSMS	13.92	4.17
MiLS total score	11.35	3.81
Peace	4.56	1.21
Purpose/goals	3.96	1.21
Spirituality	4.90	1.35
Confusion/loss of meaning	2.07	0.96

ISEL: Interpersonal Support Evaluation List, MiLS: Meaning in Life Scale, PANAS: Positive and Negative Affect Scale, PSMS: Pearlin and Schooler Mastery Scale, PSQI: Pittsburgh Sleep Quality Index

Table 3
Spearman Correlations Among Psychological Resources and Subjective and Objective Sleep

	PSQI					Actigraphy				
	Sleep Quality	Sleep Latency	Sleep Duration	Sleep Efficiency	Sleep Medication	PSQI Total	Time In Bed	Sleep Efficiency	Sleep Latency	WASO
Positive affect	-.43**	-.08	-.33**	-.23*	-.28*	-.43**	.18	-.03	.06	.08
ISEL Total	-.23*	-.11	-.24*	-.14	.00	-.18	.26*	.08	-.00	.09
ISEL Tangible	-.07	-.16	-.10	.03	.02	-.09	.31*	.01	.08	.17
ISEL Appraisal	-.12	.09	-.12	-.15	-.10	-.11	.00	.04	-.14	.06
ISEL Belonging	-.25*	-.16	-.35**	-.09	.05	-.17	.16	-.00	.02	.10
Mastery	-.32**	-.03	-.21	-.17	-.21	-.31**	-.02	.03	.03	-.11
Total meaning	-.26*	-.02	-.25*	-.15	-.25*	-.28*	-.06	-.17	.06	.11
Peace	-.26*	-.05	-.27*	-.20	-.26*	-.31*	.07	-.11	.09	.08
Spirituality	-.19	-.02	-.10	.01	-.16	-.16	-.01	-.18	.07	.16
Confusion	.33**	-.01	.29**	.27*	.17	.32**	-.00	.13	-.20	.01
Purpose/goals	-.18	-.03	-.18	-.11	-.22	-.23*	-.13	-.15	-.05	.14

	PSQI				
	Sleep Quality	Sleep Latency	Sleep Duration	Sleep Efficiency	Sleep Medication
Objective Sleep					
Time in bed	-.35**	-.18	-.39**	.06	.05
Sleep efficiency	-.14	-.13	-.17	-.12	.08
Sleep latency	-.04	.01	-.01	.02	.05
WASO	.10	.09	.05	.25*	-.10

* p<.05,

** p<.01.

PSQI: Pittsburgh Sleep Quality Index. ISEL: Interpersonal Support Evaluation List. WASO: wake after sleep onset.

Table 4

Results of Stepwise Regressions Predicting Subjective and Objective Sleep Outcomes

Predictor	Standardized Beta	t
Outcome: PSQI Total		
Adjusted R ² =.15		
Age	−0.22	−1.91
Time since diagnosis	−0.10	−0.93
Positive affect	−0.29	−2.51*
Outcome: PSQI Sleep Efficiency		
Adjusted R ² =.04		
Time since diagnosis	−0.05	−0.45
Confusion	0.25	2.17*
Outcome: PSQI Sleep Duration		
Adjusted R ² =.13		
Age	−0.25	−2.22*
Time since diagnosis	−0.17	−1.51
Total meaning	−0.23	−2.06*
Outcome: PSQI Sleep Quality		
Adjusted R ² =.20		
Age	−0.38	−3.50**
Time since diagnosis	−0.05	−0.43
Mastery	−0.29	−2.67**
Outcome: Objective Time in Bed		
Adjusted R ² =.15		
Age	0.21	1.73
Race	.33	2.74**

*
p<.05,**
p<.01.

PSQI: Pittsburgh Sleep Quality Index.