Published in final edited form as:

Cancer Nurs. 2009 ; 32(2): 90–106. doi:10.1097/01.NCC.0000339261.06442.7d.

Theories, Models, and Frameworks Related to Sleep-Wake Disturbances in the Context of Cancer

Julie L. Otte, PhD, RN and Janet S. Carpenter, PhD, RN

Authors' Affiliation: Indiana University School of Nursing, Indianapolis

Abstract

The purpose of this article was to review theories, models, and frameworks of sleep disturbances referenced in the cancer literature. Sleep-wake disturbances in cancer are a significant problem that negatively affects quality of life. There is no previously published review of the theories, models, or frameworks used to study sleep-wake disturbances in the context of cancer. Describing existing theories or models and their application in cancer is important to advance knowledge in this area. Two theories and 9 models were identified for review. These have been used to further understand the problem of sleep-wake disturbances as a primary or secondary symptom within the cancer literature. Searches were conducted from January 1, 1970, to July 31, 2008, to find relevant articles using 4 electronic databases: MEDLINE, CINAHL, PubMed, and PsychINFO. On the basis of the search, 73 descriptive or intervention studies were identified and reviewed. Most research was atheoretical, with no identified theory, model, or framework. In studies that did use theory or models, few were applied in more than one study. Although several commonalities across models did emerge, a more comprehensive and widely used model could help guide nursing research to facilitate effective symptom management for this prominent problem in cancer.

Keywords

Cancer; Framework; Model; Sleep-wake disturbances; Theory

Sleep-wake disturbances in the context of cancer are increasingly being recognized as a significant problem.^{1–3} Sleep has been characterized as a psychobiological event that includes physiological, psychological, and behavioral mechanisms.⁴ Sleep-wake disturbances have been defined as disruptions in nighttime sleep or wakefulness that can result in negative health outcomes.⁴ In various American and Canadian samples, 18% to 90% of cancer patients and survivors reported subjective sleep-wake disturbances.^{2,3,5–9} Subjectively reported sleep-wake disturbances can include a variety of diagnosable sleep-wake problems such as insomnia, restless leg syndrome, periodic limb movement disorder, obstructive sleep apnea, or daytime sleepiness. Of these, insomnia (difficulty falling asleep, staying asleep, or early awakening) is commonly reported among cancer patients and survivors.¹⁰ Sleep-wake disturbances are important to address because, if left untreated, they can negatively effect quality of life.^{9,11–13}

A number of descriptive and intervention studies have targeted sleep-wake disturbances in various cancer populations,^{2,14,15} and there are extensive published reviews of the physiology, measurement, and terminology of sleep-wake disturbances in cancer.^{10,16–19} One common limitation noted within this literature has been the lack of conceptual clarity,

in-part due to the inconsistent use or lack of disclosure of guiding theories, models, or frameworks.^{17,19} To the best of our knowledge, a review article describing the theory, models, or frameworks used to guide research in this area has not been previously published.

The purpose of this article was to review theories, models, or frameworks applied to the problem of sleep-wake disturbances in the context of cancer. The main goals of this review were to (1) quantify, summarize, and compare the number of studies with and without explicitly described theories, models, or frameworks and (2) summarize and compare the theories, models, and frameworks that were used.

This review was important because theoretically grounded research advances science for evidence-based nursing research. One could question whether it is more important to base research on a theory, model, or framework or to have clear and consistent variable names, definitions, and measurement of sleep. We argue the former. Theories, models, or frameworks are important because they provide direction for research designs, assessment tools, and intervention development for effective symptom management. Typically, authors list the theories, models, or frameworks that specify interrelationships of critical attributes of concepts related to a problem. These critical attributes then link research findings to a body of knowledge that can be used by healthcare professionals for symptom management.²⁰ Therefore, it is through the use of the underlying theories, models, and frameworks that we better understand the definitions and measurement of certain research phenomena.

In nursing, the terms *theory*, *model*, and *framework* are often used interchangeably. By definition, a theory provides systematic explanations about relationships among phenomena, whereas a concept is based on observed characteristics or behaviors such as sleep.²⁰ A theory generally includes relational statements that are useful for explanation, description, prediction, control, or prescription based on definitions of the underlying concepts.²¹ A model is a symbolic representation of relationships among variables or concepts.²⁰ A framework is often the illustration that describes the conceptual underpinnings of the research and can be based on a theory or, more specifically, on a concept (such as sleep-wake disturbances).^{20,21}

Methods

Data Sources

Searches were conducted to find relevant articles. Using MEDLINE, CINAHL, PubMed, and PsychINFO search engines (n = 4), citations from January 1, 1970, to July 31, 2008, were reviewed. Search terms used alone and in combination included the following: *sleep*, *wake*, *disturbance*, *impaired sleep*, *insomnia*, *theoretical*, *conceptual*, *model*, *framework*, *adult*, *cancer*, and *survivor*. We identified articles that included cancer patients undergoing treatment and cancer survivors (had completed treatment). Because these search terms resulted in more than 500 possible publications, articles were excluded from the review if they (1) were drug interventions, (2) focused on pediatric cancer or caregivers of cancer patients, (3) were instrument or questionnaire validation studies, (4) focused on statistical modeling of sleep-wake disturbances, (5) were letters to the editor or single case reports, or (6) reported sleep and wake as an incidental finding.

Procedures

On the basis of the above, 73 studies were identified and reviewed. We quantified the number of studies with and without an explicitly stated a theory, model, or framework to clearly define these subsets of the studies and avoid assumptions of vague descriptions of theoretical underpinnings. We then summarized studies based on these criteria: (1) discipline of authors; (2) type of study; (3) sample information including (a) cancer

diagnosis, (b) cancer stage, and (c) treatment status; (4) study variables; and (5) measures of sleep-wake. We then used χ^2 tests to compare these criteria between studies with and without a theory, model, or framework.

Next, we evaluated whether sleep was a primary or secondary variable within each theory, model, or framework. We developed a written summary of each theory, model, or framework and identified and compared their key attributes.

Results

Quantification, Summary, and Comparison of Studies With and Without Explicitly Described Theories, Models, or Frameworks

Of the 73 studies, 51 (70%) did not contain a reported theory, model, or framework.^{3,5,7,9,11,14,22–66} These studies were considered atheoretical because there was no explicit description of a theory, model, or framework that had guided the study. These 51 studies are listed alphabetically in Table 1. The remaining 22 (30%) articles included a description of a theory, model, or framework that guided the study.^{1,2,6,12,15,67–82} These 22 studies are listed alphabetically in Table 2. Tables 1 and 2 provide a general summary of all studies based on our review criteria.

Comparisons between the 51 atheoretical and 22 theoretically based studies are provided in Table 3. χ^2 Tests of differences indicated that studies that included a theory, model, or framework were significantly (1) more likely to include authors from the discipline of nursing and (2) less likely to have included wrist actigraphy as an outcome measure.

Summary and Comparison of Theories, Models, and Frameworks

Table 4 contains a summary and comparison of theories, models, and frameworks. There were 2 nursing theories^{83,84} and 9 different conceptual models.^{67,71,72,85–93} Three conceptual models focused on sleep-wake disturbances as a primary variable of interest. Two theories and 6 additional models included sleep-wake disturbances as one of several variables. These 8 latter theories/models tended to include sleep-wake disturbances as a secondary variable or as one variable within a cluster of several symptoms (eg, pain, fatigue, and sleep-wake disturbances). A description of each theory and model follows, starting with ones that included sleep wake disturbances as a primary variable and concluding with those that included it as a secondary variable.

Models With Sleep-Wake Disturbances as a Primary Variable

BIOBEHAVIORAL MODEL OF ALTERED DYSREGULATION IN CIRCADIAN SYSTEMS—The Biobehavioral Model of Altered Dysregulation in Circadian Systems proposes mechanisms that contribute to sleep-wake disturbances manifested as circadian dysregulation.⁷¹ The model postulates that psychological functioning (stress, depression, mood states) have direct-reciprocal relationships with the endocrine system, autonomic nervous system, and sleep system. Dysregulation can be attributed to one or more of these biological systems. Dysregulation can be measured by sleep duration and sleep quality, as well as by cortisol, melatonin, and autonomic nervous system activity. The ultimate outcome of this dysregulation is poor quality of life, impaired well-being, poor treatment adherence, fatigue, disease progression, and poorer survival.⁷¹ This model was included in one article.⁷¹

SPIELMAN'S THREE-FACTOR INSOMNIA MODEL—Spielman's Three-Factor Insomnia Model proposes interactions among predisposing, precipitating, and perpetuating factors of insomnia.⁹⁴ This cognitive-behavioral model is also known as the 3P model. The

model includes both stress and behavioral factors to explain the evolution of insomnia and describe how individual differences cause initiation of acute disturbances in sleep that become chronic. The model proposes that people with insomnia have predisposing factors or traits that, when combined with life stress (precipitating factors), lead to chronic insomnia if there are maladaptive coping strategies (perpetuating factors).⁸⁶ When a person with predisposing factors of insomnia experiences one or more precipitating factors, the result can be acute episodes of insomnia.⁹⁴ Perpetuating factors are behaviors used to compensate for the loss of sleep. This model was included in 2 articles.^{67,73}

TWO-PROCESS MODEL OF SLEEP REGULATION—The Two-Process Model of Sleep Regulation provides an understanding of the physiological mechanisms that drive sleep and wakefulness.⁸⁸ The model has changed over time, as researchers were able to pinpoint mechanisms or processes of sleep in relation to the 2 major sleep cycles of non-rapid eye movement and rapid eye movement sleep. Visually, the model is a wavelike structure that shows the relationship between 2 physiological processes of sleep regulation, process S and process C. The homeostatic process (process S) increases during the awake state (drives the need for sleep) and decreases during sleep (decreases the need for sleep). Process S is considered the basic mechanism of sleep regulation. If there is a deficit of sleep, process S elicits a compensatory increase in the duration and intensity of sleep. This produces a sleepy feeling during wakefulness, thus driving the need or desire to correct this deficit by falling asleep. The circadian process (process C) determines alterations of high and low sleep propensity that are independent of prior sleeping-waking (the timing to sleep and wakefulness), which determines the onset and end of sleep.⁸⁸ Process C is directed by a clocklike mechanism that is not related to prior levels of sleep or the wake-like process S. Process C is the mechanism that helps the body stay asleep. It is driven by a pacemaker found in the brain called the hypothalamic suprachiasmatic nuclei, which works in conjunction with neurotransmitters that facilitate sleep and thermoregulatory processes. The interaction of process S and process C has been used to predict the timing and duration of sleep, structure of sleep, and changes in daytime wakefulness.⁸⁸ This model was adapted for use in one article.¹

Theories or Models With Sleep Disturbances as a Secondary or Clustered Variable

MODEL OF QUALITY OF LIFE—The Model of Quality of Life identifies 4 domains that define an individual's quality of life. Developed within the discipline of nursing, the model has been used to describe the quality of life in cancer patients. The 4 domains include physical well-being (eg, sleep), psychological well-being (eg, depression), social well-being (eg, family distress), and spiritual well-being (hopefulness).^{90–92,95,96} Each domain is stated to act singly or in combination with the other domains and ultimately impact quality of life. The specific symptoms or factors within each quality of life domain have been further studied in various cancers such as breast cancer (see the study of Ferrell et al⁹⁰). For this model, sleep is depicted as a physical domain that could be singly or combined with other domain factors that impact quality of life.⁹⁰ This model was included in one article.¹²

MODEL OF SYMPTOM MANAGEMENT—The Model of Symptom Management was a nursing model developed by nursing faculty from the University of California San Francisco's Center for Symptom Management.⁸⁹ The conceptual model is based on the premise that a symptom is a subjective experience of a biophysical function, cognition, or sensation. Starting with the symptom experience, 3 inner relationships include the perception of the symptom, the evaluation of the symptom, and the response of the symptom, which is related back to the perception. The response then includes internal feelings, behaviors, or thoughts related to the perceived or actual presence of a health problem. Symptom management strategies are actions that overcome or stop the negative

outcomes from the symptoms through medical or self-care interventions such as assessment and treatment. The outcome of the symptoms is a complex construct that includes 10 possible dimensions.⁸⁹ In this model, sleep-wake disturbances can be a symptom or an outcome. This model was included in 2 articles.^{6,12}

NEUROENDOCRINE-BASED REGULATORY FATIGUE MODEL—

The Neuroendocrine-Based Regulatory Model was developed to describe mechanisms of fatigue in chronic illness.⁹³ Although thought to be a multidimensional concept, the model proposes that fatigue is strongly influenced by endocrine-based bio-chemicals such as tryptophan and melatonin. Any stress on the endocrine system creates biological effects that serve as markers for fatigue.⁹³ Antecedents of fatigue are stated to be either physiological (altered circadian rhythm of sleep/wake) or psychological (depression). The model proposes interventions that act as a mediator to reduce the impact of the antecedents on the endocrine system and improve fatigue. This model was used in 2 articles.^{69,80}

OREM'S SELF-CARE DEFICIT THEORY OF NURSING—

Orem's Self-care Deficit Theory of Nursing was developed in 1985 and focuses on the ability of an individual to perform self-care activities (termed *self-care agency*) to maintain life, health, and well-being or the ability to care for others (termed *dependent-care agency*).^{20,84} The nursing role within the model is to assess the individual's ability to perform self-care through a complete assessment of the current health state and symptoms being experienced by the individual. The model suggests that nurses provide 3 types of care: (1) total compensatory where the nurse provides total care when the individual cannot perform any self-care, (2) partial compensatory where the individual and nurse share self-care activities, and (3) supportive care or educational care where the nurse facilitates self-care through educating the individual with the tools to make decisions or learn skills needed for total self-care.^{20,84} In this model, sleep-wake disturbances are symptoms that can result from cancer treatment that potentially impact self-care. This theory was used in 2 articles.^{82,97}

PIPER INTEGRATED FATIGUE MODEL—The Piper Integrated Fatigue Model has been used to study fatigue in relation to sleep disturbances in cancer patients.¹⁵ The mid-range nursing model by Piper et al proposes a variety of factors as influencing subjective and objective manifestations of fatigue (see Piper et al⁸⁵ for the figure). Fatigue manifestations are divided into physiological, biochemical, and behavioral components. These components include physiological muscle fatigue, changes in behavioral work activity, and/or symptoms of depression, and they can occur in combination as fatigue becomes a chronic problem.⁸⁵ In this model, sleep-wake disturbances are one of several factors influencing fatigue. This model was included in 6 articles.^{15,68,70,76,78,79}

PSYCHOBIOLOGICAL HOT FLASH MODEL—This model depicts sleep disturbances as an outcome of meno-pausal hot flashes. It shows relationships among physiological hot flashes, perceived hot flashes, and the reporting of hot flash severity and bother, and it proposes that hot flashes contribute to a possible cluster of symptoms that include sleep-wake disturbances, mood disturbances, and changes in affect, which ultimately impact quality of life. This model was included in one article.⁷²

ROY ADAPTATION MODEL—Roy Adaptation Model is a complex nursing model postulating that human beings have the ability to adapt to changes in the environment.⁸⁷ Adaptation or coping with environmental change occurs through maintaining 4 subsystems: (1) physiologic needs, (2) self-concept, (3) interdependence, and (4) role function. For nursing, the goal is to use this model to guide health promotion and adaptation to illness. The model postulates that focal, contextual, or residual stimuli can be manipulated to

promote adaptation based on stage of personal development, family development, and culture.⁸⁷ Adaptation responses can be effective or ineffective depending on the mode of adaptation. Effective adaptation responses are thought to promote integrity of the human system.⁸⁷ In this model, sleep can be conceptualized as a physiological mode of adaptation alone or in combination with other outcomes.⁷⁵ This model was included in one article.⁷⁵

THEORY OF UNPLEASANT SYMPTOMS—The Theory of Unpleasant Symptoms⁸³ is a mid-range nursing theory that has been used to describe sleep as it interacts with other symptoms. The theory has 3 interrelated components: (1) symptoms that the person experiences, (2) influencing factors that cause or affect the nature of the symptoms, and (3) consequences of the symptom experience.⁸³ Symptoms are the main component of the model and are measured in terms of intensity, quality, timing, and distress. The model posits that symptoms can occur alone or simultaneously with other symptoms and suggests that certain symptoms can catalyze other symptoms (see Figure 2 in the study of Lenz et al⁸³). Influencing factors are the physiological, psychological, and situational factors influenced by the symptoms. The third component is the consequence, defined as the impact of symptoms on an individual's ability to perform functional or cognitive activities. Functional performance includes activities such as physical, daily living, social, interactive, and role performance (eg, work) activities. The interaction among the 3 major concepts of symptoms, influencing factors, and consequences is reciprocal and can change as the symptom experience changes. This suggests that symptoms can moderate or mediate the relationship between influencing factors and performance.⁸³ In this model, sleep-wake disturbances can be one of many symptoms or an influencing factor affecting other symptoms. This model was included in 2 articles.^{2,74}

Discussion

Quantification, Summary, and Comparison of Studies With and Without Explicitly Described Theories, Models, or Frameworks

The quantification of studies indicates that most research related to sleep-wake disturbances in cancer patients and survivors could be considered atheoretical. Most published studies that were reviewed here did not include an explicit description of a guiding theory, model, or framework. This is a significant limitation of existing research that may inhibit clarity of (1) the conceptual definition of sleep-wake disturbances, (2) the subsequent operationalization of sleep-wake disturbances, and (3) identification of contributing factors and consequences of sleep-wake disturbances.

The summary and comparison of studies indicated first that whether an article included a theory, model, or frame-work varied by discipline. Articles authored by nurses were significantly more likely to include an explicit description of a theory, model, or framework. It is well-known that non-nursing disciplines often do not disclose theoretical or conceptual models unless the purpose of the study is to further define the underlying concepts of the model. In addition, nonnursing journals may not allow space for the description of a theory or model. Therefore, one limitation of this review is that it is not known whether the studies were truly atheoretical or just lacking a written description of the theory, model, or framework.

The summary and comparison of studies also indicated that theoretically based articles were more likely to be based on subjective measurement rather than objective measures such as wrist actigraphy or polysomnography. Theories and models would seem to be equally relevant to subjective and objective measurement of sleep; however, exclusion of objective measures means that these theories and models are being tested only in the context of subjective sleep. In addition, the subjective measures that were used varied widely within

both groups of studies (for details of sleep measures, see review¹⁸). Although the Pittsburgh Sleep Quality Index was the most commonly used measure of subjective sleep, most studies used other types of questionnaires to measure sleep-wake disturbances. This is also reflected by the various terminology of sleep such as *sleep-wake*, *insomnia*, *sleep disturbances*, *restless sleep*, and *tiredness*. Because of these variations in terminology and measurement, it is difficult to ascertain if sleep-wake disturbances were conceptualized similarly across studies that did not include theories or models.

The summary and comparison of studies did not show significant differences by group in terms of type of study (descriptive or intervention) and sample characteristics. These criteria varied widely within both groups of studies. Varying sample characteristics may make comparisons across studies somewhat difficult.

Summary and Comparison of Theories, Models, and Frameworks

This review revealed wide variation in the theories, models, and frameworks that are used to study sleep-wake disturbances in cancer. Several theories or models were only used in one study. The exceptions were Spielman's Three-Factor Model, the Model of Symptom Management, Orem's Self-care Deficit Theory, Piper's Integrated Fatigue Model, the Neuroendocrine-Based Regulatory Fatigue Model, and the Theory of Unpleasant Symptoms. These were each used in more than one study. In addition, when an author produced multiple works, he/she tended to consistently use the same model. For example, Berger et al^{15,68–70,78,79} used the Piper's Integrated Fatigue Model and Payne⁹³ used the Neuroendocrine-Based Regulatory Fatigue Model in more than one study. On the other hand, Carpenter et al^{2,6,72} used 3 different models for each of the studies reviewed. This illustrates that use of these theories may vary both within and between investigators and hypothesis driven.

Despite variation in the theories and models used, there were some commonalities. First, the theories and models overall are consistent with the idea that sleep disturbances are a combination of physiological, psychological, and behavioral phenomena.^{71,86,88} Nine theories/models include physiological components,^{71,72,84,85,88–90,93,94} eight included psychological components,^{71,84,85,88–90,93,94} and six included behavioral components.^{83–85,88,89,94,98}

In addition, the theories/models suggest that other symptoms may be a combination of components and/or consequences of sleep-wake disturbances. For example, when the Theory of Unpleasant Symptoms⁸³ was applied, it included psychological and/or physical symptoms as components of sleep-wake disturbances. When the Model of Symptom Management was applied, the co-occurrence of sleep-wake and other symptoms was emphasized.⁶ The Piper model⁸⁵ included sleep-wake disturbances as a cofactor of fatigue, suggesting that fatigue might be a consequence of sleep disturbances. Other consequences of sleep-wake disturbances included performance status in the Lenz model and impact on wakefulness in other models.^{88,94}

Finally, the models suggest that factors that contribute to sleep-wake disturbances are nonlinear; can change over time; and include predisposing, precipitating, and perpetuating factors.⁹⁴ Factors that initiate sleep disturbances (ie, predisposing or precipitating factors) may be different from those that lead to chronic sleep disturbances (ie, perpetuating factors). Thus, these models suggest that contributing factors should be reassessed over time.

Because of the high prevalence of sleep disturbances that contribute to poor quality of life in cancer patients, future research should focus on the development of a model or mid-range theory that is specific to the problem of sleep-wake disturbances in cancer. Such a model

should include demographic, physiological, psychological, and behavioral factors of sleep disturbances and resulting health-related outcomes. In particular, cancer disease and treatment-related factors and other problems unique to this population should be included. For example, it is likely that women with breast cancer have unique health-related problems that might lead to sleep-wake disturbances (eg, premature menopause),⁶⁵ and these should be incorporated to increase model specificity. The model or theory should also account for symptoms as predisposing, co-occurring, or consequential phenomena. The theory/model also needs to clearly delineate the nonlinear nature of sleep disturbances. Finally, the model should consider the potentially broad impact of sleep and wake disturbances on physiological, psychological, behavioral, and social outcomes. Having a more specific conceptual model or theory for sleep-wake disturbances could help guide research by providing a mechanism that clearly defines and measures the concepts of sleep-wake disturbances in cancer. This would result in increased consistency among researchers by using similar types of measurement and similar variables increasing the ability to compare results across studies. Ultimately, a more specific model will provide researchers with a basis to facilitate symptom management through effective theory-based descriptive and interventions for this prominent problem in cancer.

Conclusion

In summary, although most existing research on sleep-wake disturbances in cancer does not include a description of a theory, model, or framework, several theories and models have been applied to this problem in this population at least once. The reviewed theories or models represent options that are available to guide research on sleep-wake disturbances in cancer populations. However, no one theory, model, or framework seems to provide an accurate picture of sleep-wake disturbances. Additional model or theory development is needed to enhance research that can be translated into improved clinical care in this area. It is recommended that authors should be encouraged to explicitly state the theory, model, or framework within the manuscript if one was used to guide the research. This could be accomplished through adding this type of reporting to publication guidelines to ensure that the readers can identify the conceptual underpinnings of the research.

Acknowledgments

The authors gratefully acknowledge Phyllis Dexter for the editorial support.

This work was supported by the following: National Institute of Nursing Research 1 F31 NR009890, American Cancer Society predoctoral fellowship (Doctoral Scholarship in Cancer Nursing 108142), Oncology Nursing Foundation predoctoral scholarship (2004), and Walther Cancer Institute predoctoral fellowship (2004–2008). National Cancer Institute R25 CA117865 post-doctoral fellowship.

References

1. Vena C, Parker K, Allen R, Bliwise D, Jain S, Kimble L. Sleep-wake disturbances and quality of life in patients with advanced lung cancer. *Oncol Nurs Forum* 2006;33:761–769. [PubMed: 16858458]
2. Carpenter JS, Elam J, Ridner S, Carney P, Cherry G, Cucullu H. Sleep, fatigue, and depressive symptoms in breast cancer survivors and matched healthy women experiencing hot flashes. *Oncol Nurs Forum* 2004;31:591–5598. [PubMed: 15146224]
3. Savard J, Simard S, Blanchet J, Ivers H, Morin CM. Prevalence, clinical characteristics, and risk factors for insomnia in the context of breast cancer. *Sleep* 2001;24:583–590. [PubMed: 11480655]
4. Bowman, TJ.; Moshenin, V. Synopsis of sleep. In: Bowman, TJ., editor. *Review of Sleep Medicine*. Boston: Butterworth & Heinemann; 2003. p. 3-18.

5. Davidson JR, MacLean AW, Brundage MD, Schulze K. Sleep disturbance in cancer patients. *Soc Sci Med* 2002;54:1309–1321. [PubMed: 12058848]
6. Carpenter JS, Andrykowski MA. Menopausal symptoms in breast cancer survivors. *Oncol Nurs Forum* 1999;26:1311–1317. [PubMed: 10497770]
7. Crandall C, Petersen L, Ganz PA, Greendale GA. Association of breast cancer and its therapy with menopause-related symptoms. *Menopause* 2004;11:519–530. [PubMed: 15356404]
8. Elam, JL.; Carpenter, JS. Results of Pittsburgh Sleep Quality Index parameters for female breast cancer survivors seeking treatment for hot flashes. Poster session presented at the annual research meeting of the Sigma Theta Tau International Nursing Society; Dublin, Ireland. 2004.
9. Schultz PN, Klein MJ, Beck ML, Stava C, Sellin RV. Breast cancer: relationship between menopausal symptoms, physiologic health effects of cancer treatment and physical constraints on quality of life in long-term survivors. *J Clin Nurs* 2005;14:204–211. [PubMed: 15669929]
10. Savard J, Morin CM. Insomnia in the context of cancer: a review of a neglected problem. *J Clin Oncol* 2001;19:895–908. [PubMed: 11157043]
11. Fortner BV, Stepanski EJ, Wang SC, Kasprovicz S, Durrence HH. Sleep and quality of life in breast cancer patients. *J Pain Symptom Manage* 2002;24:471–480. [PubMed: 12547047]
12. Dow KH, Ferrell BR, Leigh S, Ly J, Gulasekaram P. An evaluation of the quality of life among long-term survivors of breast cancer. *Breast Cancer Res Treat* 1996;39:261–273. [PubMed: 8877006]
13. Northouse LL, Caffey M, Deichelbohrer L, et al. The quality of life of African American women with breast cancer. *Res Nurs Health* 1999;22:449–460. [PubMed: 10630287]
14. de Moor C, Sterner J, Hall M, et al. A pilot study of the effects of expressive writing on psychological and behavioral adjustment in patients enrolled in a phase II trial of vaccine therapy for metastatic renal cell carcinoma. *Health Psychol* 2002;21:615–619. [PubMed: 12433015]
15. Berger AM, VonEssen S, Kuhn BR, et al. Adherence, sleep, and fatigue outcomes after adjuvant breast cancer chemotherapy: results of a feasibility intervention study. *Oncol Nurs Forum* 2003;30:513–522. [PubMed: 12719750]
16. Vena C, Parker K, Cunningham M, Clark J, McMillan S. Continuing education: sleep-wake disturbances in people with cancer, part I: an overview of sleep, sleep regulation, and effects of disease and treatment. *Oncol Nurs Forum* 2004;31:735–746. [PubMed: 15252429]
17. Clark J, Cunningham M, McMillan S, Vena C, Parker K. Continuing education: sleep-wake disturbances in people with cancer, part II: evaluating the evidence for clinical decision making. *Oncol Nurs Forum* 2004;31:747–771. [PubMed: 15252430]
18. Berger AM, Parker KP, Young-McCaughan S, et al. Sleep wake disturbances in people with cancer and their caregivers: state of the science. *Oncol Nurs Forum* 2005;32 E98YE126.
19. Barton-Burke M. Cancer-related fatigue and sleep disturbances. Further research on the prevalence of these two symptoms in long-term cancer survivors can inform education, policy, and clinical practice. *Am J Nurs* 2006;106:72–77. [PubMed: 16481861]
20. Polit, DF.; Hungler, BP. *Nursing Research: Principles and Methods*. Philadelphia, PA: Lippincott; 1999.
21. Walker, LO.; Avant, KC. *Strategies for Theory Construction in Nursing*. Upper Saddle River, NJ: Pearson Prentice Hall; 2005.
22. Ancoli-Israel S, Richardson GS, Mangano RM, Jenkins L, Hall P, Jones WS. Long-term use of sedative hypnotics in older patients with insomnia. *Sleep Med* 2005;6:107–113. [PubMed: 15716214]
23. Anderson KO, Getto CJ, Mendoza TR, et al. Fatigue and sleep disturbance in patients with cancer, patients with clinical depression, and community-dwelling adults. *J Pain Symptom Manage* 2003;25:307–318. [PubMed: 12691682]
24. Andrykowski MA, Carpenter JS, Greiner CB, et al. Energy level and sleep quality following bone marrow transplantation. *Bone Marrow Transplant* 1997;20:669–679. [PubMed: 9383231]
25. Bardwell WA, Profant J, Casden DR, et al. The relative importance of specific risk factors for insomnia in women treated for early-stage breast cancer. *Psychooncology* 2008;17:9–18. [PubMed: 17428006]

26. Broeckel JA, Jacobsen PB, Horton J, Balducci L, Lyman GH. Characteristics and correlates of fatigue after adjuvant chemotherapy for breast cancer. *J Clin Oncol* 1998;16:1689–1696. [PubMed: 9586880]
27. Cohen L, Warneke C, Fouladi RT, Rodriguez MA, Chaoul-Reich A. Psychological adjustment and sleep quality in a randomized trial of the effects of a Tibetan yoga intervention in patients with lymphoma. *Cancer* 2004;100:2253–2260. [PubMed: 15139072]
28. Davidson JR, Waisberg JL, Brundage MD, MacLean AW. Non-pharmacologic group treatment of insomnia: a preliminary study with cancer survivors. *Psychooncology* 2001;10:389–397. [PubMed: 11536417]
29. Engstrom CA, Strohl RA, Rose L, Lewandowski L, Stefanek ME. Sleep alterations in cancer patients. *Cancer Nurs* 1999;22:143–148. [PubMed: 10217030]
30. Koopman C, Nouriani B, Erickson V, et al. Sleep disturbances in women with metastatic breast cancer. *Breast J* 2002;8:362–370. [PubMed: 12390359]
31. Miaskowski C, Lee KA. Pain, fatigue, and sleep disturbances in oncology outpatients receiving radiation therapy for bone metastasis: a pilot study. *J Pain Symptom Manage* 1999;17:320–332. [PubMed: 10355211]
32. Owen DC, Parker KP, McGuire DB. Comparison of subjective sleep quality in patients with cancer and healthy subjects. *Oncol Nurs Forum* 1999;26:1649–1651. [PubMed: 10573681]
33. Savard J, Davidson JR, Ivers H, et al. The association between nocturnal hot flashes and sleep in breast cancer survivors. *J Pain Symptom Manage* 2004;27:513–522. [PubMed: 15165649]
34. Roscoe JA, Morrow GR, Hickok JT, et al. Temporal interrelationships among fatigue, circadian rhythm and depression in breast cancer patients undergoing chemotherapy treatment. *Support Care Cancer* 2002;10:329–336. [PubMed: 12029433]
35. Silberfarb PM, Hauri PJ, Oxman TE, Schnurr P. Assessment of sleep in patients with lung cancer and breast cancer. *J Clin Oncol* 1993;11:997–1004. [PubMed: 8487063]
36. Simeit R, Deck R, Conta-Marx B. Sleep management training for cancer patients with insomnia. *Support Care Cancer* 2004;12:176–183. [PubMed: 14760542]
37. Tatrow K, Montgomery GH, Avellino M, Bovbjerg DH. Activity and sleep contribute to levels of anticipatory distress in breast surgery patients. *Behav Med* 2004;30:85–91. [PubMed: 15648128]
38. Savard J, Simard S, Ivers H, Morin CM. Randomized study on the efficacy of cognitive-behavioral therapy for insomnia secondary to breast cancer, part I: sleep and psychological effects. *J Clin Oncol* 2005;23:6083–6096. [PubMed: 16135475]
39. Quesnel C, Savard J, Simard S, Ivers H, Morin CM. Efficacy of cognitive-behavioral therapy for insomnia in women treated for nonmetastatic breast cancer. *J Consult Clin Psychol* 2003;71:189–200. [PubMed: 12602439]
40. Wang RC, Wang SJ, Chang YC, Lin CC. Mood state and quality of sleep in cancer pain patients: a comparison to chronic daily headache. *J Pain Symptom Manage* 2007;33:32–39. [PubMed: 17196905]
41. Spelten ER, Verbeek JH, Uitterhoeve AL, et al. Cancer, fatigue and the return of patients to work—a prospective cohort study. *Eur J Cancer* 2003;39:1562–1567. [PubMed: 12855263]
42. Shapiro SL, Bootzin RR, Figueredo AJ, Lopez AM, Schwartz GE. The efficacy of mindfulness-based stress reduction in the treatment of sleep disturbance in women with breast cancer: an exploratory study. *J Psychosom Res* 2003;54:85–91. [PubMed: 12505559]
43. Servaes P, Prins J, Verhagen S, Bleijenberg G. Fatigue after breast cancer and in chronic fatigue syndrome: similarities and differences. *J Psychosom Res* 2002;52:453–459. [PubMed: 12069869]
44. Lamb MA. The sleeping patterns of patients with malignant and nonmalignant diseases. *Cancer Nurs* 1982;5:389–396. [PubMed: 6923775]
45. Le Guen Y, Gagnadoux F, Hureauux J, et al. Sleep disturbances and impaired daytime functioning in outpatients with newly diagnosed lung cancer. *Lung Cancer* 2007;58:139–143. [PubMed: 17614157]
46. Lis CG, Gupta D, Grutsch JF. The relationship between insomnia and patient satisfaction with quality of life in cancer. *Support Care Cancer* 2008;16:261–266. [PubMed: 17684773]

47. Malone M, Harris AL, Luscombe DK. Assessment of the impact of cancer on work, recreation, home management and sleep using a general health status measure. *J R Soc Med* 1994;87:386–389. [PubMed: 8046723]
48. Mao JJ, Armstrong K, Bowman MA, Xie SX, Kadakia R, Farrar JT. Symptom burden among cancer survivors: impact of age and comorbidity. *J Am Board Fam Med* 2007;20:434–443. [PubMed: 17823460]
49. Monga U, Jaweed M, Kerrigan AJ, et al. Neuromuscular fatigue in prostate cancer patients undergoing radiation therapy. *Arch Phys Med Rehabil* 1997;78:961–966. [PubMed: 9305269]
50. Okuyama T, Akechi T, Kugaya A, et al. Factors correlated with fatigue in disease-free breast cancer patients: application of the Cancer Fatigue Scale. *Support Care Cancer* 2000;8:215–222. [PubMed: 10789963]
51. Silberfarb PM, Hauri PJ, Oxman TE, Lash S. Insomnia in cancer patients. *Soc Sci Med* 1985;20:849–850. [PubMed: 4001994]
52. Pud D, Ben Ami S, Cooper BA, et al. The symptom experience of oncology outpatients has a different impact on quality-of-life outcomes. *J Pain Symptom Manage* 2008;35:162–170. [PubMed: 18082357]
53. Parker KP, Bliwise DL, Ribeiro M, et al. Sleep/wake patterns of individuals with advanced cancer measured by ambulatory polysomnography. *J Clin Oncol* 2008;26:2464–2472. [PubMed: 18487566]
54. Berger AM, Farr L. The influence of daytime inactivity and nighttime restlessness on cancer-related fatigue. *Oncol Nurs Forum* 1999;26:1663–1671. [PubMed: 10573683]
55. Bower JE, Ganz PA, Desmond KA, Rowland JH, Meyerowitz BE, Belin TR. Fatigue in breast cancer survivors: occurrence, correlates, and impact on quality of life. *J Clin Oncol* 2000;18:743–753. [PubMed: 10673515]
56. Bruera E, Fainsinger RL, Schoeller T, Ripamonti C. Rapid discontinuation of hypnotics in terminal cancer patients: a prospective study. *Ann Oncol* 1996;7:855–856. [PubMed: 8922201]
57. Chen ML, Yu CT, Yang CH. Sleep disturbances and quality of life in lung cancer patients undergoing chemotherapy. *Lung Cancer*. 2008
58. Cannici J, Malcolm R, Peek LA. Treatment of insomnia in cancer patients using muscle relaxation training. *J Behav Ther Exp Psychiatry* 1983;14:251–256. [PubMed: 6358270]
59. Coleman EA, Coon S, Hall-Barrow J, Richards K, Gaylor D, Stewart B. Feasibility of exercise during treatment for multiple myeloma. *Cancer Nurs* 2003;26:410–419. [PubMed: 14710804]
60. Couzi RJ, Helzlsouer KJ, Fetting JH. Prevalence of menopausal symptoms among women with a history of breast cancer and attitudes toward estrogen replacement therapy. *J Clin Oncol* 1995;13:2737–2744. [PubMed: 7595732]
61. Dirksen SR, Epstein DR. Efficacy of an insomnia intervention on fatigue, mood and quality of life in breast cancer survivors. *J Adv Nurs* 2008;61:664–675. [PubMed: 18302607]
62. Espie CA, Fleming J, Cassidy J, et al. Randomized controlled clinical effectiveness trial of cognitive behavior therapy compared with treatment as usual for persistent insomnia in patients with cancer. *J Clin Oncol* 2008;26:1–9.
63. Fernandes R, Stone P, Andrews P, Morgan R, Sharma S. Comparison between fatigue, sleep disturbance, and circadian rhythm in cancer inpatients and healthy volunteers: evaluation of diagnostic criteria for cancer-related fatigue. *J Pain Symptom Manage* 2006;32:245–254. [PubMed: 16939849]
64. Haghighat S, Akbari ME, Holakouei K, Rahimi A, Montazeri A. Factors predicting fatigue in breast cancer patients. *Support Care Cancer* 2003;11:533–538. [PubMed: 12730728]
65. Hunter MS, Grunfeld EA, Mittal S, et al. Menopausal symptoms in women with breast cancer: prevalence and treatment preferences. *Psychooncology* 2004;13:769–778. [PubMed: 15386641]
66. Janz NK, Mujahid M, Chung LK, et al. Symptom experience and quality of life of women following breast cancer treatment. *J Womens Health* 2007;16:1348–1361.
67. Rumble ME, Keefe FJ, Edinger JD, Porter LS, Garst JL. A pilot study investigating the utility of the cognitive-behavioral model of insomnia in early-stage lung cancer patients. *J Pain Symptom Manage* 2005;30:160–169. [PubMed: 16125031]

68. Berger AM, Farr LA, Kuhn BR, Fischer P, Agrawal S. Values of sleep/wake, activity/rest, circadian rhythms, and fatigue prior to adjuvant breast cancer chemotherapy. *J Pain Symptom Manage* 2007;33:398–409. [PubMed: 17397701]
69. Payne J, Piper B, Rabinowitz I, Zimmerman B. Biomarkers, fatigue, sleep, and depressive symptoms in women with breast cancer: a pilot study. *Oncol Nurs Forum* 2006;33:775–783. [PubMed: 16858459]
70. Berger AM, VonEssen S, Khun BR, et al. Feasibility of a sleep intervention during adjuvant breast cancer chemotherapy. *Oncol Nurs Forum* 2002;29:1431–1441. [PubMed: 12432414]
71. Carlson LE, Campbell TS, Garland SN, Grossman P. Associations among salivary cortisol, melatonin, catecholamines, sleep quality and stress in women with breast cancer and healthy controls. *J Behav Med* 2007;30:45–58. [PubMed: 17245618]
72. Carpenter JS, Neal JG, Payne JK, Kimmick G, Storniolo AM. Cognitive-behavioral intervention for hot flashes. *Oncol Nurs Forum* 2007;34 E1YE8.
73. Epstein DR, Dirksen SR. Randomized trial of a cognitive-behavioral intervention for insomnia in breast cancer survivors. *Oncol Nurs Forum* 2007;34 E51YE59.
74. Redeker NS, Lev EL, Ruggiero J. Insomnia, fatigue, anxiety, depression, and quality of life of cancer patients undergoing chemotherapy. *Sch Inq Nurs Pract* 2000;14:275–290. discussion 91–8. [PubMed: 11372188]
75. Young-McCaughan S, Mays MZ, Arzola SM, et al. Research and commentary: change in exercise tolerance, activity and sleep patterns, and quality of life in patients with cancer participating in a structured exercise program. *Oncol Nurs Forum* 2003;30:441–454. discussion-54. [PubMed: 12719744]
76. Blesch KS, Paice JA, Wickham R, et al. Correlates of fatigue in people with breast or lung cancer. *Oncol Nurs Forum* 1991;18:81–87. [PubMed: 2003120]
77. Dodd MJ, Miaskowski C, Paul SM. Symptom clusters and their effect on the functional status of patients with cancer. *Oncol Nurs Forum* 2001;28:465–470. [PubMed: 11338755]
78. Berger AM. Patterns of fatigue and activity and rest during adjuvant breast cancer chemotherapy. *Oncol Nurs Forum* 1998;25:51–62. [PubMed: 9460773]
79. Berger AM, Higginbotham P. Correlates of fatigue during and following adjuvant breast cancer chemotherapy: a pilot study. *Oncol Nurs Forum* 2000;27:1443–1448. [PubMed: 11058976]
80. Payne JK, Held J, Thorpe J, Shaw H. Effect of exercise on biomarkers, fatigue, sleep disturbances, and depressive symptoms in older women with breast cancer receiving hormonal therapy. *Oncol Nurs Forum* 2008;35:635–642. [PubMed: 18591167]
81. Hoffman AJ, Given BA, von Eye A, Gift AG, Given CW. Relationships among pain, fatigue, insomnia, and gender in persons with lung cancer. *Oncol Nurs Forum* 2007;34:785–792. [PubMed: 17723980]
82. Rhodes VA, Watson PM, Hanson BM. Patients' descriptions of the influence of tiredness and weakness on self-care abilities. *Cancer Nurs* 1988;11:186–194. [PubMed: 3401854]
83. Lenz ER, Pugh LC, Milligan RA, Gift A, Suppe F. The middle-range theory of unpleasant symptoms: an update. *ANS Adv Nurs Sci* 1997;19:14–27. [PubMed: 9055027]
84. Orem, DE.; Taylor, SG.; Renpenning, KM. *Nursing: Concepts of Practice*. St. Louis, MO: Mosby; 2001.
85. Piper BF, Lindsey AM, Dodd MJ. Fatigue mechanisms in cancer patients: developing nursing theory. *Oncol Nurs Forum* 1987;14:17–23. [PubMed: 3320981]
86. Spielman AJ, Nunes J, Glovinsky PB. Insomnia. *Neurol Clin* 1996;14:513–543. [PubMed: 8871975]
87. Roy, C.; Andrews, HA. *The Roy Adaptation Model*. Norwalk, CT: Appleton & Lange; 1999.
88. Borbely AA. A Two Process Model of Sleep Regulation. *Hum Neurobiol* 1982;1:195–204. [PubMed: 7185792]
89. UCSF School of Nursing Symptom Management Faculty Group. A model for symptom management. The University of California, San Francisco School of Nursing Symptom Management Faculty Group. *Image J Nurs Scholarsh* 1994;26:272–276.

90. Ferrell BR, Grant M, Funk B, Otis-Green S, Garcia N. Quality of life in breast cancer, part I: physical and social well-being. *Cancer Nurs* 1997;20:398–408. [PubMed: 9409061]
91. Ferrell BR, Grant M, Funk B, Otis-Green S, Garcia N. Quality of life in breast cancer, part II: psychological and spiritual well-being. *Cancer Nurs* 1998;21:1–9. [PubMed: 9494225]
92. Ferrell BR, Wisdom C, Wenzl C. Quality of life as an outcome variable in the management of cancer pain. *Cancer* 1989;63:2321–2327. [PubMed: 2720579]
93. Payne JK. A neuroendocrine-based regulatory fatigue model. *Biol Res Nurs* 2004;6:141–150. [PubMed: 15388911]
94. Spielman AJ, Caruso LS, Glovinsky PB. A behavioral perspective on insomnia treatment. *Psychiatr Clin North Am* 1987;10:541–553. [PubMed: 3332317]
95. Ferrell B, Grant M, Padilla G, Vemuri S, Rhiner M. The experience of pain and perceptions of quality of life: validation of a conceptual model. *Hosp J* 1991;7:9–24. [PubMed: 1820306]
96. Padilla GV, Ferrell B, Grant MM, Rhiner M. Defining the content domain of quality of life for cancer patients with pain. *Cancer Nurs* 1990;13:108–115. [PubMed: 2331691]
97. McMillan SC, Tofthagen C, Morgan MA. Relationships among pain, sleep disturbances, and depressive symptoms in outpatients from a comprehensive cancer center. *Oncol Nurs Forum* 2008;35:603–611. [PubMed: 18591165]
98. Lenz ER, Suppe F, Gift AG, Pugh LC, Milligan RA. Collaborative development of middle-range nursing theories: toward a theory of unpleasant symptoms. *ANS Adv Nurs Sci* 1995;17:1–13. [PubMed: 7778887]

Table 1

Summary of Studies Without a Theory, Model, or Framework

Source	Disciplines of Authors	Type of Study	Sample	Stage of Cancer	Cancer tx Status	Variables of Interest	Measure of Sleep-Wake
Coli-Israel et al ²²	Psychiatry, medicine	Descriptive	Breast cancer	I–IIIa	Pre-tx	Fatigue, sleep quality, circadian rhythm functional status, depression	Pittsburgh Sleep Quality Index, wrist actigraph
Anderson et al ²³	Psychology, psychiatry, medicine, public health	Descriptive	Mixed sample of cancer	I–IV	NR	Fatigue, sleep disturbance, depression, mood	Sleep Disturbance Scale
Drykowski et al ²⁴	Psychology, nursing, medicine	Descriptive	Bone marrow transplant	NR	Post–bone marrow transplantation	Fatigue, sleep quality, mood, depression	Pittsburgh Sleep Quality Index
Edwell et al ²⁵	Psychiatry, psychology, medicine	Descriptive	Breast cancer	I–IIIa	Active or post-tx	Insomnia, depression, mood, functional status, physical health, health behaviors	Women's Health Initiative Sleep Disturbance Scale
Enger and Farr ⁵⁴	Nursing	Descriptive	Breast cancer	I–II	Active tx	Fatigue, daytime activity nighttime rest, circadian rhythms	Wrist actigraph
Lawver et al ⁵⁵	Psychiatry, behavioral medicine, medicine, psychology, and biostatistics	Descriptive	Breast cancer	0–II	Post-tx	Fatigue, contributing factors of fatigue, depression, pain, menopausal factors, sleep, quality of life	Medical Outcomes Study–Sleep Scale
Reckel et al ²⁶	Psychology and medicine	Descriptive	Breast cancer	I–III	Post-tx	Fatigue, sleep, mood, menopausal symptoms, depression/adjustment disorder	Pittsburgh Sleep Quality Index
Wera et al ⁵⁶	Medicine	Descriptive	Mixed sample of cancer	Advanced disease	NR	Insomnia, hypnotic withdrawal, cognitive failure	Visual analog scale of insomnia items
Manici et al ⁵⁸	Psychology, psychiatry	Intervention	Mixed sample of cancer	NR	Active and post-tx	Insomnia, muscle relaxation	Daily sleep questionnaire (sleep behaviors)
Wen et al ⁵⁷	Nursing, medicine	Descriptive	Lung cancer	III–IV	Active tx	Sleep disturbances, chemotherapy, quality of life, functional performance	Pittsburgh Sleep Quality Index
Wen et al ²⁷	Psychology, public health, medicine, biostatistics, religion	Intervention	Lymphoma	I–IV	Active or post-tx	Sleep quality, psychological adjustment, depression, anxiety, impact of life event, fatigue	Pittsburgh Sleep Quality Index
Wen et al ⁵⁹	Nursing, biostatistics, public health, education	Intervention	Multiple myeloma	NR	Active tx	Exercise, sleep, fatigue, mood, activity, muscle strength, aerobic capacity	Wrist actigraph, sleep log, Epworth Sleepiness Scale

Source	Disciplines of Authors	Type of Study	Sample	Stage of Cancer	Cancer tx Status	Variables of Interest	Measure of Sleep-Wake
Widzi et al ⁶⁰	Medicine, psychiatry, public health	Descriptive	Breast cancer	0–III	Post-tx	Menopausal symptoms, willingness to take estrogen therapy	66-item questionnaire with single-item sleep question
Widall et al ⁷	Medicine, public health	Descriptive	Breast cancer	0–IIIa	Post-tx	Severity, bother of menopausal symptoms—sleep, hot flashes, urogenital, sexual, cancer-related pain, cognitive functioning, depression, menopausal status	Generic questionnaire with one question regarding restless sleep
Widson et al ²⁸	Psychology, medicine	Intervention	Mixed sample of cancer	NR	Post-tx	Sleep disturbances as insomnia, mood, functioning	Sleep diary, wrist actigraph
Widson et al ⁵	Psychology, medicine	Descriptive	Mixed sample of cancer	NR	Active or post-tx	Sleep disturbances, insomnia, fatigue, daytime sleepiness, sleep-related breathing problem, restless legs, dreaming, napping, use of sleep medications	Sleep Survey
Moor et al ¹⁴	Behavioral medicine, biostatistics, psychiatry, medicine	Intervention	Renal cell cancer	Metastatic	Active tx	Expressive writing, psychological, behavioral adjustment	Pittsburgh Sleep Quality Index
Widson and Epstein, ⁸	Nursing	Intervention	Breast cancer	I–III	Post-tx	Insomnia, cognitive behavioral intervention, quality of life	Insomnia Severity Index
Widstrom et al ²⁹	Nursing, psychiatry	Descriptive	Mixed sample of cancer	NR	Active or post-tx	Sleep disturbances, mood, performance, daytime functioning, physical activity, lifestyle behaviors	Study specific 82-item sleep disturbance questionnaire, qualitative interview specific to sleep
Widie et al ⁶²	Psychology, medicine	Intervention	Mixed sample of cancer	NR	Post-tx	Insomnia, fatigue, cognitive behavioral intervention, quality of life	Pittsburgh Sleep Quality Index, Epworth Sleepiness Scale
Widmandes et al ⁶³	General science, medicine	Descriptive	Mixed sample of cancer	Advanced disease	Active or post-tx	Fatigue, daytime activity, sleep disorders, circadian rhythm	Wrist actigraph, sleep diary
Widmer et al ¹¹	Psychology, medicine	Descriptive	Breast cancer	NR	Pre-tx, active, or post-tx	Sleep, quality of life, cancer treatment	Pittsburgh Sleep Quality Index
Widhighat et al ⁶⁴	Medicine, public health	Descriptive	Breast cancer	I–IV	Active or post-tx	Fatigue, contributing factors of fatigue	General physical symptom questionnaire
Widmer et al ⁶⁵	Psychology, medicine, psychiatry	Descriptive	Breast cancer	No active cancer	Hormonal tx	Menopausal symptoms (eg, hot flashes, sleep), quality of life, management strategies	Women's Health Questionnaire

Cancer Nurs. Author manuscript; available in PMC 2010 July 23.

Source	Disciplines of Authors	Type of Study	Sample	Stage of Cancer	Cancer tx Status	Variables of Interest	Measure of Sleep-Wake
z et al ⁶⁶	Health behaviors/education, medicine, public health	Descriptive	Breast Cancer	0–II	Post-tx	Symptom experience post-tx, quality of life	European Organization for Research of Cancer Quality of Life Questionnaire (EORTC QLQ-C30)
opman et al ³⁰	Psychology, medicine	Descriptive	Breast cancer	Metastatic/locally advanced	Active or post-tx	Sleep disturbances, depression, social support, cortisol levels	Sleep questionnaire (modified version of insomnia interview)
h ⁴²	Nursing	Descriptive	Mixed sample of cancer	Active-tx or supportive care	NR	Sleep, hospitalization, cancer diagnosis	Study specific sleep questionnaire with items, open-ended questions
Guen et al ⁴⁵	Medicine	Descriptive	Lung cancer	Small cell (limited to extensive), non–small cell (stages I–IV)	Pre-tx	Sleep disturbances, daytime functioning	Pittsburgh Sleep Quality Index, Epworth Sleepiness Scale, wrist actigraph
et al ⁴⁶	Public health	Descriptive	Mixed sample of cancer	I–IV	Pre-tx or active tx	Insomnia, patient satisfaction, quality of life	Insomnia subscale of EORTC QLQ
one et al ⁴⁷	Pharmacy, medicine	Descriptive	Mixed sample of cancer	NR	Active-tx	Quality of life (work, recreation, home management, sleep), health status	UK Sickness Impact Profile
o et al ⁴⁸	Medicine, biostatistics	Descriptive	Mixed sample of cancer	NR	Post-tx	Pain, depression, anxiety, insomnia, cancer survivorship, impact of symptom burden, age, comorbidity	Items from the National Health Interview survey
askowski and Lee ³¹	Nursing	Descriptive	Mixed sample of cancer	Metastatic	Active-tx	Fatigue, pain, sleep disturbance, depression	Sleep diary, wrist actigraph
nga et al ⁴⁹	Medicine, psychology	Descriptive	Prostate cancer	T1c–T2c	Active-tx	Neuromuscular fatigue, sleep, depression, radiation tx	Epworth Sleepiness Scale
yama et al ⁵⁰	Psychiatry, medicine	Descriptive	Breast cancer	0–III	Post-tx	Fatigue, correlates of fatigue, depression, coping, physical symptoms such as sleep	Physical symptom questionnaire
en et al ³²	Nursing	Descriptive	Mixed sample of cancer	NR	Active or post-tx	Sleep quality	Pittsburgh Sleep Quality Index
ker et al ⁵³	Nursing, medicine	Descriptive	Mixed sample of cancer	III–IV	NR	Sleep-wake patterns, advanced cancer, medications	Polysomnography
et al ⁵⁸	Nursing, psychology	Descriptive	Mixed sample of cancer	NR	Active tx	Fatigue, sleep disturbance, epression, pain, quality of life	General sleep disturbance scale
esnel et al ³⁹	Psychology	Intervention	Breast cancer	I–III	Post-tx	Insomnia, depression, state/trait anxiety, fatigue, quality of life	Insomnia Severity Index, polysomnography

Cancer Nurs. Author manuscript; available in PMC 2016 July 23.

Source	Disciplines of Authors	Type of Study	Sample	Stage of Cancer	Cancer tx Status	Variables of Interest	Measure of Sleep-Wake
Goode et al ³⁴	Psychology, medicine	Descriptive	Breast cancer	NR	Active tx	Fatigue, circadian rhythms, depression, mood, type of cancer treatment	Wrist actigraph
Hard et al ³	Psychology	Descriptive	Breast cancer	I–III	Post-tx	Insomnia, contributing factors of insomnia	Insomnia Screening Questionnaire, Insomnia Interview Schedule
Hard et al ³³	Psychology	Descriptive	Breast cancer	I–III	Post-tx	Insomnia, nocturnal hot flashes, sleep disturbances	Insomnia Interview Schedule
Hard et al ³⁸	Psychology	Intervention	Breast cancer	I–III	Post-tx	Insomnia, anxiety, depression, fatigue, quality of life	Insomnia Interview Schedule, Insomnia Severity Index, Sleep Diary, polysomnography
Waes et al ⁴³	Psychology, medicine	Descriptive	Breast cancer	NR	Post-tx	Fatigue, determinates of fatigue	Groninger Sleep Quality Scale
Multz et al ⁹	Nursing, medicine	Descriptive	Breast cancer	NR	Post-tx	Menopausal symptoms, physiological health effects related to cancer treatment, quality of life	Menopausal symptom questionnaire
Caprio et al ⁴²	Psychology, medicine/public health	Intervention	Breast cancer	II	Post-tx	Sleep disturbance, mood, worry, depression, state/trait anxiety, type of cancer treatment, sense of coherence, control	Sleep diary
Berfarb et al ⁵¹	Psychiatry, psychology	Descriptive	Lung cancer	NR	Active-tx	Insomnia, sleep, cancer	Pittsburgh Sleep Quality Index, sleep log
Berfarb et al ³⁵	Psychiatry, psychology	Descriptive	Mixed sample of cancer	I–IV	Post-tx	Sleep disturbance as insomnia, anxiety, mood, strength, depression, nausea, pain, fatigue	Polysomnography
Heit et al ³⁶	Psychology	Intervention	Mixed sample of cancer	NR	Post-tx	Sleep management, cancer-related quality of life	Pittsburgh Sleep Quality Index
Itten et al ⁴¹	Medicine, psychology	Descriptive	Mixed sample of cancer	NR	Active and post-tx	Fatigue, depression, sleep, physical problems, cognitive dysfunction, psychological distress, return to work	Pittsburgh Sleep Quality Index
Row et al ³⁷	Behavioral medicine	Descriptive	Breast cancer	NR	Active tx	Sleep, activity, distress, quality of life, fatigue, activity	Three-item sleep-wake assessment
Ng et al ⁴⁰	Nursing, medicine, biostatistics	Descriptive	Mixed sample of cancer	III–IV	Active tx	Pain, sleep disturbance	Pittsburgh Sleep Quality Index

Abbreviations: NR, not reported; tx, treatment.

Table 2

Studies With a Theory, Model, or Framework

Theory, Model, or Framework	Disciplines of Authors	Type of Study	Sample	Stage of Cancer	Cancer tx Status	Variables of Interest	Measure of Sleep-Wake
Piper's Integrated Fatigue Model	Nursing	Descriptive	Breast cancer	I-II	Active tx	Fatigue, activity/rest, cancer treatment	Wrist actigraph
Pinthorn's Integrated Fatigue Model ⁷⁹	Nursing	Descriptive	Breast cancer	I-II	Active tx	Fatigue, sleep, activity/rest, symptom distress, health status	Morin Sleep Diary, wrist actigraph
Piper's Integrated Fatigue Model	Nursing	Intervention	Breast cancer	I-II	Active tx	Fatigue, sleep, activity, chemotherapy, sleep hygiene intervention	Pittsburgh Sleep Quality Index, Brief Sleep History, Sleep Hygiene Awareness, Practice Scale, wrist actigraph, Morin Sleep Diary
Piper's Integrated Fatigue Model	Nursing	Intervention	Breast cancer	I-II	Active or post-tx	Fatigue, sleep disturbance, adherence, sleep hygiene	Pittsburgh Sleep Quality Index, wrist actigraph, Morin Sleep Diary
Piper's Integrated Fatigue Model	Nursing	Descriptive	Breast cancer	I-IIIa	Pre-tx	Fatigue, sleep-wake, activity-rest, circadian rhythms	Pittsburgh Sleep Quality Index, wrist actigraph, sleep diary
Piper's Integrated Fatigue Model	Nursing	Descriptive	Breast and lung cancer	NR	Active-tx	Fatigue, correlates of fatigue	Two-item sleep questionnaire regarding hours of sleep obtained at home, during hospitalization
Biobehavioral Model of Altered Dysregulation in Oncadian Systems ⁷⁷	Medicine and psychology	Descriptive	Breast cancer	I-IV	Post-tx	Sleep quality, cortisol, melatonin, catecholamines, psychosocial stress/factors	Pittsburgh Sleep Quality Index
Model of Symptom Management	Nursing and behavioral science	Descriptive	Breast cancer	0-III	Post-tx	Menopause, menopausal symptoms, quality of life	Blatt Menopausal Index
Theory of Unpleasant Symptoms—adapted	Nursing	Descriptive	Breast cancer	I-III	Post-tx	Hot flashes, sleep, fatigue, depression	Pittsburgh Sleep Quality Index
Psychobiological model of hot flashes	Nursing	Intervention	Breast cancer	0-III	Post-tx	Hot flashes, sleep, mood	Pittsburgh Sleep Quality Index, wrist actigraph
Model of Symptom Management	Nursing and psychology	Descriptive	Mixed sample of cancer	Metastatic and nonmetastatic	Active tx	Symptom cluster, symptom outcomes, functional status, pain, fatigue, sleep insufficiency	Quality of Life—Cancer
Model of Quality of Life	Nursing	Descriptive	Breast cancer	0-IV	Active and post-tx	Quality of life, physical, psychological, social, spiritual domains of quality of life	Quality of Life—Cancer
Spielman's Three-Factor Model ⁷³	Nursing	Intervention	Breast cancer	I-III	Post-tx	Cognitive-behavioral intervention, insomnia	Sleep Diary, wrist actigraph

Cancer Nurs. Author manuscript; available in PMC

77

drykowsk

73

Theory, Model, or Framework	Disciplines of Authors	Type of Study	Sample	Stage of Cancer	Cancer tx Status	Variables of Interest	Measure of Sleep-Wake
Theory of Unpleasant Symptoms	Nursing and psychology	Descriptive	Lung cancer	I–IV	Active tx	Symptom cluster: pain, fatigue, insomnia	Cancer Symptom Experience Inventory
Orem's Self-care Deficit Theory of Nursing	Nursing	Descriptive	Mixed sample of cancer	Any stage	NR	Pain, sleep disturbance, depression	Memorial Symptom Assessment Scale
Neuroendocrine- Based Regulatory Fatigue Model	Nursing and medicine	Descriptive	Breast cancer	II	Active tx	Fatigue, sleep, depressive symptoms, biomarkers	Demographic questionnaire (sleep disturbance), Piper Fatigue Scale (sleep disturbance item), wrist actigraph
Neuroendocrine- Based Regulatory Fatigue Model	Nursing, medicine, and biostatistics	Intervention	Breast cancer	NR	Post-tx (hormonal tx)	Fatigue, waking intervention, sleep disturbances, depressive symptoms, biomarkers, symptom management	Pittsburgh Sleep Quality Index
Theory of Unpleasant Symptoms	Nursing	Descriptive	Mixed sample of cancer	Majority metastatic	Active tx	Insomnia, fatigue, anxiety, depression, quality of life	Symptom Distress Scale
Orem's self-care Deficit Theory of Nursing	Nursing	Qualitative	Mixed sample of cancer	NR	Post-tx	Tiredness, weakness, self-care	Self-care interview
Spielman's Three-Factor Model	Psychology, psychiatry, and medicine	Descriptive	Lung cancer	I–IIIa, limited stage small cell lung cancer	NR	Insomnia, sleep hygiene, cancer symptoms, mood, quality of life	Structured Interview for Sleep Disorders, Sleep Hygiene Practice Scale, Insomnia Symptom Questionnaire, sleep log, wrist actigraph
Adapted Two-Process Model of Sleep Regulation	Nursing, psychology, and medicine	Descriptive	Lung cancer	Advanced disease	Active tx	Sleep-wake disturbances, quality of life	Pittsburgh Sleep Quality Index, Epworth Sleepiness Scale
Roy Adaptation Model	Nursing, biostatistics, psychology, medicine	Intervention	Mixed sample of cancer	0–IV	Active or post-tx	Exercise tolerance, activity, sleep patterns, quality of life	Wrist actigraph

Cancer Nurs. Author manuscript; available in PMC 2010 June 23.

Table 3

Comparisons Between Articles Without a Theory, Model, or Framework (n = 51) and Articles With a Theory, Model, or Framework (n = 22)

	Without Theory, Model, or Framework, n (%)	With Theory, Model, or Framework, n (%)	<i>p^a</i>
Author Disciplines Included Nursing			
No	38 (75)	2 (9)	<.001
Yes	13 (25)	20 (91)	
Types of Study			
Descriptive	40 (78)	16 (73)	.59
Intervention	11 (22)	6 (27)	
Sample: cancer diagnoses			
Mixed sample	20 (39)	6 (27)	.53
Breast only	23 (45)	13 (59)	
Other single cancer	8 (16)	3 (14)	
Sample: stage of cancer			
Nonmetastatic	16 (31)	11 (50)	.21
Metastatic	5 (10)	2 (9)	
Both	11 (22)	6 (27)	
Not reported	19 (37)	3 (14)	
Sample: treatment status			
Pretreatment	2 (4)	1 (5)	.60
Active treatment	12 (24)	9 (41)	
Posttreatment ^b	21 (41)	7 (32)	
Mixed sample	12 (24)	3 (14)	
Not reported	4 (8)	2 (9)	
Pittsburgh Sleep Quality Index included			
No	38 (75)	14 (64)	.35
Yes	13 (25)	8 (36)	
Polysomnography used			
No	46 (90)	22 (100)	.13
Yes	5 (10)	0 (0)	
Actigraphy used			
No	43 (84)	12 (55)	.01
Yes	8 (16)	10 (45)	

Significant differences are in bold.

^a *P* value based on χ^2 test of differences between groups.

^b Posttreatment included subjects taking hormonal therapy.

Table 4

Summary and Comparison of Theories, Models, and Frameworks

SWD	Model	Brief Synopsis	Physiological Components	Psychological Components	Behavioral Components
Primary	Biobehavioral Model of Altered Dysregulation in Circadian Systems	SWD manifested as circadian dysregulation	X	X	
Primary	Spielman's Three-Factor Model	Predisposing, precipitating, and perpetuating factors interact in insomnia	X	X	X
Primary	Adapted Two-Process Model of Sleep Regulation (adapted)	Process S and process C drive sleep and wakefulness	X	X	X
Secondary	Model of Quality of Life	Sleep as part of physical well-being, 1 of 4 quality of life domains	X	X	
Secondary	Model of Symptom Management	Symptom experience, symptom management and symptom outcomes are related	X	X	X
Secondary	Neuroendocrine-Based Regulatory Fatigue Model	Describes mechanisms of wake disturbances (fatigue)	X	X	
Secondary	Orem's Self-care Deficit Theory of Nursing	SWD potentially impact self-care abilities	X	X	X
Secondary	Piper's Integrated Fatigue Model	Sleep as one of several factors influencing fatigue	X	X	X
Secondary	Psychobiological model of hot flashes	Sleep disturbances as outcome of menopausal hot flashes	X		
Secondary	Roy Adaptation Model	Sleep as physiological mode of adaptation	X	X	
Secondary	Theory of Unpleasant Symptoms—adapted	Physiological, psychological, and situational factors influence sleep and other symptoms that negatively affect performance status	X	X	X

Abbreviation: SWD, sleep wake disturbances.