Nature and Science of Sleep

Elevate Series

Open Access Full Text Article

ORIGINAL RESEARCH

Prevalence of Insomnia and Associated Factors in Female Patients Undergoing Chemotherapy

Halil Taskaynatan, Betul Ersoz, Ufuk Camanli, Baris Gezici, Feyza Arslan Tan, Kivanc Mercan, Emir Gokhan Kahraman, Olcun Umit Unal

Department of Medical Oncology, University of Health Sciences, Izmir City Hospital, Izmir, Turkey

Correspondence: Halil Taskaynatan, Department of Medical Oncology, University of Health Sciences, Izmir City Hospital, Şevket Ince Neighborhood, 2148/11 Street, No: 1/11, Bayraklı, Izmir, 35540, Turkey, Tel +905364333248, Email haliltaskaynatan@gmail.com; halil.taskaynatan@sbu.edu.tr

Nature and Science of Sleep downloaded from https://www.dovepress.com/
For personal use only.

Purpose: Insomnia places significant physical and psychological burdens on female cancer patients undergoing chemotherapy, affecting their quality of life. This study aimed to investigate the prevalence of insomnia and its associated factors in female outpatients receiving chemotherapy.

Patients and Methods: A cross-sectional study was conducted with female cancer patients receiving chemotherapy. The questionnaire included items assessing sociodemographic and clinical characteristics. Insomnia was measured using the Insomnia Severity Index.

Results: A total of 206 female patients undergoing chemotherapy were included, with a mean age of 56.1 years (SD ± 11.7). The most common cancer types were breast (57.3%), gastrointestinal (22.8%), and gynecological malignancies (19.9%). Based on the Insomnia Severity Index (ISI), 34.0% of participants had subclinical insomnia and 17.0% had clinical insomnia. Increasing age was significantly associated with lower insomnia severity (aOR: 0.971; 95% CI: 0.945–0.998; p = 0.038). Among gynecological cancer patients, insomnia was more prevalent in those receiving treatment for metastatic disease (76.2% vs 35.0%). Psychiatric conditions (depression and/or anxiety) requiring medication and the presence of pain were both significantly associated with higher rates of insomnia ($p < 0.001$ for both).

Conclusion: Insomnia was highly prevalent among female cancer patients undergoing chemotherapy. Younger age, presence of pain, psychiatric comorbidities (particularly depression and/or anxiety), and metastatic disease status emerged as significant correlates. Considering the relationship between insomnia and physical and psychological distress, it is anticipated that regular screening and treatment approaches for insomnia will contribute to the holistic cancer care process by improving patient quality of life.

Keywords: women, cancer, chemotherapy, insomnia, insomnia severity index

Introduction

Overall cancer incidence has decreased in men but increased in women, reducing the male-to-female rate ratio (RR) from a peak of 1.6 (95% confidence interval, 1.57–1.61) in 1992 to 1.1 (95% confidence interval, 1.12–1.12) in 2021. Among individuals aged 50 to 64, cancer incidence is slightly higher in women than in men (832.5 vs 830.6 per 100,000). In addition, women under the age of 50 experience a significantly greater incidence rate 82% higher compared to men (141.1 vs 77.4 per 100,000). Although cancer mortality is on the decline, persistent racial disparities and the increasing disease burden among younger and middle-aged adults particularly women pose significant challenges to sustaining this progress.[1]

In this context, awareness of the symptom burden of female cancer patients is increasing, as living with them often presents significant physical and psychological challenges. Sleep problems, particularly insomnia, are among the most common and distressing symptoms in this population. Recent studies have highlighted the complex and multifactorial nature of insomnia in oncology patients, demonstrating that sleep problems in patients with cancer are strongly linked to various psychological and somatic symptoms such as depression, anxiety, fatigue, and pain.[2]

Quality sleep is a critical component of overall well-being, yet insomnia affects 29% to 75% of individuals diagnosed with cancer. The disease trajectory and therapeutic interventions such as chemotherapy, radiotherapy, and surgical procedures deteriorate patients' physical and psychological conditions, contributing to persistent sleep disturbances.[3–6]

Received: 24 July 2025
Accepted: 30 September 2025
Published: 8 October 2025

© 2025 Taskaynatan et al. This work is published and licensed by Dove Medical Press Limited. The full terms of this license are available at https://www.dovepress.com/terms.php and incorporate the Creative Commons Attribution – Non Commercial (unported, v4.0) License (http://creativecommons.org/licenses/by-nc/4.0/). By accessing the work you hereby accept the Terms. Non-commercial uses of the work are permitted without any further permission from Dove Medical Press Limited, provided the work is properly attributed. For permission for commercial use of this work, please see paragraphs 4.2 and 5 of our Terms (https://www.dovepress.com/terms.php).

Studies indicate that sleep disorders are the second most common symptom group in oncology, following cancer-related fatigue.[7]

Growing interest in the relationship between sleep and cancer is driven by a deeper understanding of how sleep may directly impact cancer development and how it could potentially influence mechanisms that regulate tumor growth and metastasis. Cancer patients frequently experience sleep disturbances, which, in turn, can have significant consequences. Beyond impairing quality of life, these sleep issues are linked to increased rates of mood disorders, accelerated disease progression, and reduced survival time.[8] In malignancies predominantly affecting women, such as breast and ovarian cancer, insomnia has been associated with decreased survival rates.[9,10]

Sleep disturbances have been widely researched in cancer patients, yet their significance is frequently overlooked by healthcare providers.[11] Accurate assessment of sleep disturbances in cancer patients is essential for improving patient health and improving survival rates, enhancing the effectiveness of antineoplastic treatments, improving quality of life, and minimizing comorbid conditions and treatment-related complications. The primary objective of this study was to examine the prevalence of insomnia and its associated factors among female outpatients undergoing active chemotherapy. While insomnia is a common problem in cancer patients, its prevalence and multifactorial associations with insomnia experienced by female ambulatory patients have not been adequately investigated, particularly in non-Western cultural contexts. The current study contributes to addressing this knowledge gap.

Materials and Methods

Subjects

This cross-sectional study was conducted at the Chemotherapy Unit of İzmir City Hospital between April 1, 2025, and July 1, 2025, and included patients undergoing chemotherapy. Only female patients who were aware of their cancer diagnosis confirmed either by their primary physician or a first-degree relative were eligible for inclusion. Participants were selected through a random sampling method. The objectives of the study, its procedures, and confidentiality assurances were explained in detail to all participants. Written informed consent was obtained from each participant prior to the administration of the questionnaire. All personal identifiers were kept strictly confidential and were accessible only to the research team. The study protocol was reviewed and approved by the Ethics Committee of İzmir City Hospital (Approval No:2025/195). The research process was carried out in accordance with the ethical standards stated in the Declaration of Helsinki.

Instrument

The questionnaire included items assessing sociodemographic and clinical characteristics such as age, presence of comorbidities, income level, educational status, smoking and alcohol use, presence of psychiatric disorders (eg, depression and/or anxiety) requiring pharmacological treatment, type of psychiatric medications used (if applicable), and the presence of pain. Pain assessment was measured as a categorical variable (present/absent) based on patient self-report, and validated pain measurement tools such as the Visual Analog Scale or Brief Pain Inventory were not used. The lack of a standardized measure of pain intensity constitutes a significant methodological limitation, limiting detailed analysis of the relationship between pain and insomnia levels. Additional clinical data, including tumor type, disease stage, current treatment status, history of immunotherapy or radiotherapy, and menopausal status, were collected by the clinician-researcher. Insomnia was evaluated using the Insomnia Severity Index (ISI), a validated self-report instrument designed to assess individuals' subjective perception of insomnia. Validation of the Turkish version of the ISI has been completed and it meets adequate psychometric standards for use in research.[12] The ISI comprises seven items that evaluate difficulties with sleep initiation, sleep maintenance, and early morning awakening, as well as the impact of sleep disturbances on daytime functioning, the level of concern or dissatisfaction with sleep problems, and the extent to which these issues are perceived by others. Each item is rated on a 4-point Likert scale. Based on the total ISI score (ranging from 0 to 28), a total ISI score of 0–7 was categorized as no clinically significant insomnia, 8–14 as subthreshold (subclinical) insomnia, and 15 or above as clinical insomnia.[13,14] However, the temporal discrepancy between the ISI's assessment framework, which focuses on the past two weeks, and the time required for a clinical

diagnosis of insomnia disorder (at least three months according to DSM-5 and ICSD-3) should be taken into account. This discrepancy between the measurement period and diagnostic standards is a factor that should be addressed within the context of the study's methodological limitations. During the data analysis process, participants with subclinical and clinical insomnia symptoms were categorized into a single group to form the insomnia-positive group.

Statistical Analysis

All statistical analyses were performed using SPSS version 30.0 (IBM Corp., Armonk, NY, USA) and Stata version 18.0 (StataCorp LP, College Station, TX, USA). An a priori sample size calculation was performed using G*Power version 3.1. The analysis was based on a two-tailed test, with the significance level set at $\alpha = 0.05$ and the desired statistical power at $1-\beta = 0.80$. An anticipated Cohen's $d = 0.405$, corresponding to a noncentrality parameter $\delta = 2.82$, was specified as the target effect size. The computation yielded a critical t-value of 1.97, indicating that a minimum of $n = 194$ participants would be required to reliably detect the hypothesized effect with an achieved power of 0.801. Continuous variables were presented as means and standard deviations (SD) or medians and interquartile ranges (IQR), depending on the normality of the distribution, while categorical variables were summarized as counts and percentages. Group comparisons for continuous variables were conducted using the independent samples *t*-test. The distribution of categorical variables such as educational status (below high school, high school and above), income status (low, middle, high), cancer type (breast, gastrointestinal system, gynecological malignancy), disease stage (Stage 1–2, Stage 3–4), menopausal status (premenopause, perimenopause, postmenopause), smoking status (yes, no), alcohol status (yes, no), comorbidities (hypertension, diabetes mellitus [DM], coronary artery disease [CAD], additional comorbidities), treatment intent (adjuvant, metastatic), radiotherapy status (received/receiving, none), immunotherapy status (received/receiving, none), psychiatric illness requiring medication (yes, no), and pain affecting sleep quality (yes, no) was assessed using the chi-square test or Fisher's exact test, as appropriate. To identify independent predictors of increased insomnia severity, multivariable logistic regression analyses were performed. The dependent variable was insomnia severity, dichotomized as "no clinically significant insomnia (ISI 0–7)" vs "subclinical (8–14) or clinical insomnia (≥15)" based on ISI scores. Variables included in the regression model were: age (continuous), education level (binary: below high school vs high school and above), income group (low, middle, high), cancer type group (breast, gastrointestinal system, gynecological malignancy), disease stage (Stage 1–2 vs Stage 3–4), menopausal status (premenopause, perimenopause, postmenopause), smoking status (yes, no), alcohol consumption (yes, no), hypertension (yes, no), diabetes mellitus (yes, no), coronary artery disease (yes, no), presence of additional comorbid diseases (yes, no), treatment intent (adjuvant vs metastatic), radiotherapy status (received/receiving, none), immunotherapy status (received/receiving, none), presence of psychiatric illness requiring medication (yes, no), and pain expected to affect sleep quality (yes, no). The multivariable model was constructed using the backward stepwise likelihood ratio (LR) method, and adjusted odds ratios (aOR) and 95% confidence intervals (CI) were calculated for each variable. The goodness-of-fit of the model was evaluated using the Hosmer-Lemeshow test, and all variance inflation factor (VIF) values were examined to assess multicollinearity, with values below 5 indicating no serious concern. For all statistical tests, a two-sided p-value of less than 0.05 was interpreted as indicative of statistical significance.

Results

Demographic and clinical characteristics of the 206 participants included in the study are shown in Table 1. The mean age of participants was 56.1 years (SD ± 11.7). The majority of patients had completed elementary school (54.9%), with fewer having attained higher education (16.0% university and above). Most participants reported a middle income (54.9%), whereas only a small proportion reported a high income (6.3%). Regarding malignancy type, breast cancer constituted the most common diagnosis (57.3%), followed by gastrointestinal system (GIS) cancers (22.8%) and gynecological malignancies (19.9%). Advanced disease was predominant, with 43.7% of patients classified as Stage 4 and only 6.3% at Stage 1. The majority of the study population consisted of postmenopausal women (60.2%), and a significant proportion of participants did not report smoking (89.3%) or alcohol consumption (96.6%). When evaluated for comorbidities, the prevalence of hypertension, diabetes, and coronary artery disease was 20.9%, 12.6%, and 7.3%, respectively. Additional comorbidities were observed in 38.8% of the cohort. In terms of treatment, 56.3% of patients

Table 1 Baseline Descriptive and Clinical Characteristics of the Study Group (n = 206)

Variables	**Total (n = 206)**
Age (years), mean ± SD	56.1 ± 11.7
Educational status, n (%)	
Elementary School	113 (54.9)
Middle School	20 (9.7)
High School	40 (19.4)
University and above	33 (16.0)
Income status, n (%)	
Low	80 (38.8)
Middle	113 (54.9)
High	13 (6.3)
Malignancy type, n (%)	
Breast	118 (57.3)
GIS[a]	47 (22.8)
Gynecological malignancy[b]	41 (19.9)
Stage, n (%)	
Stage 1	13 (6.3)
Stage 2	49 (23.8)
Stage 3	54 (26.2)
Stage 4	90 (43.7)
Menopausal status, n (%)	
Premenopause	44 (21.4)
Perimenopause	38 (18.4)
Postmenopause	124 (60.2)
Smoking status, n (%)	
None	184 (89.3)
Yes	22 (10.7)
Alcohol status, n (%)	
None	199 (96.6)
Yes	7 (3.4)
Comorbidity, n (%)	
Hypertension	163 (79.1)
None	43 (20.9)
Yes	
DM	
None	180 (87.4)
Yes	26 (12.6)
CAD	
None	191 (92.7)
Yes	15 (7.3)
Additional comorbidity, n (%)	
None	126 (61.2)
Yes	80 (38.8)
Treatment Setting, n (%)	
Adjuvant	116 (56.3)
Metastatic	90 (43.7)

(*Continued*)

Table 1 (Continued).

Variables	Total (n = 206)
RT status, n (%)	
None	120 (58.3)
Received treatment or receiving	86 (41.7)
Immunotherapy, n (%)	
None	193 (93.7)
Received treatment or receiving	13 (6.3)
Psychiatric illness[c] requiring medication, n (%)	
None	173 (84.0)
Yes	33 (16.0)
Pain	
None	160 (77.7)
Yes	46 (22.3)

Notes: [a]Colon, stomach, rectum, esophagus, pancreas. [b]Ovarian, endometrium, cervix. [c]Depression and/or anxiety.
Abbreviations: SD, standard deviation; RT, radiotherapy; GIS, gastrointestinal system; DM, diabetes mellitus; CAD, Coronary artery disease.

were receiving adjuvant therapy, while 43.7% were in the metastatic setting. Radiotherapy was administered to 41.7% of patients. Immunotherapy use was limited (6.3%). Psychiatric illness requiring medication was reported in 16.0% of patients. Additionally, 22.3% of participants experienced pain severe enough to impair sleep quality.

Table 2 presents the distribution of Insomnia Severity Index (ISI) scores among the study population. The mean ISI score was 8.3 (SD ± 5.5), with an interquartile range (IQR) of 4–8 and scores ranging from 0 to 21. In the classification based on ISI scores, approximately half of the study group (49.0%) did not show clinically significant insomnia symptoms, while 34.0% were in the subclinical insomnia category and 17.0% met the diagnostic criteria for clinical insomnia.

Table 3 also compares the distributions of sociodemographic and clinical characteristics between patients without clinically significant insomnia and those with subclinical or clinical insomnia. No significant differences were observed between groups in terms of age, educational status, income, malignancy type, disease stage, menopausal status, smoking, alcohol use, or primary comorbidities such as hypertension, diabetes mellitus, or coronary artery disease (all $p > 0.05$). Similarly, treatment setting (adjuvant versus metastatic), radiotherapy status, and receipt of immunotherapy did not differ significantly between groups. In patients with breast and gastrointestinal cancer, the distribution of treatment environment for insomnia did not differ significantly between the groups (p = 0.691 and p = 0.528, respectively). However, a significant difference was found in patients with gynecological cancer (p = 0.008); insomnia was more common in

Table 2 Distributions of Insomnia Severity Index Scores of the Research Group (n = 206)

Variables	Total (n = 206)
Insomnia Severity Index, mean ± SD	8.3 ± 5.5 (IQR: 4–8, min-max: 0–21)
Insomnia Severity group *, n (%)	
No clinically significant insomnia	101 (49.0)
Subclinical insomnia	70 (34.0)
Clinical insomnia	35 (17.0)

Notes: *Insomnia categories are based on ISI scores: 0–7 = no insomnia, 8–14 = subclinical, ≥15 = clinical insomnia.
Abbreviations: SD, standard deviation; IQR, interquartile range.

Table 3 Distribution of the Patients According to Insomnia Severity Index and Various Sociodemographic and Clinical Parameters (n = 206)

Variables	**No Clinically Significant Insomnia (n = 101)**	**Subclinical or Clinical Insomnia (n = 105)**	***p*-value**
Age (years), mean ± SD	57.1 ± 11.1	55.1 ± 12.4	0.215*
Educational status, n (%)			0.416**
Below high school	68 (67.3)	65 (61.9)	
High school and above	33 (32.7)	40 (38.1)	
Income status, n (%)			0.389**
Low	42 (41.6)	38 (32.6)	
Middle	51 (50.5)	62 (59.0)	
High	8 (7.9)	5 (4.8)	
Malignancy type, n (%)			0.399**
Breast	54 (53.5)	64 (61.0)	
GIS[a]	27 (26.7)	20 (19.0)	
Gynecological malignancy[b]	20 (19.8)	21 (20.0)	
Stage, n (%)			0.162**
Stage 1–2	35 (34.7)	27 (25.7)	
Stage 3–4	66 (65.3)	78 (74.3)	
Menopausal status, n (%)			0.469**
Premenopause	18 (17.8)	26 (24.8)	
Perimenopause	20 (19.8)	18 (17.1)	
Postmenopause	63 (62.4)	61 (58.1)	
Smoking status, n (%)			0.209**
None	93 (92.1)	91 (86.7)	
Yes	8 (7.9)	14 (13.3)	
Alcohol status, n (%)			0.717***
None	97 (96.0)	102 (97.1)	
Yes	4 (4.0)	3 (2.9)	
Comorbidity, n (%)			
Hypertension			0.081**
None	85 (84.2)	78 (74.3)	
Yes	16 (15.8)	17 (25.7)	
DM			0.249**
None	91 (90.1)	89 (84.8)	
Yes	10 (9.9)	16 (15.2)	
CAD			0.207**
None	96 (95.0)	95 (90.5)	
Yes	5 (5.0)	10 (9.5)	
Additional comorbidity, n (%)			**0.019****†
None	70 (69.3)	56 (53.3)	
Yes	31 (30.7)	49 (46.7)	
Treatment Setting, n (%)			0.085**
Adjuvant	63 (62.4)	53 (50.5)	
Metastatic	38 (37.6)	52 (49.5)	

(*Continued*)

Table 3 (Continued).

Variables	No Clinically Significant Insomnia (n = 101)	Subclinical or Clinical Insomnia (n = 105)	*p*-value
Treatment Setting, n (%)			
Breast			0.691**
Adjuvant	34 (63.0)	38 (59.4)	
Metastatic	20 (37.0)	26 (40.6)	
GIS[a]			0.528**
Adjuvant	16 (59.3)	10 (50.0)	
Metastatic	11 (40.7)	10 (50.0)	
Gynecological malignancy[b]			**0.008**†**
Adjuvant	13 (65.0)	5 (23.8)	
Metastatic	7 (35.0)	16 (76.2)	
RT status, n (%)			0.144**
None	64 (63.4)	56 (53.3)	
Received treatment or receiving	37 (36.6)	49 (46.7)	
Immunotherapy, n (%)			0.720**
None	94 (93.1)	99 (94.3)	
Received treatment or receiving	7 (6.9)	6 (5.7)	
Psychiatric illness[c] requiring medication, n (%)			**<0.001**†**
None	96 (95.0)	77 (73.3)	
Yes	5 (5.0)	28 (26.7)	
Pain			**<0.001**†**
None	93 (92.1)	67 (63.8)	
Yes	8 (7.9)	38 (36.2)	

Notes: *Independent sample *t*-test; **Chi-Square (χ^2) test; ***Fisher's Exact test; †Statistically significant (p<0.05); Bold values indicate statistically significant results (p<0.05); [a]Colon, stomach, rectum, esophagus, pancreas; [b]Ovarian, endometrium, cervix; [c]Depression and/or anxiety.

Abbreviations: SD, standard deviation; DM, diabetes mellitus; GIS, gastrointestinal system; CAD, Coronary artery disease; RT, radiotherapy.

patients receiving metastatic treatment (76.2% vs 35.0%). Insomnia was also more common in individuals with comorbidities (46.7% vs 30.7%, p = 0.019), in patients with psychiatric disorders requiring medication (26.7% vs 5.0%, p < 0.001), and in patients with pain affecting sleep quality (36.2% vs 7.9%, p < 0.001).

The results of a multivariable logistic regression analysis examining the association between insomnia severity and various sociodemographic and clinical parameters in the study population are presented in Table 4 (n = 206). After adjusting for potential confounders, several factors remained significantly associated with increased insomnia severity. Age was inversely associated with insomnia severity, with each additional year of age slightly reducing the odds of subclinical or clinical insomnia (aOR: 0.971, 95% CI: 0.945–0.998, $p = 0.038$). The presence of additional comorbidities was independently associated with higher odds of insomnia (aOR: 2.545, 95% CI: 1.315–4.925, $p = 0.006$). Patients with a psychiatric illness requiring medication had a markedly elevated risk of insomnia (aOR: 8.143, 95% CI: 2.764–23.992, $p < 0.001$). Similarly, those experiencing pain were significantly more likely to report subclinical or clinical insomnia (aOR: 5.895, 95% CI: 2.472–14.059, $p < 0.001$). The overall fit of the regression model was acceptable, as indicated by the Hosmer-Lemeshow test ($\chi^2 = 9.629$, p = 0.292). Multicollinearity was assessed using the VIF and tolerance statistics. All VIF values were below the commonly accepted threshold of five, indicating no serious multicollinearity concerns. Of note, tolerance values for all predictors were well above 0.2, further supporting the absence of problematic multicollinearity in the model.

Table 4 Multivariable Logistic Regression Analyses of the Association Between Insomnia Severity and Various Sociodemographic and Clinical Parameters (n = 206)

Variables	aOR [95% CI]	*P*-value*
Age	0.971 [0.945–0.998]	**0.038**†
Additional comorbidity, n (%) None Yes	 Ref 2.545 [1.315–4.925]	**0.006**†
Psychiatric illness[a] requiring medication, n (%) None Yes	 Ref 8.143 [2.764–23.992]	**<0.001**†
Pain None Yes	 Ref 5.895 [2.472–14.059]	**<0.001**†
Hosmer Lemeshow test	χ^2 = 9.629	0.292

Notes: The multivariable logistic regression model included the following variables: age (continuous), education level (binary), income group, cancer type group, disease stage (binary), menopausal status, smoking status, alcohol consumption, hypertension, diabetes mellitus, coronary artery disease, presence of additional comorbid diseases, treatment intent (adjuvant vs metastatic), radiotherapy status, immunotherapy status, presence of chronic disease requiring medication, and pain. The dependent variable was insomnia severity, dichotomized as "no clinically significant insomnia" vs "subclinical or clinical insomnia" based on ISI scores. †Statistically significant ($p<0.05$); Bold values indicate statistically significant results ($p<0.05$); [a]Depression and/or anxiety; *Multivariable logistic regression analysis was calculated by using the backward stepwise likelihood ratio (LR) method (14 steps). All VIF values were below the commonly accepted threshold of 5, indicating no serious multicollinearity concerns.

Abbreviations: aOR, Adjusted odds ratio; CI, confidence interval.

Discussion

Evaluation of insomnia prevalence among cancer patients is crucial for a comprehensive understanding of symptomatology and the development of effective management strategies. This study investigated the prevalence of insomnia and associated factors in female patients undergoing chemotherapy. Among ambulatory cancer patients receiving chemotherapy, the prevalence of clinical insomnia and subclinical insomnia was found to be 17% and 34%, respectively. These findings indicate that at least half of cancer patients experience insomnia to varying degrees. This result is consistent with previous studies.[15,16] A slight decrease in both subclinical and clinical insomnia prevalence was observed with increasing age. Insomnia symptoms exhibit strong associations with age, presence of pain, psychiatric medication use, and comorbidity burden. To the best of our knowledge, this study represents one of the rare studies that systematically investigates the insomnia profile and associated risk factors in female oncology patients undergoing chemotherapy for heterogeneous cancer types in a middle-income country context.

The study results indicate that a negative correlation between age and insomnia severity, with older patients reporting milder symptoms. This finding contradicts the findings of Ohayon et al's general population study,[17] which found that the prevalence of insomnia increased progressively with age. However, our data are consistent with specific studies in oncology. Indeed, one study found that patients under 58 years of age exhibited a significantly higher prevalence of insomnia compared with older age groups, with each decade of age increasing associated with a 29% decrease in insomnia symptom reporting.[15] Several contextual factors may help explain this inverse association in oncology populations. Younger patients are often diagnosed with cancer at an earlier stage of life, which imposes a greater psychological burden, including unexpected reductions in career plans, parenting responsibilities, and life expectancy. They may also receive more aggressive treatment regimens that may increase symptom burden. Furthermore, younger patients may be more likely to recognize or report sleep disturbances due to differences in sleep expectations or health-

seeking behaviors. These psychosocial and clinical dynamics specific to oncology practice may partially explain the inverse age-insomnia relationship observed in this and similar studies. These findings suggest that insomnia management in younger cancer patients may necessitate tailored and targeted intervention approaches; however, the cross-sectional nature of this investigation precludes causal inferences and longitudinal studies are needed to further clarify these associations.

An increased incidence of insomnia was documented in individuals treated with psychiatric medications for anxiety and/or depressive conditions. Similarly, another study found that participants reporting symptoms of depression and/or anxiety had significantly higher rates of insomnia compared to those without such symptoms. In that study, depression and anxiety were assessed using the Vietnamese version of the Hospital Anxiety and Depression Scale (HADS); however, it was not reported whether the patients were receiving pharmacological treatment.[16] Although the association between depression, anxiety, and insomnia is well-documented in both general and oncology populations, the specific prevalence and severity of insomnia among cancer patients with a confirmed diagnosis of depression or anxiety who are receiving psychiatric medications remains underexplored. Moreover, there is a risk of underestimating insomnia severity or overlooking its management in this subgroup based on the assumption that psychiatric treatment (eg, antidepressants or anxiolytics) adequately addresses sleep disturbances. It is important to note that despite adequate pharmacological intervention for depressive or anxiety disorders, insomnia symptoms may persist independently. This observation highlights the need for personalized assessment and treatment approaches for sleep disorders in patients with psychiatric comorbidities. However, the strength of this observation in our study is limited by the relatively small number of patients using psychiatric medications and by the lack of information regarding whether their psychiatric diagnosis preceded or followed their cancer diagnosis.

In the present study, no statistically significant association was observed between cancer type and the prevalence of insomnia. While insomnia appeared to be more common among patients with metastatic disease in the general population, this difference did not reach statistical significance. However, a statistically significant association was identified within the subgroup of patients with gynecological malignancies, in which those with metastatic-stage disease exhibited a markedly higher prevalence of insomnia. This finding is consistent with previous research, including a study conducted on patients with endometrial cancer, which also demonstrated a significant correlation between advanced disease stage and the occurrence of insomnia.[18] These results suggest a potential link between the metastatic stage and increased insomnia symptoms specifically in patients with gynecological cancers. The elevated prevalence of insomnia in this group may be attributed to the greater physical symptom burden and psychological distress commonly associated with advanced-stage disease.

The co-occurrence of symptoms such as pain, fatigue, and insomnia commonly referred to as a symptom cluster has been well documented in the literature.[16] In a separate study, the use of standardized pain assessment scales revealed a significant correlation between pain severity, sleep quality, and overall quality of life.[19] Although our study did not employ a validated instrument to quantify pain severity, participants were asked to report the presence or absence of pain. A statistically significant association was observed between the presence of pain and insomnia. This finding can be considered part of a broader symptom spectrum that occurs in cancer patients, along with sleep problems and poor quality of life. Early recognition and appropriate management of these conditions can contribute to the development of effective treatment strategies. Appropriate pain management may also help improve other symptoms, including sleep problems; however, further prospective studies are needed to definitively demonstrate this relationship.

In addition to statistical significance, the effect sizes we obtained demonstrate the clinical relevance of our findings. For instance, the risk of insomnia was more than eightfold increased in patients taking psychiatric medications, and this risk was sixfold higher in patients with pain. These large effect sizes demonstrate the serious clinical implications of these factors and indicate the need for specialized treatment approaches in these patient groups.

To better understand insomnia in cancer patients can be achieved by considering broader theoretical models of sleep regulation. In addition to the oncology-specific findings, The links between insomnia and psychological or physical stress found in this study can be explained by established sleep theories. The hyperarousal model of Bonnet and Arand proposes that increased mental, physical, or emotional arousal due to stress, pain, anxiety, or perceived threat plays a significant role in the development and maintenance of insomnia.[20] This model is particularly important for cancer

patients, who often face ongoing psychological distress, physical symptoms, and uncertainty about their illness, all of which can impact their sleep-wake cycles. Similarly, the two-process sleep model by Borbély et al explains that sleep as the interaction of a homeostatic sleep drive (Process S) and a circadian rhythm (Process C).[21] These processes may be disrupted by treatment-related behavioral changes, reduced activity, irregular exposure to light, and fatigue, which can contribute to sleep problems in cancer patients. Evaluating our results with these theories shows that sleep problems in cancer patients are multidimensional and that not only biological but also psychological and social factors should be taken into account in treatment. These models could serve as valuable frameworks for future research aimed at developing targeted sleep interventions for cancer patients.

This study was conducted on female outpatients from a single institution, resulting in a relatively small and limited sample. The cross-sectional nature of the study, absence of a control group, and reliance on voluntary participation without longitudinal follow-up constrain the generalizability of the findings. Additionally, as data were collected at a single time point, the reported prevalence of insomnia symptoms may not accurately capture their temporal variability. The use of the Insomnia Severity Index (ISI), which assesses symptoms over the past two weeks, also poses limitations, given that formal diagnostic criteria for insomnia disorder require a minimum symptom duration of three months.[22] Consequently, the insomnia prevalence reported here may not fully align with criteria for chronic insomnia. Moreover, this study employed solely self-reported sleep assessments and did not include objective measurements such as actigraphy or polysomnography. This limits the accuracy of our findings. In future studies, combining both self-reported and objective measurement methods would improve diagnostic accuracy and facilitate comparison across studies. Additionally, assessing pain only as "present" or "absent" without incorporating a validated test to measure pain severity limited our analysis. This methodological shortcoming may have impacted our full understanding of the relationship between pain and sleep disturbances. Furthermore, seasonal changes and the timing of chemotherapy treatments, which could affect sleep quality, were not recorded in the study. These omissions may limit the interpretation of our findings. Another limitation is that, although our model demonstrated acceptable fit according to the Hosmer-Lemeshow test, additional diagnostic assessments to evaluate regression robustness were not performed. Nevertheless, the exclusive focus on female patients and the inclusion of multiple cancer types are notable strengths. This study adds to the emerging body of evidence on insomnia in women undergoing chemotherapy and underscores the necessity for more robust, longitudinal research with broader assessment tools in the future.

Conclusion

This study has demonstrated that nearly half of female patients undergoing chemotherapy experience insomnia. The relationship between sleep and cancer is complex and influenced by multiple variables. Recognizing these factors may help inform the development of management strategies. While the precise impact of sleep on various cancer types remains to be fully characterized, clinical evaluation and management of insomnia may support treatment adherence and quality of life. Nevertheless, its influence on cancer-related outcomes is not yet clear and should be explored in prospective randomized studies. In addition, systematic screening and individualized interventions may be particularly relevant for younger patients, those experiencing pain, and individuals with psychiatric comorbidities.

Data Sharing Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Acknowledgments

The authors utilized ChatGPT (OpenAI, GPT-5 model) to assist with grammar correction and English language editing during the preparation of this paper.

Author Contributions

All authors take full responsibility for the content of this paper and have given their consent for its submission. Furthermore, all authors have reviewed and approved the final version of the paper and have collectively agreed to submit it to this journal. Conceptualization: Halil Taskaynatan and Betul Ersoz; Methodology: Ufuk Camanli, Baris

Gezici and Olcun Umit Unal; Data curation: Kivanc Mercan and Baris Gezici; Formal analysis: Ufuk Camanli and Feyza Arslan Tan; Investigation: Emir Gokhan Kahraman, Kivanc Mercan and Feyza Arslan Tan; Writing-original draft: Halil Taskaynatan, Betul Ersoz and Ufuk Camanli; Writing-review & editing: Halil Taskaynatan, Betul Ersoz, Olcun Umit Unal, Feyza Arslan Tan, Kivanc Mercan, Baris Gezici and Emir Gokhan Kahraman; Supervision: Olcun Umit Unal; Project administration: Halil Taskaynatan.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Siegel RL, Kratzer TB, Giaquinto AN, Sung H, Jemal A. Cancer statistics, 2025. *CA Cancer J Clin*. 2025;75:10–45. doi:10.3322/caac.21871
2. Gasparro R, Calabria E, Coppola N, et al. Sleep disorders and psychological profile in oral cancer survivors: a case-control clinical study. *Cancers*. 2021;13:1855. doi:10.3390/cancers13081855
3. Savard J, Villa J, Ivers H, Simard S, Morin CM. Prevalence, natural course, and risk factors of insomnia comorbid with cancer over a 2-month period. *J Clin Oncol*. 2009;27:5233–5239. doi:10.1200/JCO.2008.21.6333
4. Al Maqbali M, Al Sinani M, Alsayed A, Gleason AM. Prevalence of sleep disturbance in patients with cancer: a systematic review and meta-analysis. *Clin Nurs Res*. 2022;31:1107–1123. doi:10.1177/10547738221092146
5. Mogavero MP, DelRosso LM, Fanfulla F, Bruni O, Ferri R. Sleep disorders and cancer: state of the art and future perspectives. *Sleep Med Rev*. 2021;56:101409. doi:10.1016/j.smrv.2020.101409
6. Zhao K, Yu Z, Wang Y, Feng W. Prevalence of insomnia and related factors among cancer outpatients in China. *Nat Sci Sleep*. 2025;17:69–79. doi:10.2147/NSS.S492373
7. Phillips KM, Jim HS, Donovan KA, Pinder-Schenck MC, Jacobsen PB. Characteristics and correlates of sleep disturbances in cancer patients. *Support Care Cancer*. 2012;20:357–365. doi:10.1007/s00520-011-1106-z
8. Gottfried T, Kamer I, Salant I, et al. Self-reported sleep quality as prognostic for survival in lung cancer patients. *Cancer Manag Res*. 2020;12:313–321. doi:10.2147/CMAR.S234523
9. Wang H, Reid BM, Richmond RC, et al. Impact of insomnia on ovarian cancer risk and survival: a Mendelian randomization study. *E Bio Medicine*. 2024;104:105175.
10. Strøm L, Danielsen JT, Amidi A, Cardenas Egusquiza AL, Wu LM, Zachariae R. Sleep during oncological treatment—A systematic review and meta-analysis of associations with treatment response, time to progression and survival. *Front Neurosci*. 2022;16:817837. doi:10.3389/fnins.2022.817837
11. Laugsand EA, Sprangers MA, Bjordal K, Skorpen F, Kaasa S, Klepstad P. Health care providers underestimate symptom intensities of cancer patients: a multicenter European study. *Health Qual Life Outcomes*. 2010;8:104. doi:10.1186/1477-7525-8-104
12. Boysan M, Gulec M, Besiroglu L, Kalafat T. Psychometric properties of the insomnia severity index in Turkish sample. *Anadolu Psikiyatri Dergisi*. 2010;11:248–252.
13. Bastien CH, Vallières A, Morin CM. Validation of the insomnia severity index as an outcome measure for insomnia research. *Sleep Med*. 2001;2:297–307. doi:10.1016/S1389-9457(00)00065-4
14. Riemann D, Espie CA, Altena E, et al. The European insomnia guideline: an update on the diagnosis and treatment of insomnia 2023. *J Sleep Res*. 2023;32:e14035. doi:10.1111/jsr.14035
15. Palesh OG, Roscoe JA, Mustian KM, et al. Prevalence, demographics, and psychological associations of sleep disruption in patients with cancer: university of Rochester cancer center-community clinical oncology program. *J Clin Oncol*. 2010;28:292–298. doi:10.1200/JCO.2009.22.5011
16. Hoang HTX, Molassiotis A, Chan CW, Nguyen TH, Nguyen VL. New-onset insomnia among cancer patients undergoing chemotherapy: prevalence, risk factors, and its correlation with other symptoms. *Sleep Breath*. 2020;24:241–251. doi:10.1007/s11325-019-01839-x
17. Ohayon MM, Roth T. What are the contributing factors for insomnia in the general population? *J Psychosom Res*. 2001;51:745–755. doi:10.1016/S0022-3999(01)00285-9
18. Tuyan Ilhan T, Uçar MG, Gül A, Saymaz Ilhan T, Yavaş G, Çelik Ç. Sleep quality of endometrial cancer survivors and the effect of treatments. *Turk J Obstet Gynecol*. 2017;14:243–248. doi:10.4274/tjod.59265
19. Mystakidou K, Parpa E, Tsilika E, et al. The relationship of subjective sleep quality, pain, and quality of life in advanced cancer patients. *Sleep*. 2007;30:737–742. doi:10.1093/sleep/30.6.737
20. Bonnet MH, Arand DL. Hyperarousal and insomnia: state of the science. *Sleep Med Rev*. 2010;14:9–15. doi:10.1016/j.smrv.2009.05.002
21. Borbély AA, Daan S, Wirz-Justice A, Deboer T. The two-process model of sleep regulation: a reappraisal. *J Sleep Res*. 2016;25:131–143. doi:10.1111/jsr.12371
22. Sateia MJ. International classification of sleep disorders-third edition: highlights and modifications. *Chest*. 2014;146:1387–1394. doi:10.1378/chest.14-0970

Nature and Science of Sleep

Dovepress
Taylor & Francis Group

Publish your work in this journal

Nature and Science of Sleep is an international, peer-reviewed, open access journal covering all aspects of sleep science and sleep medicine, including the neurophysiology and functions of sleep, the genetics of sleep, sleep and society, biological rhythms, dreaming, sleep disorders and therapy, and strategies to optimize healthy sleep. The manuscript management system is completely online and includes a very quick and fair peer-review system, which is all easy to use. Visit http://www.dovepress.com/testimonials.php to read real quotes from published authors.

Submit your manuscript here: https://www.dovepress.com/nature-and-science-of-sleep-journal