

# Sleep Quality in Women with Breast Cancer: an Integrative Review

REVIEW

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## Abstract

**Background:** Sleep disturbances are a chronic and challenging problem in cancer patients, often associated with multiple factors such as depression, anxiety, fatigue and pain.

**Aim:** The purpose of this integrative review is to evaluate the literature on sleep quality in women with breast cancer and the influence that poor sleep quality has on health.

**Methods:** Between 2009 and 2016, a search of PubMed, CINAHL, PsycINFO, Cochrane and Joanna Briggs databases with the descriptors *sleep quality* and *breast cancer* resulted in 27 studies that met the review criteria. The review questions were: How is the sleep quality in women with breast cancer? What health issues are associated with poor sleep quality in women with breast cancer?

**Results:** Findings support the presence of poor sleep quality in many women with breast cancer, before, during and after treatment associated with health issues.

**Conclusions:** Sleep disruptions are associated with breast cancer in woman, and affects their overall health. It is essential for nurses to identify sleep disorders and their impact on the health and quality of life of women with breast cancer. A deeper understanding of sleep quality in women with breast cancer can increase cancer nurses' skill in caring for their patients.

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## Introduction and Background

It is estimated that until 2020, the number of new cases of cancer per year will be about 15 million, of which about 60 % will occur in developing countries. [1] Breast cancer is the second most frequent

## Keywords

Sleep Quality, Breast Cancer, Nursing.

type of cancer in the world, and the most common cancer in women [1]. During 2010, in the United States, over 207,000 women were diagnosed with breast cancer [2].

Sleep disturbances occur in all types of cancer patients, and are associated with multiple factors such as depression, anxiety, treatment (e.g., chemotherapy radiation and surgery), cancer treatment-induced hot flashes, pain, fatigue and changes in biological rhythms [3]. Most studies do not consider whether sleep changes are associated with baseline sleep quality, baseline mental and physical health, demographic and clinical variables. Such associations might lead clinicians to target those at high risk for sleep problems [4].

An important study showed that better sleep efficiency was found to predict a significant reduction in overall mortality [5]. Additional research is needed to determine if beginning treatment of these symptoms before the start of chemotherapy will minimize symptom severity over time [6].

Sleep problems occur in many patients with cancer resulting in sleep deprivation that may affect their immunological status. Sleep deprivation produces a stress reaction in the body, being immunologically best characterized as an increase in leukocyte and neutrophil count, and in serum C-reactive protein rates. An experimental study conducted with healthy subjects showed that a single night of sleep deprivation is sufficient to cause these increases that return to baseline only with ten hours of recovery sleep. Cancer patients experiencing chronic sleep loss may be more vulnerable to these immunological changes because of the obstacles in obtaining sufficient recovery sleep, thus mounting an exacerbated and sustained inflammatory response [7].

Furthermore, Liu et al [8] reports a longitudinal relationship between fatigue, sleep parameters, and inflammation in breast cancer patients. These authors found that changes in reports of sleep quality were significantly associated with a decrease in circulating levels of IL-1RA. Additionally, there are changes in fatigue and sleep quality that were sig-

nificantly associated with an increase in circulating levels of IL-6, and the relationship between sleep quality and IL-6 was likely driven by fatigue.

When sleep disturbances become chronic, nurses need to make recommendations and referrals [9]. Because the sleep disturbances are common among breast cancer survivors, even after completion of active cancer treatment [10].

In a study aimed to associate breast cancer symptoms with sleep quality, [11] researchers found poor sleep quality present in 85% of women. A follow-up of those women, 2 to 7 months after baseline, revealed that 20% of those who reported poor sleep quality had worsening of clinical symptoms and 8% died [11, 7] The recognition that poor sleep quality may represent a prognostic factor in cancer patients should encourage nurses and other health professionals to give special attention to this important aspect of routine life [4, 12]

## Methods

### Review Questions

The purpose of this review is to evaluate the scientific literature on sleep quality in women with breast cancer, and to assist nurses with understanding the potential health effect of poor sleep quality. The review questions are:

- 1) How is the sleep quality in women with breast cancer?
- 2) What health issues are associate with poor sleep quality in women with breast cancer?

### Search Criteria

The population of concern is women (18 years or older), diagnosed with any type of breast cancer, and who are undergoing any treatment. Additional inclusion criteria are full-text articles, published in the last eight years (2009-2016), and in English. The primary outcome measure of interest is sleep quality including sleep, sleep duration, sleep disturbance, insomnia, and circadian-rhythms. This review con-

siders both experimental and epidemiological study designs including randomized controlled trials, non-randomized controlled trials, quasi-experimental, before and after studies, prospective and retrospective cohort studies, case control studies and analytical cross sectional studies.

### Search Strategy

An initial search of PubMed, CINAHL, PsycINFO, Cochrane database of systematic reviews and Joanna Briggs databases was undertaken. The title, abstract, and keywords of the articles were reviewed for relevance to the inclusion criteria. The following combinations of keywords were used in the search; *sleep quality (sleep quality analysis, sleep quality assessment, sleep quality characteristics, sleep quality evaluation, sleep quality disturbance)* and *breast cancer (breast neoplasm, breast cancer symptoms, breast cancer fibroblast, breast cancer experimental)*.

Data collection was performed utilizing an instrument to identify the publication (main authors, year of publication), research purpose, methodological characteristics (design, sample, and instruments), and findings with conclusions on sleep quality and associated health issues.

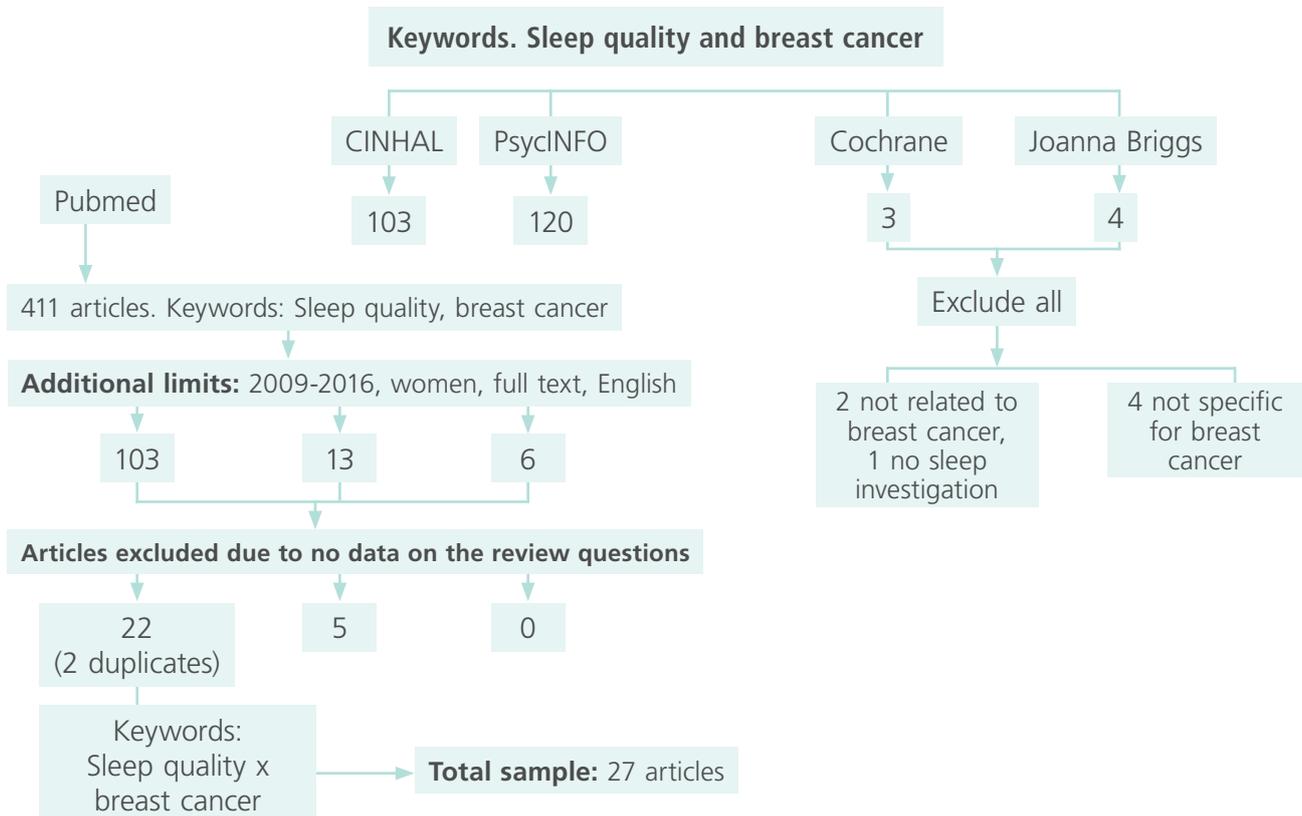
### Results

We selected 27 studies for review from an initial search in which 634 articles were found as outlined in the **Figure 1**.

Of the 634 articles found in the databases searched, we retrieved 27 articles that met the inclusion criteria as outlined in the **Table 1**.

Levels of Evidence by the Joanna Briggs Institute (JBI) Levels of Evidence and Grades of Recommendation Working on **Table 2**. [13].

**Figure 1:** Study selection process and results.



**Table 1.** Summary of Research on Sleep Quality and Associated Health Issues in Women with Breast Cancer.

Authors	Year Research Purpose	Design	Sample	Instruments	Finding / Conclusions on Sleep Quality Associated Health Issues
Berger	(2009) Level 1.a. To determine whether sleep quality and fatigue are associated with breast cancer adjuvant chemotherapy treatments and can be improved with behavioral therapy (BT) including modified stimulus control, modified sleep restriction, relaxation therapy, and sleep hygiene	Randomized-controlled trial based on Piper Integrated Fatigue Model -Longitudinal	219 females stage, I–IIIA breast cancer, -BT participants had an Individualized Sleep Promotion Plan (ISPP), -Controls received healthy eating information (HEC)	Pittsburgh Sleep Quality Index (PSQI) , sleep diary and actigraphy (48 hrs prior to initial treatment, 7 days/nights at each treatment, 7 days/nights 30 days after last treatment), Piper Fatigue Scale (PFS), Symptoms Experience Scale (SES), Hospital Anxiety and Depression Scale, Medical Outcomes Study Short-form General Health Survey	Daily sleep diary and actigraphy data revealed sleep near or within normal limits, except for number of awakenings and longer wake after sleep onset Participants reported mild Fatigue, poor sleep quality, normal anxiety and depression levels and low physical functioning Significant differences over time on all sleep variables obtained by diary and actigraphy [all P< .01] Changes in sleep quality (PSQI) in the groups over time [P = .003] BT group showed improved sleep quality over time on sleep per diary and actigraphy [less awakenings P = .032 and P = .03; higher efficiency P = .027 and total sleep time P = .09] Mean PSQI scores in both groups were greater than 5 but less than 8 at all measurements, reflecting fairly poor sleep quality Peri-and postmenopausal women in the HEC group rated poorer sleep quality than ISPP group Menopausal status when starting chemotherapy was associated with differing patterns of poor sleep and hot flashes over time Difficulty maintaining sleep was evident by higher than normal (2-6) number of awakenings per night (6-12) Mean number of awakenings varied significantly over time P= .04-Minutes awake after sleep onset per night over time varied widely, and was higher than normal values
Banthia	(2009) Level 3.e. To examine age, cancer stage, sleep quality and depressed mood as predictors of five dimensions of fatigue	Cross-sectional	70 fatigued female breast cancer survivors with a minimum of 5 on the Multidimensional Fatigue Symptom Inventory-Short Form (MFSI-SF)	General fatigue scale, MFSI-SF, PSQI, and Center for Epidemiological Studies-Depression Scale (CES-D)	PSQI global score was significantly correlated with the CES-D total score and all MFSI-SF subscales, except mental fatigue Correlations of greatest magnitude were general [.44] and physical [.42] fatigue Simple bivariate relationships of the four predictors (age, cancer stage, CES-D and PSQI) Variables that had coefficients above an absolute value of .33 were interpreted as strong predictors Higher scores on the PSQI predicted membership in the higher fatigue group for general and physical fatigue

Authors	Year Research Purpose	Design	Sample	Instruments	Finding / Conclusions on Sleep Quality Associated Health Issues
Dirksen	(2009). Level 1.b. To determine if breast cancer survivors with insomnia can be grouped according to their level of fatigue	Secondary data analysis of baseline data from a randomized control trial	86 female breast cancer survivors with insomnia	Profile of Mood States Fatigue (POMS F/I), Insomnia Severity Index (ISI), State-Trait Anxiety Inventory (STAI), CES-D	58(68%) had clinically significant insomnia (ISI score >15) 20 (24%) had clinically significant level of depression (CES-D score >16) Significant differences were also noted on anxiety, with the Restored and Tired groups having a significantly lower level of state and trait anxiety compared to the Exhausted group Exhausted group had a significantly higher level of depression in comparison to the Tired and Restored groups
Otte	(2010) Level 3.d. To refine knowledge regarding prevalence, severity, and correlates of sleep-wake disturbances in long-term breast cancer survivors compared to age-matched women without breast cancer (WWC).	Cross-sectional, comparative, case-controlled	246 female breast cancer survivors (BCS) and 246 women without breast cancer (WWC)	RAND Physical Functioning-10 (PF-10), PSQI, CES-D, Concerns about Recurrence Scale (CARS), Impact of Events Scale (IES)	BCS had significantly more prevalent sleep-wake disturbances (65%) compared to WWC (55%) [P <.05] BCS had significantly higher PSQI global scores indicating poorer sleep quality compared to WWC [P <.05] Significant correlates of poor sleep prevalence for BCS included hot flashes, poor physical functioning, depressive symptoms and distress WWC had higher impact of a life event reflected by higher mean scores for the IES P < .05
Thomas	(2009) Level 3.e. To examine changes in sleep and coping as a predictor of sleep during radiation therapy and over a 6- month follow up	Longitudinal	33 women with breast cancer (BC) and 23 men with prostate cancer (PC) Self-reported sleep was assessed at eight time points before, during, and after treatment	Medical Outcomes Study Health Survey (MOS), Sleep Scale (MOS-Sleep), COPE Inventory (COPE-brief), Cancer treatment-related symptoms scales	BC and PC patients reported the most sleep problems prior to and during the early weeks of treatment [P<.05] Significant relationship between depressed mood and sleep latency over time in a regression analysis. On weeks when patients reported more depression, took longer to fall asleep [P=.13]
Beck	(2010) Level 1.b. To characterize sleep quality and quantity prior to and in the first 3 nights after initial chemotherapy for breast cancer	Secondary analysis from two data sets	183 women with breast cancer	PSQI, actigraphy, MOS	65% were poor sleepers, 25.7% had "fairly bad" or "very bad" overall sleep quality on PSQI (Item 6) at baseline 3 nights of actigraphy recorded a wide range of sleep experience with an average of 10 awakenings, first night sleep worst Poor sleep at baseline had significantly lower [P< .001] physical (MOS PCS) and mental (MOS MCS) health status
Garrett	(2011) Level 3.e. To evaluate for differences in the occurrence rates of sleep disturbances and fatigue	Cross-sectional	Women with breast (N =78) and men with prostate (N =82) cancer	PSQI, General Sleep Disturbance Scale (GSDS), Lee Fatigue Scale (LFS), actigraphy	Breast cancer patients reported significantly longer sleep onset latency [P=.02], significantly more sleep disturbances [P <.001], and significantly greater daytime dysfunction [P=.003] Mean PSQI global score was significantly higher in the patients with breast cancer than prostate cancer [P=.08].

Authors	Year Research Purpose	Design	Sample	Instruments	Finding / Conclusions on Sleep Quality Associated Health Issues
Wu	(2011) Level 1.b. To characterize and compare disrupted sleep patterns in fatigued breast cancer patients receiving chemotherapy with postmenopausal women without a history of cancer	Secondary data analysis from two studies	30 fatigued female breast cancer (BC) chemotherapy outpatients and 32 non-cancer postmenopausal women	PSQI and STA	BC patients showed significant sleep difficulties; prolonged sleep onset latency [M= 54.3, SD= 49.2 minutes] and frequent nighttime awakenings, despite 40% of the patients using sleep medications three or more times a week Compared to the non-cancer group, fatigued cancer patients reported significantly longer sleep latency [P=.041], more use of sleep medications [P=.06], and higher total PSQI scores [P=.05] STAI scores did not differ between the two groups [P=.88]
Alfano	(2011) . Level 3.e. To investigate patterns of sleep duration change across the early breast cancer survivorship period, demographic and clinical predictors, and relationships with subsequent cancer-related symptoms and health-related quality of life (HRQOL)	Longitudinal: 6 months post-diagnosis, 30 months post-diagnosis and 39 months post-diagnosis	572 female breast cancer survivors	Modifiable Activity Questionnaire, PFS, Perceived Stress Scale (PSS), CARS, SF-36	-Mean total sleep time about 7 hours at each time point [SD=1,2; range for each 3.5–9] 25% had sleep duration change over time; temporary (5.6%), late-occurring (14%), or sustained (5.9%) Sustained sleep changes were related to greater subsequent severity, affective, and sensory aspects of fatigue [P= all<.01]
Mosher and DuHamel	(2012) Level 3.e- To assess the prevalence of distress among metastatic cancer patients using Distress Thermometer (DT)	Cross-sectional-telephone survey 1 week after DT to assess anxiety, depressive symptoms, sleep problems, and fatigue.	173 female metastatic breast cancer patients	DT, PSQI, CES-D, Hospital Anxiety and Depression Scale, Functional Assessment of Chronic Illness Therapy Fatigue subscale, Karnofsky Performance Status Scale (KPS)	70% had PSQI scores greater than 5 [95% CI=59–79%], indicating significant decrements in sleep quality 60% met the clinical cutoff (4) for probable distress on the DT Younger women had higher levels of anxiety [P<.05], greater medical comorbidities were associated with greater depressive symptoms [P<.05], greater fatigue [P<.05], and poorer sleep quality [P<.05]
Liu	(2012) Level 3.e.To explore the longitudinal relationship between fatigue and sleep measured both subjectively and objectively	Longitudinal	97 women with newly diagnosed stage I-III breast cancer, scheduled to receive at least four 3-week cycles of chemotherapy Data collected at 7 time points: before (baseline) and during the 3 weeks of cycle 1 through cycle 4 chemotherapy (C=cycle and W=week)	PSQI, actigraphy, MFSI-SF	Mean PSQI scores indicated poor sleep quality at all 7 time points At baseline, 61% reported PSQI > 5 and 32% PSQI > 8; at the end of treatment (C4W33), 76% PSQI > 5 and 42% PSQI > 8 Subjective sleep quality was poor at baseline and remained unchanged throughout treatment. There was a significant overall time effect [P<.001] for total sleep time Significant negative correlations between total wake time during the day (WAKE) and MFSI-SF General [P = .03] and Physical [P = .05] subscale scores at C1W1, and significant positive correlation between WAKE and MFSI-SF Vigor subscale scores [P=.04]

Authors	Year Research Purpose	Design	Sample	Instruments	Finding / Conclusions on Sleep Quality Associated Health Issues
Dhruva	(2012) Level 3.e.To examine how actigraphy and self-report ratings of sleep disturbance changed over the course of and following radiation therapy (RT)	Longitudinal	73 women with breast cancer	Actigraphy, GSDS, KPS scale, LFS,CES-D, Spielberg State-Trait Anxiety, Brief Pain Inventory	For actigraphy, 87% had an excessive number of awakenings, 46% had an abnormal Wake After Sleep Onset (WASO), and 58% had Total Seep Time (TST) below healthy adult values More than 85% of the patients had high number of nighttime awakenings Approximately 50% had abnormal WASO and total GSDS scores at the initiation of RT Comorbidity, evening fatigue, and depressive symptoms predicted baseline levels of subjective sleep disturbance, and depressive symptoms predicted the trajectory of subjective sleep disturbance
Girschik	(2013) Levels of Evidence:3.d	population-based case-control study	control: 1695, Case:1133	a self-administered postal questionnaire that contained questions on demographic, reproductive, and lifestyle factors as well as sleep. The domains of sleep investigated were: usual duration of sleep on workdays; usual duration of sleep on nonworkdays; and subjective sleep quality.	no association between self-reported sleep duration on workdays and risk of breast cancer (for <6 hours, odds ratio (OR) = 1.05 (95% CI: 0.82, 1.33); for 6–7 hours, OR = 0.96 (95% CI: 0.80, 1.16); and for >8 hours, OR = 1.10 (95% CI: 0.87, 1.39), compared with the reference category of 7–8 hours' sleep). In addition, we found no association between sleep duration on nonworkdays, subjective sleep quality, or combined duration and quality and risk of breast cancer. This study does not provide evidence to support an association between self-reported sleep duration or quality and the risk of breast cancer.
Aldridge-Gerry	(2013) Levels of Evidence:3.e	observational	Women with metastatic breast câncer MBC (N=103)	3 nights of polysomnography (PSG).	Women with MBC who reported more depressive symptoms had lighter sleep (e.g., stage 1 sleep; P<.05), less slow-wave sleep (SWS) (P<.05), and less rapid eye movement (REM) sleep (P<.05). Single women had less total sleep time (TST) (P<.01), more wake after sleep onset (WASO) (P<.05), worse sleep efficiency (SE) (P<.05), lighter sleep (e.g., stage 1; P<.05), and less REM sleep (P<.05) than married women. Women with MBC and greater symptoms of depression had increased light sleep and reduced SWS and REM,
Liu	(2013) Levels of Evidence:3.e	longitudinal	166 women with newly diagnosed stage I-III breast. Câncer	Medical Outcomes Study-Short Form Physical Component Scale and Mental Component Scale scores. Subjective sleep was assessed with the Pittsburgh Sleep Quality Index (PSQI); objective sleep was measured with actigraphy.	Patients reported poor HRQOL and poor sleep quality before and during chemotherapy. Short sleep time and long naps were recorded at both time points. The Mental Component score was related to reports of poor sleep but not to recorded sleep, worse Physical Component scores were associated with reports of poor sleep and less recorded nap time, suggesting sleep plays an important role in cancer patients' HRQOL.

Authors	Year Research Purpose	Design	Sample	Instruments	Finding / Conclusions on Sleep Quality Associated Health Issues
Tell	(2014) Levels of Evidence:3.e	Longitudinal	Women (N=130,	collected saliva 5x/day/2 days for cortisol; Diaries;Multidimensional Fatigue Symptom Inventory and the Pittsburg Sleep Quality Inventory.	Greater ongoing fatigue (b=0.035, p = .032), or sleep disturbance (b=0.026, p = .006) predicted a slower cortisol decline. Longer sleep latency predicted both a greater cortisol linear decline (b=-0.013, p < .001). Both daily variations in sleep behaviors and ongoing sleep disturbance and fatigue associated with a disrupted cortisol rhythm
Garland	(2014) Levels of Evidence:3.d	case control	70 women with moderate to severe insomnia symptoms and a matched comparison group of 70 women without insomnia symptoms (n = 140).	Insomnia Severity Index (ISI); The Hospital Anxiety and Depression Scale (HADS) ;The Brief Fatigue Inventory (BFI)	Women with significant insomnia symptoms had higher levels of unemployment compared to women without insomnia. TL (telomere length) was positively skewed and shorter in the insomnia group. Women with insomnia also reported significantly higher levels of depression ( p < 0.001), anxiety ( p < 0.001), and fatigue ( p < 0.001).
Mao	(2014) Levels of Evidence:1.a	randomized Trial	67 randomly assigned patients, of an eight-week course of electro-acupuncture (EA) as compared to waitlist control (WLC) and sham acupuncture (SA) in postmenopausal women with breast cancer	Brief Fatigue Inventory (BFI), Pittsburgh Sleep Quality Index (PSQI), and Hospital Anxiety and Depression Scale (HADS).	baseline pain interference was associated with fatigue (Pearson correlation coefficient r =0.75, p<0.001), sleep disturbance (r=0.38, p=0.0026), and depression (r= 0.58, p<0.001). Compared to the WLC, EA produced significant improvement in fatigue (p=0.0095), anxiety (p=0.044), and depression (p=0.015) Compared to usual care, EA produced significant improvement in fatigue, anxiety, and depression, whereas SA improved only depression in women experiencing AI-related arthralgia.
Palesh	(2014) Levels of Evidence:3.e	Longitudinal	among 97 women.	wrist-worn actigraphy and sleep diaries for 3 days	better sleep efficiency was found to predict a significant reduction in overall mortality (hazard ratio [HR], 0.96; 95% confidence interval [CI], 0.94–0.98; P < 0.001) at median 6 y follow-up. This relationship remained significant (HR, 0.94; 95% CI, 0.91–0.97; P < 0.001) even after adjusting for other known prognostic factors (age, estrogen receptor status, cancer treatment, metastatic spread, cortisol levels, and depression). These findings show that better sleep efficiency and less sleep disruption are significant independent prognostic factors in women with advanced breast cancer. Further research is needed

Authors	Year Research Purpose	Design	Sample	Instruments	Finding / Conclusions on Sleep Quality Associated Health Issues
Ancoli-Israel	(2014) Levels of Evidence:3.e	Longitudinal	Sixty-eight women with stage I-III breast cancer (BC) scheduled to receive $\geq 4$ cycles of chemotherapy	actigraphy (nocturnal total sleep time [nocturnal TST] and daytime total nap time [NAPTIME]) and with the Pittsburgh Sleep Quality Index (PSQI); fatigue with the Multidimensional Fatigue Symptom Inventory-Short Form (MFSI-SF); depression with the Center of Epidemiological Studies-Depression (CES-D). CARs were derived from actigraphy.	Compared to NC, BC had longer NAPTIME, worse sleep quality, more fatigue, more depressive symptoms, more disrupted CARs and worse QoL at Baseline Cycle-4, BC showed worse sleep, increased fatigue, more depressive symptoms, and more disrupted CARs compared to their own Baseline levels and to NC (all $p$ 's $<0.05$ ). By 1-year, BC's fatigue, depressive symptoms and QoL returned to Baseline levels but were still worse than those of NC, while NAPTIME and CARs did not differ from NC's Additional research is needed to determine if beginning treatment of these symptoms before the start of chemotherapy will minimize symptom severity over time.
Chen	(2014) Levels of Evidence:1.a	randomized, placebo-controlled trial	95 postmenopausal women with a prior history of stage 0-III breast cancer	Pittsburgh Sleep Quality Index (PSQI), Depression (CES-D), and the North Central Cancer TreatmentGroup (NCCTG) hot flash diary,	At baseline, 52% of participants reported poor sleep in the month prior to enrollment. Compared to subjects on placebo, subjects randomized to melatonin experienced significantly greater improvements in subjective sleep quality as measured by the PSQI, including domains on sleep quality, daytime dysfunction and total score. Sleep disturbances are common among breast cancer survivors, even after completion of active cancer treatment. This is the first randomized placebo-controlled study among breast cancer survivors to demonstrate that melatonin was associated with an improvement in subjective sleep quality, without any significant adverse effects.
Ratcliff	(2014) Levels of Evidence:3.e	longitudinal	Twenty women undergoing CT for breast cancer	Pittsburgh Sleep Quality Index (PSQI) and mood three times daily (morning, afternoon, and evening) via ecological momentary assessments (EMAs) using automated handheld computers.	The results showed that disturbed sleep (PSQI score $\geq 5$ ) prior to CT infusion was associated with greater fatigue, and more negative and anxious mood throughout the 3 week CT cycle, and good pre-CT infusion sleep (PSQI score $< 5$ ) buffered anxious mood in the first days following infusion. No evening symptom or mood ratings were related to subsequent sleep quality. These findings suggest that disturbed sleep before and after a CT infusion exacerbates fatigue, and negative, anxious, and drowsy mood during a CT cycle. Reducing sleep disturbance may be an important way to improve quality of life during chemotherapy.

Authors	Year Research Purpose	Design	Sample	Instruments	Finding / Conclusions on Sleep Quality Associated Health Issues
Vargas	(2014) Levels of Evidence:1.	intervention Trial	Patients were randomized to CBSM (n = 120) or a one-day psychoeducation control group (n = 120).	Pittsburgh Sleep Quality Index (PSQI) and Fatigue Symptom Inventory were completed prior to randomization and 6 and 12 months after the baseline assignment	In latent growth analyses, women in CBSM reported greater improvements in PSQI sleep quality scores than controls, although there were no significant differences between conditions on PSQI total scores. Future work may consider integrating sleep and fatigue content into stress management interventions for women with early-stage breast cancer.
Roscoe	(2014) Levels of Evidence:1*	randomized trial	96 cancer survivors	Insomnia Severity Index and sleep quality by the Pittsburgh Sleep Quality Inventory; sleep hygiene instructions.	Analyses controlling for baseline differences showed that both the CBT-I (cognitive behavioral therapy for insomnia ) plus A (P _ .001) and CBT-I plus P (P _ .010) groups had significantly greater reductions in insomnia. CBT-I results in significant and durable improvements in insomnia and sleep quality
Rogers	(2015) Levels of Evidence:1.a	Pilot randomized controlled trial	Forty-six postmenopausal BCS ( $\leq$ Stage II, off primary treatment) were randomized to a 3-month exercise intervention or control group.	PSQI and PROMIS®, objective sleep quality (accelerometer), serum cytokines, accelerometer physical activity, cardiorespiratory fitness, body composition, fatigue, and psychosocial factors.	When compared with control, the intervention group demonstrated a significant increase in PSQI sleep duration (i.e., fewer hours of sleep/night) (d=0.73, p=.03). Medium to large but non-significant standardized effect sizes were noted for PSQI daytime somnolence (d=-0.63, p=.05) and accelerometer latency (d=-0.49, p=.14). Inflammation and psychosocial factors may mediate or enhance sleep response to our exercise intervention. Further study is warranted to confirm our results
Lengacher	(2015) Levels of Evidence: 1.a	randomized controlled	Seventy-nine BCS participants	sleep diaries and the Pittsburg Sleep Quality Index (PSQI)) and objective sleep parameters (OSP) (i.e., actigraphy) were measured at baseline, six weeks and 12 weeks after completing the MBSR(BC) or UC program.	Results showed indications of a positive effect of MBSR(BC) on OSP at 12 weeks on sleep efficiency. These data suggest that MBSR(BC) may be an efficacious treatment to improve objective and subjective sleep parameters in BCS.

\* Levels of Evidence is developed by the Joanna Briggs Institute Levels of Evidence and Grades of Recommendation Working Party October 2013 [13].

**Table 2.** Levels Of Evidence For Effectiveness BY JBI.

Level 3	
Observational	Analytic Designs
a	Systematic review of comparable cohort studies
b	Systematic review of comparable cohort and other lower study designs
c	Cohort study with control group
d	Case – controlled study
e	Observational study without a control group
Level 1	
Observational	Analytic Designs
a	Randomized Controlled Trials (RCTs)
b	RCTs and other study designs
c	RCT
d	Pseudo-RCTs

### Characteristics of the Studies

A variety of journals has published articles on sleep quality in breast cancer patients over the last years. The largest number of articles was found in the *Psycho-Oncology Journal* and in the *Journal of Pain Symptom Management*, with 3 articles each. There were articles published in several international oncology journals such as the *European Journal of Oncology Nursing* and *Cancer Nursing*, as well as in more general publications such as *Psychology and Health*. Regarding the year of publication, 5 articles were published in 2009, 2 in 2010, 3 in 2011, 4 in 2012, 2 in 2013, 8 in 2014 and 3 in 2015.

Nurse investigators, including five PhD prepared lead authors, contributed to a majority of the studies. The participation of undergraduate nursing students is noted in 2 articles [14, 15]. Inter-professional collaboration in researches is important, and this was evident in the majority of these articles with contributions from medicine, nursing, and psychology.

All studies in this review utilized a quantitative methodology, with 13 cross-sectional studies and 20 longitudinal studies. We emphasize the impor-

tance of longitudinal studies because analyzing the patient in 2 or more stages of treatment and documenting the difference in quality of sleep, may be helpful to nurses in managing their patients care. Nine articles reported randomized clinical trials [8, 10, 16-21] and 3 were a secondary analysis [4, 22-23].

In the studies selected for this review, the most common instrument used for data collection was the Pittsburgh Sleep Quality Index (PSQI) in 9 studies [2-4, 6, 9, 10, 14-17, 19-22, 24, 25], followed by actigraphy in 7 studies [6, 17, 18, 22, 25-27], sleep diaries in 6 studies [6, 17, 18, 22, 25-27] and general questions in 1 study [15].

### How Is the Sleep Quality in Women with Breast Cancer?

All 27 studies in this review found a significant level of sleep disturbance in women with breast cancer at various stages in their treatment. A summary of the findings is in **Table 1**.

Studies using the PSQI documented poor sleep quality for 65% to 70% of the participants [4, 28] and, actigraphy verified that up to 87% of the sample had an excessive number of awakenings. Moreover, sleep diary records identified that difficulty maintaining sleep was evident by the higher than normal (2-6) number of awakenings per night (6-12) [27].

Common sleep-time complaints noted in all of these studies is time spent in bed without sleeping, difficulty returning to sleep, decreased nocturnal sleep duration, increased sleep latency and waking earlier than desired. Additionally, the associated wake-time symptoms of sleepiness, fatigue, increased naps, cognitive impairment, and performance are also prevalent.

Mosher and Duhamel report that 70% of the patients completing the PSQI had scores greater than the cutoff point of five, indicating significant decrements in sleep quality [28]. In a longitudinal study, more than 85% of the patients had a high number of nighttime awakenings [16]. When comparing wo-

men with cancer-related fatigue and postmenopausal women without cancer, the authors found that breast cancer patients showed significantly more sleep difficulties [27]. These sleep problems were characterized by prolonged sleep onset latency ( $M=54.3$ ,  $SD=49.2$  minutes) and frequent nighttime awakenings, despite 40% of the patients using sleep medications three or more times a week [16]. Greater ongoing fatigue or sleep disturbance predicted a slower cortisol decline, and longer sleep latency predicted both a greater cortisol linear decline and slower cortisol decline [9].

Several studies elucidate how the sleep quality changed during cancer treatments such as chemotherapy or radiotherapy. Considering the PSQI score  $>5$  that represents poor quality sleep, [29] found that 65% of women self-reported poor sleep in the month preceding chemotherapy. Subjective sleep quality was poor at baseline and remained unchanged throughout treatment [3]. Half of the survivors reported no sleep duration change over time; however, 25% reported sleep changes indicating a temporary (5.6%), late-occurring (14%), or sustained (5.9%) change [15]. Patients reported poor quality of life and poor sleep quality before and during chemotherapy with short sleep time and long naps recorded at both time points [26].

Prior to chemotherapy, participants' related mild fatigue, and poor sleep quality; after an intervention using behavior therapy, they perceived increased sleep quality [27]. On Cycle-4 chemotherapy, the breast cancer patients showed worse sleep, increased fatigue and more depressive symptoms, compared to their baseline levels [6].

A study suggests that disturbed sleep before and after a chemotherapy infusion exacerbates fatigue and anxiety [30]. Authors concluded that reducing sleep disturbance may be an important way to improve quality of life during chemotherapy [30].

Other studies reported using an intervention and the authors concluded that future work might

consider integrating sleep and fatigue content into stress management interventions for women with early-stage breast cancer [20]. Compared to usual care, electro acupuncture produced significant improvement in fatigue, anxiety and depression [21]. The cognitive behavioral therapy for insomnia was used and showed durable improvements in insomnia and sleep quality [19].

A few researchers compare the sleep quality in those with breast cancer to other types of cancer. For instance, 2 articles compare women with breast cancer (BC) and men with prostate cancer (PC). Both BC and PC patients report the most sleep problems prior to and during chemotherapy. [14] The occurrence rates for sleep disturbance and fatigue were significantly higher in patients with breast cancer as compared to prostate cancer [2].

Future work may consider integrating sleep and fatigue content into stress management interventions for women with early-stage breast cancer [20].

### What Health Issues Are Associated with Poor Quality Sleep in Women with Breast Cancer?

Poor sleep quality is reported in all 27 studies and is associated with several health issues such as severe fatigue, depression, anxiety, hot flashes, pain, and generally poorer quality of life. A significant relationship between fatigue and sleep disturbances was found in 3 studies [2, 3, 9, 2, 3, 28, 30] and higher scores on the PSQI predicted membership in the higher fatigue group for general and physical fatigue. [31]

Participants with breast cancer self-reported significantly higher levels of sleep disturbance ( $P=.008$ ) and fatigue ( $P=.005$ ) than patients with prostate cancer [2]. Fatigue was significantly associated with subjective reports of poor sleep and objective measures of daytime sleepiness; however, not with nocturnal sleep as measured by actigraphy [3]. Additionally, there is a high prevalence of distress, sleep problems, and fatigue across demographic

and medical subgroups of metastatic breast cancer patients [28].

The relationship between fatigue and sleep has been reported in other studies [12, 32]. Fatigue was significantly correlated with subjective and objective measures of sleep in women with breast cancer [8]. Women with insomnia also reported significantly higher levels of depression, anxiety and fatigue [33].

Studies identify a significant relationship between sleep quality and mental health disorders including depression and anxiety [21, 22, 24-25, 34]. One group of researchers that investigated if breast cancer survivors (BCS) with insomnia can be grouped according to their level of fatigue discovered significant differences in insomnia severity, anxiety, depression, and quality of life among the subgroups of exhausted, tired and restored [22]. A study of prevalence, severity, and correlates of sleep-wake disturbances compares long-term breast cancer survivors (BCS) to age-matched women without breast cancer (WWC) and finds significant correlates of prevalence with poor sleep for BCS including hot flashes, poor physical functioning, depressive symptoms and distress [24].

The authors identify that comorbidity, evening fatigue, and depressive symptoms predicted baseline levels of subjective sleep disturbance, and that depressive symptoms predicted the trajectory of subjective sleep disturbance [25]. Worse Physical Component scores were associated with reports of poor sleep and less recorded nap time, suggesting sleep plays an important role in cancer patients' quality of life [8].

## Discussion

Our review findings expose the overlooked disorders of sleep in women with breast cancer and the associations with cancer-related fatigue (CRF), depression and other important health issues. Furthermore, these 27 studies consistently document the high prevalence of poor sleep quality and decrease

in quality-of-life. To begin to address this important patient care issue, we recommend use of tools like the PSQI, actigraphy and sleep diary for identification and assessment of sleep quality in women with breast cancer.

Comparisons between women with and without cancer revealed that breast cancer survivors had significantly higher PSQI global scores, indicating poorer sleep quality, as compared to women without breast cancer [24]. Another study comparing 30 fatigued female breast cancer chemotherapy outpatients and 32 non-cancer postmenopausal fatigued patients found a significantly longer sleep latency in the breast cancer group. Forty-seven percent of CRF patients expressed "severe difficulty" with sleep latency, while 25% of postmenopausal women were in this category [16]. Additionally, women's menopausal status when starting chemotherapy was associated with differing patterns of sleep and hot flashes over time [4].

The grouping or "clustering" of cancer-related symptoms has been highlighted in recent reports as an important priority for nursing research. Greater knowledge is needed regarding the interaction of multiple symptoms and their potential impact on cancer patient outcomes if advances are to be realized in caring for persons diagnosed with cancer. The studies in this review inform health care professionals to proactively assess for the continued presence of multiple symptoms once treatment has ended, with an understanding that a single, intense symptom rarely occurs. Moreover, the focus of care should target the symptom interactions, and their association with quality of life. Those caring for cancer patients need to overcome the outdated practice of managing pain, fatigue, depression or poor sleep quality as isolated symptoms by concurrently assessing and managing these related health problems [12, 22]. Tools such as PSQI, actigraphy and sleep diary can assist health professionals to assess the sleep quality of their female breast cancer patients.

The PSQI is a patient questionnaire designed to evaluate the subjective sleep quality and disturbances that have been present during the past month. This questionnaire, which has been validated in several countries and languages, contains 19 items that can be self-administered or employed in an interview, and 5 questions to be answered by roommates. The latter 5 questions are used only for information and are not scored. The 19 questions are grouped into seven sleep-related components comprising quality, latency, duration, efficiency, disturbances, use of sleeping medication, and daytime sleepiness. The score of each component ranges from zero to three points. The overall score is obtained with the sum of components, ranging from zero to 21 points. The higher the value obtained, the poorer sleep quality with the overall score of five points as the cut off for distinguishing between poor sleep quality (higher than five points) from good sleep quality (five points or less) [29].

Actigraphy is a technique for recording a persons' sleep-wake pattern through recording of limb movements for a 24-hour cycle. This device is placed on the wrist of the non-dominant limb and detects motion, thus recording rest and activity. It provides data for interpretation in order to infer the presence of sleep or wakefulness. Frequent movements are interpreted as wakefulness, and low movements as sleep. It provides data on total sleep time, total time awake, number of awakenings, and sleep latency [35,36]. This objective measure records sleep and awake patterns. This tool is helpful to the health care professional as an adjunct to the PSQI and sleep diary; although, not commonly found in use outside of a sleep disorders center.

Another means of assessing sleep patterns and sleep quality is a sleep diary, which is often used with actigraphy. This diary is usually completed for 14 days by the patient to document sleep patterns, subjective sleep of quality and behaviors affecting sleep [8]. documented that this tool could be used

to obtain reliable data about home sleep/wake patterns in women undergoing chemotherapy for breast cancer.

Studies in this review consistently found that poor sleep quality is experienced by female breast cancer patients. Nurses assess the responses that patients have to disease in order to select and implement interventions to improve their quality of life. Because poor sleep quality is a frequent complaint of women with breast cancer and decreases their quality of life, it is essential to routinely assess for sleep disruptions and intervene. The nurses' evaluation of sleep quality should include the associated symptoms discovered in these studies that may be clustered with pain, fatigue, depression and others. And just one base population study was found on this study, it is necessary more future studies [37].

The sleep disturbances often become chronic and nurses need to make recommendations and to treat them because sleep disturbances are common among breast cancer survivors, even after completion of active cancer treatment, we need to be proactive to avoid the worst problems after treatment [10].

Interventions studies are very important and authors concluded MBSR may be an efficacious treatment to improve objective and subjective sleep parameters in breast cancer patients [17]. In another study, when compared with controls, the intervention group demonstrated a significant increase in sleep duration with MBSR [18].

However, it is important to note that often the poor quality of sleep gets little attention from patients, who regard it as a "normal" consequence of the treatment. Despite the latest knowledge on this topic, many health care professionals do not identify and treat their patients' sleep problems. If untreated, many sleep disorders can become chronic health problems in patients with cancer, persisting after treatment of the disease. Furthermore, attention should be paid to the importance of

quality-of-life that has been frequently explored in the literature and encompasses sleep.

### Limitations

There is a possibility that relevant articles were missed by this review. Future reviews are necessary to expand knowledge about the relationships between sleep quality, fatigue, depression, and pain in women with breast cancer.

### Implications for Practice

An important aspect of nursing care for breast cancer patients is assessment for associated health problems, which includes sleep quality. We recommend the use of validated screening tools such as the PSQI and sleep diary to assess for sleep disturbances. This assessment should be done at several key points in the cancer care process including the initial encounter prior to diagnosis, at diagnosis, during treatment, at the end of treatment, and at follow-up.

Furthermore, we recommend that nurses increase their knowledge of normal and abnormal sleep to better assess for disorders, counsel their patients, and refer for further evaluation and management. Through regular assessment of sleep quality, nurses can promote additional improvements in the quality-of-life for cancer patients.

### Conclusions

This review is relevant in view of the increased incidence of breast cancer and the high prevalence of sleep disorders. Assessing and identifying sleep problems in cancer patients should be a priority, as the disease is debilitating, and compromised sleep quality may further decrease functional ability. The negative effects of poor sleep quality can exacerbate other cancer-related symptoms and persist long after the end of treatment. We recommend that researchers focusing on breast cancer care should study the effectiveness of interventions that target

the symptom cluster of poor sleep quality, pain, fatigue, and depression to decrease the burden of this devastating disease.

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