Online Exclusive Article



# Subjective Sleep Quality, Objective Sleep Characteristics, Insomnia Symptom Severity, and Daytime Sleepiness in Women Aged 50 and Older With Nonmetastatic Breast Cancer

Carol A. Enderlin, PhD, RN, Elizabeth Ann Coleman, PhD, RNP, AOCN®, Catherine Cole, PhD, RN, ACNS-BC, Kathy C. Richards, PhD, RN, FAAN, Robert L. Kennedy, PhD, Julia A. Goodwin, PhD, Laura F. Hutchins, MD, and Karen Mack, BSN, RN, RNP, OCN®, CCRP



**Purpose/Objectives:** To examine subjective sleep quality in women aged 50 and older as predicted by cancer status, age, number of comorbidities, and symptoms of depressed mood; and to describe objective sleep characteristics, insomnia symptom severity, and daytime sleepiness.

**Design:** Descriptive.

**Setting:** Urban university and private oncology clinics in the southern United States.

**Sample:** 32 women with and 35 without nonmetastatic breast cancer, aged 50–90 years ($\bar{X}$ = 64.9, SD = 4.67).

**Methods:** Two telephone interviews, the Pittsburgh Sleep Quality Index, Profile of Mood States, three days of home actigraphy, Insomnia Severity Index, Epworth Sleepiness Scale, and medical records review.

**Main Research Variables:** Subjective quality of sleep; secondary objectives were sleep characteristics, insomnia symptoms, and daytime sleepiness.

**Findings:** Poor subjective sleep quality was predicted by depressed mood ($p < 0.00005$). All mean objective sleep characteristics were similar for the breast cancer and comparison groups. Nocturnal awakenings were excessive (9.2 versus 7.3). Mean sleep onset latency was longer for the breast cancer group than for the comparison group (34.8 versus 15.6 minutes). Mean insomnia severity scores for the breast cancer group indicated subthreshold insomnia symptoms, and no clinically significant insomnia for the comparison group (8.9 versus 6.4). Mean daytime sleepiness scores were normal for both groups (7 versus 6).

**Conclusions:** Subjective sleep quality was predicted by depressed mood only. Sleep in the breast cancer group was characterized by poor sleep quality, frequent nocturnal awakenings, and insomnia symptoms.

**Implications for Nursing:** Screening and monitoring in women aged 50 and older with breast cancer may help promote early sleep intervention; however, additional collaborative research regarding the underlying causes of sleep disruption is needed.

Sleep quality often is poor in adult women with breast cancer (Berger et al., 2009; Berger, Farr, Kuhn, Fischer, & Agrawal, 2007; Carpenter et al., 2004). Sleep disturbance also is common (Davidson, MacLean, Brundage, & Schulze, 2002), and may remain problematic throughout breast cancer treatment (Byar, Berger, Bakken, & Cetak, 2006). Objective sleep changes among adult women with breast cancer reportedly include less than average duration of nocturnal sleep time (Ancoli-Israel et al., 2006; Berger et al., 2007; Payne, Piper, Rabinowitz, & Zimmerman, 2006), frequent nocturnal awakenings (Ancoli-Israel et al., 2006; Berger et al., 2007), and increased insomnia symptoms (Bardwell et al., 2008; Haghighat, Akbari, Holakouei, Rahimi, & Montazeri, 2003; Savard, Simard, Blanchet, Ivers, & Morin, 2001). In addition, daytime sleepiness has been found to increase during chemotherapy (Kuo, Chiu, Liao, & Hwang, 2006). A detailed review of these sleep issues and studies regarding women aged 50 years and older has been described elsewhere (Enderlin et al., 2010.)

## Patient Impact

The detrimental impact of poor sleep quality on the daytime symptoms and health-related quality of life of women with breast cancer has been suggested in several studies. Poor subjective sleep quality was significantly associated with poor functional well-being, greater fatigue intensity, greater disruptions in social interactions, and lower positive states of mind in women prior to adjunct therapy for breast cancer (Vargas et al., 2010). Among breast cancer survivors, significant correlates of poor subjective sleep quality included poor physical functioning, depressive symptoms, and distress.

Severity of poor subjective sleep quality in breast cancer survivors was significantly correlated with the presence of noncancer comorbidities (Otte, Carpenter, Russell, Bigatti, & Champion, 2010). Finally, subjective sleep quality was predictive of fatigue in breast cancer survivors (Banthia, Malcarne, Ko, Varni, & Sadler, 2009).

Although sleep studies to date have included older adult women with breast cancer among their sample participants, none have focused solely on their sleep characteristics, despite a predominance of breast cancer cases within this population (American Cancer Society, 2009). Findings of sleep in adult women with breast cancer may not be generalizable to older adult women because sleep in older adults is likely to be influenced not only by cancer and its treatment, but by age-related changes as well (Yancik et al., 2001).

A number of changes in sleep have been associated with increasing comorbidities as well as with advancing age. Sleep quality (perception of sleep as refreshing and adequate for function) has been associated with the number and type of comorbid medical conditions in older adults, and those with major comorbidities (four or more medical conditions) have reported four times the number of sleep problems as those without major comorbidities (National Sleep Foundation, 2003). In particular, comorbid depression has been associated with greater insomnia symptoms (Foley, Ancoli-Israel, Britz, & Walsh, 2004) and reportedly doubles the risk for insomnia in older women (Maggi et al., 1998; Su, Huang, & Chou, 2004).

Numerous changes in objective sleep characteristics, defined in Figure 1, have been associated with advancing age, including an increase in sleep onset latency (Ohayon, Carskadon, Gulleminault, & Vitiello, 2004), wake after sleep onset (Ohayon et al., 2004; Yoon, Kripke, Youngstedt, & Elliott, 2003), and nocturnal arousals (Huang et al., 2002; Park, Matsumoto, Seo, Kang, & Nagashima, 2002). Characteristics that decrease with advancing age include sleep efficiency (Huang et al., 2002; Ohayon et al., 2004), nocturnal sleep time duration (Ohayon et al., 2004; Park et al., 2002), and total sleep time (Huang et al., 2002; Ohayon et al., 2004; Yoon et al., 2003). Day sleep time (napping) increases with advancing age (Huang et al., 2002; Ohayon, Zulley, Guilleminault, Smirne, & Priest, 2001; Park et al., 2002), and longer day sleep duration has been associated with comorbidities and health problems (Ohayon et al., 2004). Suggested ranges of sleep values for older adult women were described in Enderlin et al. (2010).

**Day sleep time:** minutes of sleep during the day (napping)
**Nocturnal awakenings:** number of times awakened during nocturnal sleep
**Nocturnal sleep time:** minutes of sleep during the night, from falling asleep to final awakening
**Sleep efficiency:** percentage of time in bed spent sleeping, while in bed trying to sleep (time asleep/time in bed x 100)
**Sleep percentage:** same as sleep efficiency, but excludes sleep onset latency from time in bed
**Sleep onset latency:** number of minutes taken to fall asleep, from intention to sleep until actual sleep onset
**Total sleep time:** minutes of sleep in a 24-hour period
**Wake after sleep onset:** total minutes awake during the night from sleep onset to final awakening; excludes sleep onset latency

**Figure 1. Definitions of Sleep Characteristics**

Insomnia symptoms (difficulty initiating or maintaining sleep) have been described as present in about 25%–50% of older adult women (National Sleep Foundation, 2003; Ohayon et al., 2001; Roberts, Shema, Kaplan, & Strawbridge, 2000; Schubert et al., 2002). Waking up repeatedly has been reported as the most common symptom (Schubert et al., 2002). However, increased insomnia symptoms have been associated with physical and mental disorders as well as inactivity rather than the aging process alone (Ohayon et al., 2001).

Daytime sleepiness (propensity to fall asleep during the day) has been reported to increase with age despite good nighttime sleep (Reid et al., 2006). Daytime sleepiness also is associated with poor nighttime sleep (Pack et al., 2006), including increased nocturnal arousals with difficulty falling back to sleep (Asplund, 1996), comorbidities (Asplund, 1996; Reid et al., 2006), and medications with sleepiness as a reported side effect (Pack et al., 2006).

In summary, sleep disturbances have been identified in adult women of all ages with breast cancer. Sleep changes also have been associated with increasing comorbidities and advancing age. Therefore, older adult women with breast cancer would appear at high risk for sleep disturbance because of their cancer, increasing comorbidities, and increasing age. Consequently, knowledge of the relationship between age, the number of comorbidities, and symptoms of depression appear integral to gaining greater insight into the subjective sleep quality of women with breast cancer aged 50 years and older. In addition, the characteristics of objective sleep and nature of insomnia symptom severity and daytime sleepiness in this vulnerable population remain to be described.

The purpose and primary aim of the current study was to investigate subjective sleep quality in women aged 50 years and older as predicted by breast cancer or noncancer status, age, number of comorbidities, and symptoms of depressed mood. Secondary aims were to describe and compare objective sleep characteristics, insomnia symptom severity, and daytime sleepiness in women aged 50 years and older with and without nonmetastatic breast cancer. The research hypothesis of the current study related to the primary aim was that a relationship exists at the 0.1 level between subjective quality of sleep and the variables of cancer status, age, number of comorbidities, and symptoms of depressed mood.

This study was underpinned by (but did not attempt to validate) the Conceptual Model of Impaired Sleep (Lee, 2003). This model links impaired sleep to sleep deprivation or disruption, ultimately leading to adverse health outcomes in physiologic, cognitive-behavioral, emotional, and social domains (Lee, 2003).

# Methods

## Sample and Setting

The University of Arkansas for Medical Sciences institutional review board and the Winthrop P. Rockefeller Cancer Research Institute protocol review and monitoring committee approved the study. Informed consent was obtained from all study participants prior to enrollment. Two groups of women, aged 50–90 years, with and without breast cancer comprised the sample. Inclusion criteria for participants with breast cancer were active treatment (chemotherapy or hormone therapy) or being within one year of treatment completion for nonmetastatic breast cancer. English was the primary language of all participants, and exclusion criteria were reported or documented current diagnoses of Parkinson disease, sleep disorders, cognitive impairment, or psychiatric disorders other than depression. Comparison participants without breast cancer had no current diagnosis of any type of cancer.

The experiment-wise error level was set to 0.1 because this study was a preliminary investigation into the impact on sleep quality of breast cancer status, age, number of comorbidities, and depressed mood. The model was a multiple regression with four predictor variables. For a two-tailed regression with an alpha level of 0.1, a total sample size of 70 (35 in each group) yielded an actual power of 0.8 to detect a moderate Cohen f-squared effect size of 0.15 between sleep quality and the four predictor variables (Faul, Erdfelder, Lang, & Buchner, 2007). To adjust for estimated attrition, the planned sample size was increased to 76 or 38 per group.

A convenience sample of participants with breast cancer was recruited from four oncology clinics in four regions of Arkansas through clinic research nurses, posters, or flyers. Thirty-eight women consented to participate in the study out of the 60 potentially eligible participants contacted (63%), and 32 remained after the exclusion of five women because they did not meet the inclusion criteria and the voluntary withdrawal of one participant because of a busy schedule.

A convenience sample of comparison women without breast cancer was recruited by facility staff, posters, or flyers from one ambulatory geriatric clinic, a breast imaging center, two federally funded older adult apartment complexes, one private retirement complex, and community churches. Thirty-eight women agreed to participate in the study out of the 46 potentially eligible comparison participants contacted (83%), and 35 remained after exclusion of three women found to be ineligible because they did not meet the inclusion criteria.

The two groups were combined to comprise a total sample size of 67. The final effect size was $f^2 = 0.16$, slightly larger than estimated for the power analysis, with a final resulting power of 0.81.

## Measures

Multiple instruments were used in the study, including an investigator-developed **demographic data form**, the **Pittsburgh Quality of Sleep Index (PSQI)** (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989), the **Profile of Mood States (POMS)** (McNair & Heuchert, 2005), **wrist actigraphy**, the **Insomnia Severity Index (ISI)** (Morin, 1993), and the **Epworth Sleepiness Scale (ESS)** (Johns, 1991, 1992). Detailed information about the validity and reliability of the standardized instruments and related references is summarized in Table 1.

After giving informed consent, the women participated in two interviews by phone or in person (based on their preference) about one month apart and wore a wrist actigraph in their homes for 72 consecutive hours (during the time between interviews) in addition to recording bedtimes and final awakening times. All data were collected and compiled by the principal investigator.

**Demographic and clinical data form:** Demographic and related clinical information including age, race or ethnicity, primary language, marital status, employment status, income, current coexisting medical diagnoses, current medication use, daily caffeine intake, daily nicotine intake, and recent smoking cessation was obtained through participant interviews. Additional clinical and treatment information, including type and stage of cancer, time since diagnosis, type of treatment (surgery, chemotherapy, radiation, or hormone), and treatment status or time from completion of treatment was obtained through participant interviews and medical records review.

**Pittsburgh Sleep Quality Index:** The PSQI is a questionnaire assessing subjective sleep quality and quantity based on self-report. Composed of 19 items, it provides seven component scores that are rated from 0 (no difficulty) to 3 (severe difficulty) and summed to comprise a total global sleep quality score ranging from 0–21. A cutoff score of more than five is recommended to indicate poor sleep (Buysse et al., 1989) and for maximum sensitivity and specificity for insomnia (Backhaus, Jughanns, Broocks, Riemann, & Hohagen, 2002). The Chronbach alphas for the two PSQI global sleep scores (two interview administrations) in this study were 0.72 and 0.71.

**Profile of Mood States:** POMS assesses health outcomes and includes six rating subscales (65 items) for assessment of mood, including a depression-dejection subscale (15 items). The POMS depression-dejection subscale is designed to evaluate depressive symptoms only and does

## Table 1. Instrument Validity and Reliability Information

| Instrument | Construct Validity | Convergent Validity | Divergent Validity | Reliability |
|---|---|---|---|---|
| Actigraph (Sadeh et al., 1994) | – | Actigraphy demonstrated 85%–95% minute-by-minute agreement with polysomnography in healthy participants. | – | – |
| ESS (Johns, 1991, 1992) | Construct validity was demonstrated through known groups with sleep disorders associated with excessive daytime sleepiness having reported a high (96%) propensity of dozing under circumstances not conducive to sleep in control participants. Individual ESS scores of 16 or higher have been found only in patients with narcolepsy, idiopathic hypersomnia, or obstructive sleep apnea syndrome of at least moderate severity; all scores for participants without sleep disorders were 2–10 (Johns, 1991). | Convergent validity was demonstrated through correlations between the ESS total scores and sleep latency measured by polysomnography ($r_{138} = –0.379$, $p < 0.001$), and Multiple Sleep Latency Test scores ($r_{27} = –0.514$, $p < 0.01$). | Divergent validity was demonstrated through known groups with sleep disorders associated with inability to sleep having reported an inability or slight chance of dozing under circumstances conducive to sleep in 94% of control participants (Johns, 1991). | High internal consistency was demonstrated (Cronbach alpha = 0.88). Temporal reliability was demonstrated through high correlations ($r = 0.82$) in testing and retesting of sleepiness in healthy young adult participants not expected to change in sleep propensity, and through decreased scores in patients with sleep disorders at retesting (Johns, 1992). |
| ISI (Savard et al., 2001) | – | Convergent validity was demonstrated through significant correlations ($p < 0.05$) between items, other sleep measures, and architectural sleep variables (Morin, 1993). | Divergent validity was demonstrated through low correlations between the total ISI score and scores not related to insomnia from a standardized quality-of-life questionnaire. | Based on a validation study with patients with cancer, a Cronbach alpha of 0.91 was obtained for women with breast cancer. Temporal stability was demonstrated through significant correlations between scores obtained at one-, two-, and three-month intervals ($r_{59, 116, 82} = 0.83, 0.77, 0.73$, respectively; all $p < 0.001$) (Morin, 1993). |
| PSQI (Buysse et al., 1989) | Construct validity was demonstrated through known groups. Individuals in the breast cancer group reporting sleep problems and sleep restlessness were found to have significantly higher ($p < 0.001$) global PSQI scores (poorer sleep and more sleep disturbance) compared to those reporting no sleep problems (Carpenter & Andrykowski, 2004). Construct validity was supported through a comparison of global sleep quality scores in two contrasting groups (low and high fatigue) (Beck et al., 2004). | Convergent construct validity for women with breast cancer was demonstrated through moderate-to-high correlations with single- or multi-item sleep quality or problems scales (Carpenter & Andrykowski, 2004). | Discriminant or divergent construct validity was demonstrated through low correlations with unrelated constructs such as nausea. Differentiation between the absence or presence of sleep problems and good or bad sleep quality was demonstrated by scores of less than 5 in groups without sleep problems (Carpenter & Andrykowski, 1998). | The global sleep quality score has a reported Cronbach alpha of 0.8 across groups, including a breast cancer group, and ranges from 0.7–0.78 for the sleep disturbance component, demonstrating internal consistency reliability (Carpenter & Andrykowski, 2004). Evaluations of the PSQI report an overall Cronbach alpha of 0.81 and 0.77, which supports the internal consistency (reliability) of this instrument in cancer populations (Beck et al., 2004). |
| POMS (McNair et al., 1992) | Predictive and construct validities of the POMS were demonstrated through studies of brief psychotherapy and studies of emotion-producing conditions (McNair & Heuchert, 2005). | – | – | The internal consistency reliability of the subscales range from 0.87–0.95, with the highest reported for the depression-dejection subscale. Test-retest (stability) coefficients were reported as 0.74 for the depression-dejection subscale (McNair et al., 1992; McNair & Heuchert, 2005). |

ESS—Epworth Sleepiness Scale; ISI—Insomnia Severity Index; POMS—Profile of Mood States; PSQI—Pittsburgh Sleep Quality Index

not evaluate clinical depression (McNair & Heuchert, 2005). Geriatric normative values have been established, and a negative relationship has been suggested between age and reported distress with significantly lower (6.9 versus 8.5, $p < 0.01$) depression-dejection subscale scores in older adult (median age = 68 years, range 55–94 years) versus younger adult women (median age = 44 years) (Nyenhuis, Yamamota, Luchetta, Terrien, & Parmentier, 1999). The POMS also has been used extensively in cancer research (at least 251 studies), including 57 studies related to breast cancer (McNair, Heuchert, & Shilony, 2003). The recommended cutoff for distinguishing between clinical and nonclinical populations using the POMS is 1.5 standard deviations above the standardization mean (Nyenhuis et al., 1999). The Chronbach alphas for the two POMS total mood scores (two interview administrations) in this study were 0.89 and 0.95.

**Actigraphy:** An actigraph device, similar in appearance to a wristwatch, is worn on the wrist and senses and records physical motion. The absence of motion is considered a proxy of sleep, although sleep cannot be distinguished from inactive wakefulness with this measure. Actigraph signals are processed online and recorded data is transferred to a computer for display and interpretation. These data are then converted to estimated parameters of sleep, although actigraphy does not yield data on actual sleep stages.

Actigraphy was used to objectively measure nocturnal sleep characteristics and is considered an acceptable proxy of sleep efficiency, nocturnal wake episodes, and total sleep time (Lichstein, 2006). Total sleep time, nocturnal sleep time, and day sleep time were determined using actigraphy and patient-reported bedtimes and final morning wake times in a sleep diary maintained during the three days of actigraphy recording. Sleep efficiency was based on the time the participants were presumed to be asleep (essentially motionless) divided by the time they were in bed attempting to sleep, using sleep diary bedtime and wake time recordings multiplied by 100 to obtain a percentage. The time spent awake after the onset of sleep before the final awakening was not included in the time the participant was presumed to be asleep. Sleep percentage was determined in the same way as sleep efficiency, except that sleep onset latency (the amount of time taken to fall asleep after lights out, based on sleep diary recordings) was excluded. Wake after sleep onset was based on the number of minutes of motion detected, and nocturnal awakenings on the number of times motion was detected between the bed time and final wake time noted on the sleep diary recordings. Consequently, the sleep characteristics measured were not totally objective. Sleep onset latency also was measured by actigraphy and is considered a helpful adjunct to sleep assessment (Littner et al., 2003), but is not considered as valid as when determined using polysomnography (Lichstein, 2006).

**Insomnia Severity Index:** The ISI is a Likert-type scale (seven items) that evaluates perceived severity of insomnia over the previous two weeks, rated from 0 (not at all) to 4 (very much). A total ISI score of 28 is possible, with a higher score indicating greater insomnia severity. A cutoff score of eight is recommended, and has been associated with a sensitivity of 95% and a specificity of 47% for patients with sleep difficulty. A cutoff score of 15 has been associated with detecting the majority of patients with insomnia syndrome (Morin, 1993). The Chronbach alphas for the two ISI total scores (two interview administrations) in this study were 0.87 and 0.88.

**Epworth Sleepiness Scale:** The ESS is an eight-item questionnaire that measures daytime sleep propensity in adults during sleep-inducing situations. The total score is based on Likert-type scale ratings of 0 (would never doze) to 3 (high chance of dozing), with a score of 7–8 considered average and a sum of 9 or higher indicating excessive daytime sleepiness. Developed using a sample ranging from 18–78 years, a mean of 5.9 with no difference in total scores between male and female controls has been demonstrated. It should be noted that the ESS is not considered diagnostic of sleep disorders (Johns, 1991). The Chronbach alphas for the two ESS total scores (two interview administrations) in this study were 0.79 and 0.78.

## Data Analysis

All aggregate data were analyzed using Number Cruncher Statistical Systems. Actigraphy data were initialized and downloaded using Act Millennium, version 3.10.11.2, and individual sleep characteristics were analyzed using AW2 Action equipment.

Descriptive statistics, including frequency, mean measure of central tendency, and SD measure of variability were used to describe demographic and clinical characteristics, subjective sleep quality, depressed mood, insomnia severity, and daytime sleepiness in the two groups. The findings from the two telephone interviews were averaged for the final results. Descriptive statistics also were used to describe objective sleep variables (sleep efficiency, sleep percentage, wake after sleep onset, total sleep time, sleep onset latency, nocturnal sleep time, nocturnal awakenings, day sleep time) in the two groups. Findings of the three days of actigraphy recorded between the two telephone interviews also were averaged for the final results.

The percentage of participants in each group who scored above five (indicating poor sleep) on the PSQI global sleep quality score (Buysse et al., 1989) for both groups was calculated. The percentage of participants in each group with a sleep efficiency and a sleep percentage of less than 80% (indicating poor sleep efficiency and sleep percentage), a wake-after-sleep onset greater than 31 minutes, and total sleep times fewer than seven hours by actigraphy also were calculated. In addition, the

percentage of the two groups that had nocturnal sleep times fewer than seven hours, sleep onset latencies greater than 35 minutes, nocturnal awakenings greater than six times, and day sleep times more than 31 minutes and more than two hours were calculated. The percentage of the two groups scoring 8–14 (indicating subthreshold insomnia symptoms), 15–22 (indicating moderate insomnia symptoms), and higher than 22 (severe insomnia symptoms) on the ISI (Morin, 1993) were calculated. Finally, the percentage of the two groups whose scores exceeded the recommended cutoff of eight (indicative of excessive sleepiness requiring medical attention) on the Epworth Sleepiness Scale (Johns, 1991, 1992) was calculated.

All data were prescreened for missing information, outliers, normality, and linearity. Differences between the breast cancer and comparison groups were then analyzed using two sample t tests, the Kolmogorov-Smirnov test or chi-square method, depending on the nature of the data. The significance level was set at 0.01 to account for multiple tests.

# Results

## Sample Description

The mean age of the total sample was 65.08 years (SD = 9.38, range = 50–90 years) and race was predominantly Caucasian (93%). The breast cancer group ($\bar{X}$ = 63.59, SD = 8.18, range = 50–79 years) and comparison group ($\bar{X}$ = 66.43, SD = 10.29, range = 51–90 years) had similar demographic and clinical characteristics (see Table 2).

**Table 2. Demographic Characteristics of Total Sample, Breast Cancer, and Comparison Groups**

| | Total Sample (N = 67) | | Breast Cancer Group (n = 32) | | Comparison Group (n = 35) | | |
|---|---|---|---|---|---|---|---|
| **Characteristic** | **n** | **%** | **n** | **%** | **n** | **%** | **p** |
| **Age (years)** | | | | | | | 0.34 |
| 50–69 | 47 | 70 | 25 | 78 | 22 | 63 | |
| 70–90 | 20 | 30 | 7 | 22 | 13 | 37 | |
| **Race** | | | | | | | 0.92 |
| Caucasian | 62 | 93 | 29 | 91 | 33 | 94 | |
| African American | 5 | 7 | 3 | 9 | 2 | 6 | |
| **Marital status** | | | | | | | 0.19 |
| Married | 31 | 46 | 18 | 56 | 13 | 37 | |
| Single, divorced, widowed | 36 | 54 | 14 | 44 | 22 | 63 | |
| **Employment status** | | | | | | | 0.51 |
| Full-time, on leave, part-time | 29 | 43 | 12 | 38 | 17 | 49 | |
| Retired or retired and disabled | 38 | 57 | 20 | 63 | 18 | 51 | |
| **Annual income ($)[a]** | | | | | | | 0.78 |
| 60,000 or less | 51 | 77 | 23 | 74 | 28 | 80 | |
| More than 60,000 | 15 | 23 | 8 | 26 | 7 | 20 | |

[a] One participant did not answer.

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

The breast cancer group had more comorbidities than the comparison group ($\bar{X}$ = 3.59, SD = 2.31, range 0–9 versus $\bar{X}$ = 2.29, SD = 1.93, range 0–7). The breast cancer group had more chronic lung disease and gastroesophageal reflux, took more antidepressants and benzodiazepines, and drank more caffeinated beverages. The comparison group experienced more fibromyalgia and took more antihypertensives and anticonvulsants. More participants in the breast cancer group drank caffeinated beverages, and few participants in either group were smokers. These comorbidities, medications, and other findings are summarized in Table 3.

Participants in the breast cancer group were diagnosed with breast cancer stages I–III a mean of 18 months previously (SD = 20.39, range 4–96). Eighty-one percent of the breast cancer group had received surgical treatment a mean of 21 months previously (SD = 21.69, range 3–96 months); 59% had finished chemotherapy, whereas 6% currently were receiving chemotherapy; 69% were receiving hormone therapy, whereas 6% had completed hormonal therapy; and 38% had completed postoperative radiation therapy, whereas 3% were currently receiving radiation therapy. Clinical and treatment characteristics of the breast cancer group are summarized in Table 4.

## Predictors of Subjective Sleep Quality

A multiple regression analysis procedure was conducted to determine the accuracy of the independent variables (breast cancer or no cancer status, age, number of comorbidities, and depressed mood) in predicting a participant's subjective sleep quality. These independent variables were included in the multiple regression analysis based on the previously discussed review of the literature. Regression results indicated that, in the model, only depressed mood statistically significantly predicted subjective sleep quality ($R^2 = 0.26$, $F[1, 62] = 25.55$, $p < 0.00005$). In this model, depressed mood accounted for 26% of the variance in subjective sleep quality. Therefore, the research hypothesis that a statistically significant relationship exists at the 0.1 level between subjective sleep quality and depressed mood can be accepted. However, breast cancer status, age, and number of comorbidities did not predict subjective sleep quality. Therefore, the research hypothesis that a statistically significant relationship exists at the 0.1 level between subjective sleep quality and these independent variables must be rejected. These findings are summarized in Table 5.

**Table 3. Sleep-Impairing Comorbidities and Medications**

| Variable | Total Sample (N = 67) n | % | Breast Cancer Group (n = 32) n | % | Comparison Group (n = 35) n | % |
|---|---|---|---|---|---|---|
| **Sleep-impairing medical comorbidities**[a] | | | | | | |
| Congestive heart failure | 1 | 1 | – | – | 1 | 3 |
| Chronic lung disease | 6 | 9 | 5 | 16 | 1 | 3 |
| Gastroesophageal reflux | 16 | 24 | 11 | 34 | 5 | 14 |
| Osteoarthritis and rheumatoid arthritis | 27 | 40 | 13 | 41 | 14 | 40 |
| Fibromyalgia | 3 | 4 | – | – | 3 | 9 |
| Menopausal syndrome | 2 | 3 | 2 | 6 | – | – |
| Depression | 6 | 9 | 4 | 13 | 2 | 6 |
| **Comorbidity categories** | | | | | | |
| Fewer than 4 comorbidities | 42 | 61 | 16 | 50 | 26 | 74 |
| 4–9 comorbidities | 25 | 37 | 16 | 50 | 9 | 26 |
| **Sleep-impairing medications**[a] | | | | | | |
| Antidepressants | 13 | 19 | 9 | 28 | 4 | 11 |
| Opioids | 6 | 9 | 4 | 13 | 2 | 6 |
| Benzodiazepines | 13 | 19 | 10 | 31 | 3 | 9 |
| Antihistamines (sedating) | 8 | 12 | 5 | 16 | 3 | 9 |
| Skeletal muscle relaxants | 7 | 10 | 5 | 16 | 2 | 6 |
| Antipsychotics | 1 | 1 | – | – | 1 | 9 |
| Diuretics | 22 | 33 | 12 | 38 | 10 | 29 |
| Antihypertensives and anticonvulsants | 17 | 25 | 4 | 13 | 13 | 37 |
| **Sleep medications** | | | | | | |
| Taking sleep medication | 23 | 34 | 13 | 41 | 10 | 29 |
| Not taking sleep medication | 44 | 66 | 19 | 59 | 25 | 71 |

[a] Some participants had one or more sleep-impairing medical comorbidity or were taking one or more sleep-impairing medication.

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

Depressed mood means were similar for the breast cancer and comparison groups (54.13 versus 50.51), recommended cutoff greater than 65, and are summarized in Table 6. A larger percentage of the breast cancer group reported depressed mood exceeding the recommended cutoff (19 versus 11), but this difference was not significant based on chi-square analysis.

## Sleep Findings

Mean subjective sleep quality was poor, and similar for the breast cancer and comparison groups (PSQI global sleep score 7.9 versus 6.3; recommended cutoff of 5). Mean sleep characteristics measured by actigraphy remained within or close to expected limits and were similar in both groups for sleep efficiency (90% versus 92%; poor: less than 80%), sleep percentage (87% versus 90%; poor: less than 80%), wake after sleep onset (37.6 minutes versus 32.9 minutes; prolonged: more than 30 minutes), total sleep time (8.9 hours versus 8.9 hours; expected for age: 7–9 hours), nocturnal sleep time (6.8 hours versus 6.9 hours; expected for age: 7.1 hours), and sleep onset latency (34.8 versus 15.6, prolonged: more than 35 minutes). Mean nocturnal awakenings were similar and exceeded the expected findings for both groups ($\bar{X}$ = 9.2 versus 7.3 times per night; expected for age: 2–6 times per night). The most common reasons given for awakenings included getting up to go to the bathroom, arthritic pain, and leg cramps. Mean day sleep time was similar and exceeded the expected findings in both groups (126.7 minutes versus 119.5 minutes; expected for age: less than 31 minutes), although absence of motion may be misinterpreted as sleep by actigraphy. No differences between groups were significant after adjustment for multiple comparisons. Sleep findings are summarized in Table 6.

A larger percentage of the breast cancer group than the comparison group reported poor subjective sleep quality (69% versus 49%). A larger percentage of the breast cancer group than the comparison group demonstrated poor (less than 80%) sleep efficiency (10% versus 6%) and sleep percentage (23% versus 9%), and wake after sleep onset over 35 minutes (43% versus 37%) using actigraphy. A smaller percentage of the breast cancer group than the comparison group had a total sleep time of fewer than seven hours (17% versus 24%) by actigraphy. However, differences between the groups' percentages were not significant based on chi-square analysis.

A larger percentage of the breast cancer group than the comparison group had a sleep onset latency exceeding 35 minutes (43% versus 15%), nocturnal sleep times of fewer than seven hours (53% versus 49%), and more than six nocturnal awakenings per night (57% versus 49%). A slightly smaller percentage of the breast cancer group than the comparison group had day sleep times of more than 31 minutes (87% versus 93%) and more than two hours (37% versus 39%). Again, differences in percentages of groups were not significant based on chi-square analysis.

## Insomnia Symptom Severity

The mean total insomnia severity score for the breast cancer group (8.9, SD = 6.43) exceeded the recommended cutoff score of 7 and was indicative of subthreshold insomnia when matched to the comparison group score (6.4, SD = 5.64) that reflected no clinically significant insomnia. However, differences between the two group means were not significant.

**Table 4. Breast Cancer Group Clinical and Treatment Characteristics**

| Characteristic | $\bar{X}$ | SD | Range |
|---|---|---|---|
| Months since diagnosis (N = 26) | 17.81 | 20.39 | 4–96 |
| Months) since surgery (N = 20) | 21.29 | 21.69 | 3–96 |
| Months) since most recent chemotherapy (N = 20) | 11.36 | 21.16 | 0.03–90 |
| Months since start of hormone therapy | 18.9 | 23.3 | 1–98 |

| Characteristics | n | % |
|---|---|---|
| **Breast cancer stage** | | |
| I | 13 | 41 |
| II | 12 | 38 |
| III | 7 | 22 |
| **Months since diagnosis** | | |
| Less than 12 | 20 | 63 |
| 12–48 | 10 | 31 |
| More than 48 | 2 | 6 |
| **Surgical treatment (N = 26)** | | |
| Presurgery | 6 | 19 |
| Lumpectomy | 13 | 41 |
| Modified radical or simple mastectomy | 13 | 41 |
| **Months since surgery (N = 26)** | | |
| Less than 12 | 13 | 50 |
| 12–48 | 10 | 39 |
| More than 48 | 3 | 12 |
| **Chemotherapy** | | |
| Adjuvant | 12 | 38 |
| Neoadjuvant | 8 | 25 |
| None | 12 | 38 |
| Finished | 19 | 59 |
| Ongoing | 2 | 6 |
| **Months since most recent chemotherapy (N = 20)** | | |
| Less than 12 | 15 | 75 |
| 12–48 | 4 | 20 |
| More than 48 | 1 | 5 |
| **Hormone therapy** | | |
| Ongoing | 22 | 69 |
| Finished | 1 | 3 |
| None | 9 | 28 |
| **Months since start of hormone therapy (N = 21)** | | |
| Less than 12 | 12 | 57 |
| 12–48 | 7 | 33 |
| More than 48 | 2 | 10 |
| **Radiation therapy (postoperative)** | | |
| Ongoing | 1 | 3 |
| Finished | 12 | 38 |
| None | 19 | 59 |

N = 32 unless otherwise noted

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

When broken down by insomnia severity score categories, the breast cancer group reported a greater percentage of moderate and severe insomnia symptoms (19% versus 9%) that correspond to insomnia syndrome (insomnia symptoms with accompanying daytime dysfunction) than the comparison group. This difference between the group percentages was not significant based on chi-square analysis.

### Daytime Sleepiness

Mean daytime sleepiness scores were similar and within expected limits for the breast cancer and comparison groups (7 versus 6; expected for age: less than 9). In addition, both groups had similar percentages that reported a score exceeding the recommended cutoff of 9, which indicates excessive daytime sleepiness requiring medical attention (22% versus 20%). This difference in percentages between groups for daytime sleepiness was not significant based on chi-square analysis.

## Discussion

The breast cancer group in this study reported poor subjective sleep quality at different points in treatment, a finding consistent with previous studies of broader age groups of women (Andrykowski, Curran, & Lightner, 1998; Carpenter et al., 2004; Fortner, Stepanski, Kasprowicz, & Durrence, 2002). The global sleep quality mean score of the breast cancer group in this study was slightly poorer (7.98 versus 7.12) than previously reported (Andrykowski et al., 1998). The percentage of the breast cancer group in this study exceeding the recommended PSQI cutoff score for poor sleep was similar (69 versus 61 and 66) to previously reported findings (Fortner et al., 2004; Liu et al., 2009). Finally, the subjective sleep quality of the breast cancer group in this study did not significantly differ from that of the comparison group, which is consistent with findings of a previous study that suggested that sleep quality in women with breast cancer was similar to that of women with benign breast disorders (Andrykowski et al., 1998).

Similar sleep efficiency (one measure of objective sleep quality) was found to reflect good objective sleep quality in this study using actigraphy, a finding that did not correspond to poorer subjective sleep quality. This finding is consistent with research that reported an apparent lack of correspondence between subjectively and objectively assessed sleep quality in older adult women (Vitiello, Larsen, & Moe, 2004). Although this finding may appear contradictory, the actual time spent asleep in bed may have been adequate but the subjective quality of sleep is diminished because of the frequency of nocturnal awakenings. Sleep efficiency findings in this study also were higher (90% versus 82%) than those previously reported using actigraphy, likely because of the greater number of women actively receiving chemotherapy in that study (Kuo et al., 2006).

The actigraphy findings of this study were similar to those of a previous study of adult women with breast cancer for mean sleep onset latency (34.8 versus 35.1 and 23.1 minutes) and for mean nocturnal sleep (duration) time (6.8 versus 6.6 and 6.5 hours) during the active and recovery phases of chemotherapy treatment (Kuo et al., 2006). Nocturnal awakenings were considerably

fewer but still frequent (9 versus 22 times) in this study compared to a study of women with breast cancer assessed repeatedly over the course of their first three adjuvant chemotherapy cycles (Berger, 1998). Day sleep time appeared excessive for age, but no studies have researched this characteristic in women with breast cancer for comparison.

The presence of insomnia symptoms (subthreshold through severe categories) described in this study was similar to findings reported using an insomnia screening questionnaire ($\bar{X}$ = 53% versus 51%) in Savard et al. (2001), and slightly less than the finding ($\bar{X}$ = 60%) reported in response to a single-item assessment of insomnia in Haghighat et al. (2003). However, the presence of insomnia symptoms in this study was greater than insomnia symptoms ($\bar{X}$ = 53% versus 39%) reported from a secondary analysis of the Women's Healthy Eating and Living Study (Bardwell et al., 2008). Findings of insomnia symptoms indicating moderate-to-severe insomnia that are considered consistent with insomnia syndrome were the same ($\bar{X}$ = 19%) in this and a previous study (Savard et al., 2001) that identified insomnia syndrome based on the Insomnia Interview Schedule–Revised tool (Morin, 1993).

Mean daytime sleepiness in this study was similar to a previous study of women with breast cancer during chemotherapy treatment ($\bar{X}$ = 7 versus 6 [active phase] and 4 [recovery phase]) as assessed by the Epworth Sleepiness Scale (Kuo et al., 2006).

Overall, the findings of this study in women aged 50 and older with nonmetastatic breast cancer were consistent with previous studies that included women of broad age ranges at different points in treatment. Main areas of concern included poor subjective sleep quality, frequent nocturnal awakenings, and insomnia symptoms.

### Limitations

The current study was cross-sectional, which did not provide information about the quality of sleep over time; however, the design was strengthened by including two interviews rather than just one. This study used a convenience sample, which limits the generalizability of its findings because women with extremely poor sleep may not have participated. The sample size in this study was small and was further affected by the number of participants who ultimately failed to meet study criteria; however, the needed sample size was predetermined based on a power analysis, and this study represented a preliminary investigation. Although the breast cancer and comparison groups were not matched, they were relatively balanced for most characteristics, and age was included as a predictor variable in the multiple regression analysis. The status of treatment for breast cancer was variable. The current study was strengthened by the use of subjective and objective methods of sleep quality assessment and of a comparison group.

## Implications for Nursing Practice

The findings of this study underscore the importance of baseline sleep assessment and monitoring in clinical practice. The fact that objective quality of sleep was within normal expected limits despite poor subjective quality of sleep suggests a discrepancy between what is considered acceptable by simple quantitative measurements of sleep and what is perceived as adequate based on patient perception of sleep. In addition, necessary information about sleep quality cannot be obtained through brief questions with dichotomous response options. More in-depth standardized sleep screening tools are needed. One of the reasons sleep has traditionally received limited attention by healthcare providers may be that sleep problems do not emerge in the provider-patient conversation until sleep is severely disturbed. Nurses are in a prime position to assess and monitor subjective sleep quality using a brief standardized instrument such as the PSQI (Buysse et al., 1989) and to collaboratively address problems early in the course of cancer treatment.

The need to investigate further the source of frequent nocturnal awakenings that disrupt sleep in older women with breast cancer also is indicated. For instance, women may be unaware of snoring or gasping during sleep that might alert them to symptoms of obstructive sleep apnea. Following breast surgery, women may find it uncomfortable to sleep on their sides and revert to a supine position that may compromise airway patency during sleep. Preexisting obesity or the development of obesity because of inactivity during treatment may further predispose women to airway obstruction. Because many older adult women have experienced peripheral neuropathy or leg cramps during treatment for breast cancer, they may not recognize

**Table 5. Summary of Multiple Regression Analysis for the Variables Predicting Subjective Sleep Quality**

| Variable | df | $R^2$ | B | SE | β | p |
|---|---|---|---|---|---|---|
| Model* | 4 | 0.3691 | – | – | – | – |
| Breast cancer status | 1 | 0.0092 | 0.0823 | 0.8651 | 0.1029 | 0.3451 |
| Age | 1 | 0.0013 | 0.0162 | 0.0448 | 0.0377 | 0.7192 |
| Number of comorbidities | 1 | 0.0071 | 0.1724 | 0.2056 | 0.0945 | 0.4051 |
| Depressed mood* | 1 | 0.26 | 0.1969 | 0.039 | 0.5413 | – |

N = 67
* $p < 0.00005$
df—degrees of freedom; $R^2$—effect size; SE—standard error

**Table 6. Sleep Quality, Mood, Actigraphy, Insomnia Severity, and Daytime Sleepiness Findings**

| Measure | Breast Cancer Group (N = 32) $\bar{X}$ | Breast Cancer Group (N = 32) SD | Comparison Group (N = 35) $\bar{X}$ | Comparison Group (N = 35) SD | p |
|---|---|---|---|---|---|
| **Pittsburgh Sleep Quality Index** | | | | | |
| Global sleep score | 7.9 | 4.27 | 6.3 | 3.65 | 0.08 |
| **Profile of Mood States** | | | | | |
| Depression subscale t score | 54.13 | 12.25 | 50.51 | 10.01 | 0.52 |
| **Actigraph**[a] | | | | | |
| Sleep onset latency | 34.8 | 30.57 | 15.6 | 18.36 | 0.01 |
| Nocturnal sleep time (minutes) | 406.1 | 80.35 | 414.2 | 63.99 | 0.74 |
| Sleep efficiency (%) | 90.1 | 11.57 | 92.2 | 7.59 | 0.95 |
| Sleep (%) | 86.5 | 10.12 | 89.9 | 8.24 | 0.013 |
| Wake after sleep (minutes) | 37.6 | 33.48 | 32.9 | 33.88 | 0.67 |
| Nocturnal awakenings | 9.2 | 5.44 | 7.3 | 4.66 | 0.64 |
| Day sleep time (minutes) | 126.7 | 119.05 | 119.5 | 97.27 | 0.79 |
| Total sleep time (minutes) | 532.8 | 141.73 | 533.8 | 110.68 | 0.85 |
| **Insomnia Severity Index** | | | | | |
| Total score | 8.9 | 6.43 | 6.4 | 5.64 | 0.09 |
| **Epworth Sleepiness Scale** | 7.16 | 4.95 | 5.57 | 3.82 | 0.55 |

[a] N = 30 for the breast cancer group and 33 for the comparison group

symptoms of restless legs syndrome common in women and often become symptomatic only later in life. The use of some antidepressants may precipitate symptoms of restless leg syndrome, resulting in difficulty maintaining sleep. Hot flashes also may disrupt sleep and may still be experienced by older adult women who have gone through menopause, particularly with hormone therapy. These possible causes of sleep disruption may be screened or symptom information gathered with methods that are not extremely costly or burdensome for the women or the nurses.

A simple instrument like the Epworth Sleepiness Scale[a] (Johns, 1991, 1992) may be used to screen for excessive daytime sleepiness strongly associated with obstructive sleep apnea and restless leg syndrome. Home pulse oximetry might then be considered to detect any oxygen desaturation episodes during sleep associated with obstructive sleep apnea.

A family history revealing restless leg syndrome in a close relative may indicate a higher risk for this disorder, and a medication review could identify whether reported symptoms coincide with starting a particular medication. A sleep diary (Restless Legs Syndrome Foundation, 2007) might be used to collect symptom information. More information about restless leg syndrome can be accessed through the Restless Legs Syndrome Foundation (www.rls.com), including details on the sleep diary (www.whatisrls.org/rls_symptom_diary.html).

[a] More information on the Pittsburgh Sleep Quality Index and the Epworth Sleepiness Scale, as well as tools and videos, can be found at www.ConsultGeriRN.com.

The use of a simple sleep log, a sleep diary, or a standardized diary such as the Pittsburgh Sleep Diary (Monk et al., 1994) could help determine how often other factors, such as hot flashes, are disturbing sleep. Assessment findings can be made available to the healthcare provider for further evaluation, management, or referral.

The presence and severity of insomnia symptoms in older women warrant careful assessment following breast cancer diagnosis, and a routine sleep history at baseline may reveal preexisting insomnia symptoms that may worsen during treatment. Screening for current insomnia symptoms may identify their presence when still below the clinical threshold, before they become severe enough to impair daytime function. Because older adult women are already at risk for functional impairment, and because insomnia can rapidly progress from an acute to a chronic disorder, identifying and managing symptoms before they become severe and resistant to resolution is important. The potential for insomnia also should be considered in all women with symptoms or a diagnosis of depression, which is common in older adult women and in patients with breast cancer, and which may precipitate or exacerbate insomnia symptoms. A short instrument such as the Insomnia Severity Index (Morin, 1993) may be used to screen, rate, and monitor the severity of insomnia symptoms and patient response to management plans.

Additional collaborative research regarding the underlying causes of sleep disruption in older adult women with breast cancer is needed, including investigation of common sleep disorders using standardized sleep measures. Investigation also is required to elucidate the complex interplay between insomnia and depression and to explore nonpharmacologic measures that do not have the counterproductive side effect of daytime sleepiness. Qualitative research regarding the nature of sleep in older adult women with breast cancer may reveal new areas of concern that have not been detected by standard methods.

Nurses can learn more about sleep or specific sleep problems by visiting the American Academy of Sleep Medicine (www.sleepeducation.com and www.aasmmet.org/MedSleep_Resources.aspx) and the National Sleep Foundation (www.sleepfoundation.org). In addition, more information on the management of sleep-wake disturbances in patients with cancer can be accessed by reviewing the Oncology Nursing Society's Putting Evidence Into Practice research at www.ons.org/Research/PEP/Sleep.

Carol A. Enderlin, PhD, RN, is a clinical assistant professor in the College of Nursing and Elizabeth Ann Coleman, PhD, RNP, AOCN®, is a professor and the Elizabeth Stanley Cooper Endowed Oncology Chair in the Colleges of Nursing and Medicine, both at the University of Arkansas for Medical Sciences in Little Rock; Catherine Cole, PhD, RN, ACNS-BC, is an associate professor in the School of Nursing at the University of Kansas in Lawrence; Kathy C. Richards, PhD, RN, FAAN, is a professor in the School of Nursing and director of the Hartford Center for Geriatric Nursing Excellence and Center for Integrative Science in Aging at the University of Pennsylvania in Philadelphia; and Robert L. Kennedy, PhD, is the director of the Office of Research and Scholarship, Julia A. Goodwin, PhD, is a clinical assistant professor in the College of Nursing, Laura F. Hutchins, MD, is a professor and the Virginia Clinton Kelly Endowed Chair for Breast Cancer Research in the College of Medicine, Hematology/Oncology Division, and Karen Mack, BSN, RN, RNP, OCN®, CCRP, is a clinical research nurse in the Medical Oncology Clinic, Winthrop P. Rockefeller Cancer Institute, all at the University of Arkansas for Medical Sciences in Little Rock. No financial relationships to disclose. Enderlin can be reached at caenderlin@uams.edu, with copy to editor at ONFEditor@ons.org. (Submitted April 2009. Accepted for publication September 10, 2010.)

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