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Original Article

Sleep in hospitalized children with cancer: relationship with psychiatric disorders and hospital conditions

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ABSTRACT

Background. Children with cancer often undergo prolonged and recurrent hospitalization, which leads to an increased incidence of sleep disruptions and psychiatric disorders. This study aimed to objectively quantify the prevalence of sleep disruptions in hospitalized pediatric oncology patients and to determine the effects of psychiatric disorders, treatment regimens, and hospital conditions on sleep patterns.

Method. This cross-sectional study included 39 children who were undergoing treatment and monitoring in the pediatric oncology inpatient service. Parents completed questionnaires providing information about their child's sleep patterns, quality of life, and hospital conditions. The children were monitored for five days using actigraphy to record sleep parameters. They were evaluated with a semi-structured interview form (Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version-DSM 5-Turkish Adaptation) for psychiatric diagnoses.

Results. Sleep disruptions were identified in 27 (69.2%) children with cancer. In addition to adjustment disorder and anxiety disorder psychiatric diagnoses, behavioral problems and emotional symptoms were more common in the group with sleep disruptions. Actigraphy measurements indicated that poor sleep was associated with younger age, recent cancer diagnosis, specific phobias, depression, daytime napping, and frequent vital sign assessments.

Conclusion. Sleep problems in hospitalized children with cancer are linked to psychiatric comorbidities, treatment routines, and hospital conditions. By recognizing psychiatric symptoms and optimizing hospital conditions that affect sleep, healthcare providers can enhance the quality of sleep for these children.

Key words: cancer, sleep, actigraphy, child psychiatry, Schedule for Affective Disorders and Schizophrenia for School-Age Children - Present and Lifetime Version, K-SADS-PL.

Cancer refers to a group of diseases characterized by the uncontrolled proliferation and spread of abnormal cells.[1] With advancements in early diagnosis and treatment, five-year survival rates have reached 80%, emphasizing the importance of quality of life and psychosocial approaches in the care of cancer patients.[2]

Adequate restorative sleep is crucial for children's pain perception, glucose regulation, neuroendocrine function, and immune system function.[3] However, treatment side effects, hospital environmental factors (such as noise and light), and frequent monitoring exacerbate sleep problems in pediatric cancer patients.[4,5] Sleep disruptions affect 30-75% of newly diagnosed or recently treated cancer patients, which is nearly double the rate seen in the general population.[6] Previous studies have shown that 60% of children with cancer

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experience excessive daytime sleepiness, 30-45% suffer from frequent sleep interruptions, and 66% have insufficient total sleep duration.[3,4,7]

In addition to sleep disruptions, children with cancer commonly experience depression, anxiety, adjustment disorder, post-traumatic stress disorder (PTSD), and behavioral problems. The rate of psychiatric diagnoses in this population is 2-2.5 times higher than that of the general population.[8-10] PTSD, anxiety and depressive symptoms persist in a significant proportion of children undergoing treatment and adolescent cancer survivors.[11] Notably, 50-80% of patients with psychiatric disorders experience sleep disturbances[12], suggesting that sleep issues may be related not only to cancer treatment and hospital conditions but also to comorbid psychiatric disorders.

Recent literature on sleep and cancer has highlighted a lack of studies on this topic and a dearth of objective sleep measurements in evaluating sleep disruptions.[4] This study aims to objectively assess sleep disruptions in pediatric oncology patients and investigate the impact of psychiatric disorders, treatments, and hospital conditions on sleep patterns during hospitalization. Specifically, we seek to answer the following questions: (1) What is the prevalence of sleep disruptions in hospitalized children with cancer based on objective measurements (actigraphy) and subjective scales? (2) Is the frequency of psychiatric comorbidities higher in the group with sleep disruptions compared to the group without sleep disruptions? (3) What hospital and treatment conditions are associated with sleep disruptions?

Materials and Methods

Sample

The study included 39 cancer patients who were being treated and followed up as in-patients in the Pediatric Hematology-Oncology Department between June 2021 and March 2022. The inclusion criteria were: (1) Age between 3 and 18 years, (2) Presence of a literate parent throughout the treatment, (3) Absence of autism spectrum disorder[13] or intellectual disability[14], as these conditions could affect data collection (i.e., actigraphy), (4) Informed consent provided by the parent or legal guardian. The Ethics Committee of Trakya University approved the study on June 14, 2021.

Data collection tools

Psychiatric evaluations were conducted by two experienced child and adolescent psychiatrists (B.G.Y. and H.C.A.) using the Schedule for Affective Disorders and Schizophrenia for School-Age Children - Present and Lifetime Version -DSM 5 - Turkish Adaptation (K-SADS-PL-DSM-5-T). In addition to the K-SADS-PL-DSM-5-T, Revised Child Anxiety and Depression Scale (RCADS), Preschool Anxiety Scale (PAS), Strengths and Difficulties Questionnaire-parent form, Pediatric Quality of Life Inventory (PedsQL), and Children's Sleep Habits Questionnaire (CSHQ) were employed to assess specific aspects of mental health, quality of life and sleep. Parents also completed a comprehensive sleep diary adapted for hospitalized children with cancer. Objective sleep data were collected using actigraphy.

Sociodemographic Data Form: This form was developed based on relevant literature to collect information about the children's sociodemographic characteristics, cancer type, age at diagnosis, treatment duration, treatment type, and prognosis.

Schedule for Affective Disorders and Schizophrenia for School-Age Children - Present and Lifetime Version - DSM 5 -Turkish Adaptation- (K-SADS-PL-DSM-5-T): This semi-structured interview tool developed by Kaufman et al.[15] comprises three parts: an unstructured interview gathering sociodemographic and developmental information, a structured screening of over 200 specific symptoms, and a diagnostic evaluation based on DSM-5 criteria. The assessment integrates information from child interviews, parent interviews, and clinical observations

to determine the presence and severity of psychiatric symptoms and diagnoses. Ünal et al.[16] conducted the validity and reliability study of the DSM-5 updated version in Turkish.

Strengths and Difficulties Questionnaire (SDQ): Designed by Goodman et al.[17] to screen for mental disorders in children and adolescents. It consists of 25 items with 5 subscales of behavioral problems, emotional symptoms, hyperactivity, peer problems, and prosocial behavior. Cut off values and interpretation are described elsewhere.[18] Güvenir et al.[19] conducted the validity and reliability studies of the Turkish version.

Pediatric Quality of Life Inventory (PedsQL): This scale was developed by Varni et al.[20] in 1999, with validity and reliability studies of the Turkish version performed by Memik et al.[21,22] The scale yields a total score, physical health score, and psychosocial health score, ranging from 0 to 100. Higher scores indicate better health-related quality of life.

Pre-school Anxiety Scale (PAS): Revised by Edwards et al. in 2018, with the Turkish version validated by Uğraş et al.[23] This 29-item scale measures social phobia, separation anxiety disorder, specific phobia, and generalized anxiety disorder symptoms in children aged 2 to 5 years. A score of ≥34 indicates an anxiety disorder.[24]

Revised Child Anxiety and Depression Scale (RCADS): Revised by Chorpita et al. from the Spence Anxiety Scale for Children[25] it includes 47 items across 6 subscales based on DSM-IV criteria. Gormez et al. conducted a validity and reliability study of the Turkish version.[26] Age and gender-specific scores were evaluated according to reference values.[25]

Sleep Diary: Adapted from the Sleep in a Children's Hospital–Parent Version (SinCH-P) and the Sleep at Memorial Sloan Kettering Cancer Center (SAM) questionnaires[4,27], it includes 12 items completed by parents,covering various aspects of sleep patterns and disturbances specific to hospitalized children with cancer (e.g. bed time, medication requirements, and vital signs measurement) (Supplementary Materials).

Children's Sleep Habits Questionnaire (CSHQ): Developed by Owens et al.[28] to investigate children's sleep habits and problems Perdahlı Fiş et al. conducted the validity and reliability study of the Turkish version in 2010.[29] A score of ≥41 is considered 'clinically significant'. Although originally designed for children aged 4 to 10 years[28], it has been found useful for screening sleep problems in toddlers[30] and has been used in studies with adolescents.[31,32]

Actigraphy: The Actiwatch 2 device (Actiwatch 2®, Philips Respironics, Murrysville, PA, USA) was used to measure rest-activity patterns, detect light and motor movements, and monitor sleep-wake cycles. It was placed on the non-dominant wrist of each patient for five days. Sleep parameters were analyzed according to age-specific reference values.[3,33,34] In line with previous research the following criteria were applied for sleep parameters: Sleep onset latency exceeding 20 minutes was considered prolonged. The reference values for total sleep duration varied by age group: 10-13 hours for ages 3-5 years, 9-11 hours for ages 6-11 years, and 8-10 hours for ages 12-17 years.[34] Sleep efficiency below 80% was regarded as low.[3,34] Bedtime was considered delayed if it was later than 22:00 for the 3 to 5 years age group, 23:00 for the 6 to 11 years age group, and 24:00 for the 12 to 17 years age group. Similarly, a wake-up time later than 9:00 for all age groups was considered a delayed wake-up time.[3,33,34]

Data analysis

Data were analyzed using SPSS version 22.0 software. Descriptive statistics were reported as mean ± standard deviation (SD), median, minimum, maximum values, or number (n) and percentage (%). The one sample Kolmogorov-Smirnov test was used to evaluate the normality of distribution. Independent samples t-test and Mann-Whitney U-test were applied for quantitative data analysis. Relationships

between quantitative variables were examined using Pearson or Spearman correlation analysis. Pearson, Yates, or Fisher exact chi-square tests were used for categorical data. A p-value <0.05 was considered statistically significant.

Results

The study evaluated 39 patients, consisting of 71.8% males and 28.2% females, with a mean age of 10.1 ± 5.2 years (median: 11 years). Of these, 51.3% (n=20) were in the pediatric age group (3-11 years) and 48.7% (n=19) in the adolescent age group (12-17 years). Eleven children in the pediatric group were under 6 years of age. Patients were monitored for hematological tumors (53.8%), central nervous system (CNS) tumors (7.7%), and other solid tumors (38.5%). Of the total patients, 61% were hospitalized for initial diagnosis, 30.8% for relapse diagnosis, and 7.7% for routine follow-up (Table I).

According to the CSHQ, 69.2% of all patients and 81.8% of patients under 6 years of age had sleep disturbances. Actigraphy revealed that 74.4% of patients exhibited prolonged sleep onset latency (Table I). No significant

Table I. Sociodemographic, psychiatric and sleep data of patients with cancer.

		n	%
Age (years)	3-11	20	51.3
	12-17	19	48.7
Gender	Male	28	71.8
	Female	11	28.2
CSHQ Sleep disruptions	Yes	27	69.2
	No	12	30.8
Actigraphy Sleep onset latency (>20 minutes)	Yes	29	74.4
	No	10	25.6
K-SADS Psychiatric diagnosis	Yes	25	64.1
	No	14	35.9
Tic disorder	Yes	1	2.6
Encopresis	Yes	1	2.6
Enuresis	Yes	2	5.1
Specific phobia	Yes	3	7.7
Social phobia	Yes	5	12.8
Separation anxiety	Yes	8	20.5
Generalized anxiety	Yes	3	7.7
Disruptive mood dysregulation disorder	Yes	2	5.1
Depression	Yes	3	7.7
Adjustment disorder	Yes	8	20.5
Attention deficit hyperactivity disorder	Yes	7	17.9
Oppositional defiant disorder	Yes	2	5
Cancer type	Hematological tumor	21	53.8
	CNS tumor	3	7.7
	other solid tumors	15	38.5
Diagnosis	Initial diagnosis	24	61.5
	Relapse	12	30.8
	Remission	3	7.7

CSHQ, Children's Sleep Habits Questionnaire; CNS, central nervous system; K-SADS, Schedule for Affective Disorders and Schizophrenia for School-Age Children.

differences between genders were observed regarding sleep disruptions. Younger patients experienced significantly higher numbers of awakenings (p=0.043) and wakening after sleep onset (WASO, p=0.040). WASO was also higher in patients who napped during the day (p=0.049) and those with initial diagnosis (p=0.015), but lower in patients with relapsed diagnosis (p=0.039). Sleep efficiency was lower in patients who napped during the day (p=0.001), and those with an initial diagnosis (p=0.009), but higher in patients with relapse (p=0.022). Sleep onset latency was higher in patients who napped during the day (p=0.027, Table II).

According to the K-SADS-PL, 64.1% of all these patients with cancer had a psychiatric diagnosis (Table I). The most common diagnoses were anxiety disorders, trauma-related disorders, attention deficit hyperactivity disorder (ADHD), depression disorders, externalizing disorders, oppositional defiant disorder (ODD), and tic disorders.

The presence of any psychiatric diagnosis (77.8% vs 23.3%, p=0.012) and adjustment disorder diagnosis (29.6% vs 0%, p=0.034) were higher in the group with sleep disorders compared to the other group. In the pre-school age group with sleep disruptions, the rate of anxiety disorder diagnosis was higher (100% vs 0%, p=0.018, Table III). A negative correlation was found between the specific phobia scores on the PAS administered to children under age 6 and total sleep duration (r=-0.632, p=0.037, Table II). Sleep efficiency was lower in patients with depression (p=0.031). Onset latency was higher in patients who were diagnosed with depression (p=0.029, Table II).

Psychosocial health score was found to be lower in the group with sleep disruptions (p = 0.048). In addition to general difficulty (p=0.006), when the SDQ was evaluated, emotional symptoms (p=0.017) and behavioral problems (p=0.001) were found to be more prevalent among patients with sleep disruptions (Table III).

Table II. Examination of factors associated with the actigraphy data of the patients.

		Time in bed	Total sleep time	Onset latency	Sleep efficiency	WASO	Number of awakenings
Age	r (n=25)	-0.144	-0.187	0.046	0.095	-0.330	-0.326
	p	0.383[s]	0.255*	0.779[s]	0.564*	***0.040****	***0.043****
Initial diagnosis	Yes (n=3)	563.7±105.8	448.4±96	14.2±9.9	80.2±5.8	75.1±21.5	29.3±9.1
	No (n=36)	596.4±126.4	482.8±110.8	13.5±13.3	84.9±16.8	59.4±16.8	26.2±8.8
	p[m]	0.784	0.386	0.355	***0.009***	***0.015***	0.284
Relapse	Yes (n=8)	568.1±79.7	481.6±64.9	12.2±11.3	85.0±3.4	59.1±14.3	26.5±8.1
	No (n=31)	565.0±125.8	452.7±114.6	14.7±11.2	80.6±5.9	73.5±22.2	28.9±9.4
	p[m]	0.915	0.191	0.247	***0.022***	***0.039***	0.447
K-SADS depression	Yes (n=3)	566.3±57.7	418.3±69.3	29.7±3.3	73.7±6.4	88.7±22.9	31.5±4.8
	No (n=36)	565.9±116.5	465.2±104.1	12.6±10.6	82.7±5.1	67.4±20.3	27.8±9.3
	p[m]	0.979	0.370	***0.029***	***0.031***	0.155	0.370
PAS-specific phobia	r (n=11)	-0.577	-0.632	0.132	-0.373	-0.042	-0.237
	p*	0.063	***0.037***	0.699	0.259	0.903	0.484
Napping during the day	Yes (n=7)	566.29±103.4	454±93.4	15.9±11.6	80.7±5.6	71.6±21.6	28.3±9.5
	No (n=32)	564.7±151.5	491.3±133.2	6.4±3.9	86.9±1.8	59.1±16.1	27.6±7.5
	p[m]	0.808	0.434	***0.027***	***0.001***	***0.049***	0.945

K-SADS, Schedule for Affective Disorders and Schizophrenia for School-Age Children; PAS, Pre-School Anxiety Scale; r, correlation coefficient; WASO, wakening after sleep onset.
[m] Mann-Whitney U test, *Pearson correlation analysis, [s] Spearman correlation analysis

Table III. Comparisons of PedsQL, SDQ, K-SADS-PL and PAS in patients with and without sleep disruptions according to the CSHQ.

	Sleep disruptions (+)		Sleep disruptions (-)		P
	Mean±SD		Mean±SD		
PedsQL: Psychosocial health total score	62.0 ± 19.7		74.9 ± 15.2		***0.048***[m]
	n	%	n	%	
SDQ: General difficulty	12	44.4	0	0	***0.006***[X²]
SDQ: Emotional symptoms score	13	48.1	1	8.3	***0.017***[X²]
SDQ: Behavioral problems score	16	59.3	0	0	***0.001***[X²]
K-SADS: Presence of diagnosis	21	77.8	4	23.3	***0.012***[X²]
Adjust K-SADS: ment disorder	8	29.6	0	0	***0.034***[X²]
PAS: Anxiety disorder	9	100	0	0	***0.018***[X²]

CSHQ, Children's Sleep Habits Questionnarie; K-SADS, Schedule for Affective Disorders and Schizophrenia for School-Age Children; PAS, Pre-School Anxiety Scale; PedsQL, Pediatric Quality of Life Inventory; SD, standard deviation; SDQ, Strengths and Difficulties Questionnaire.
[m] Mann Whitney U test, [X²] Chi-square test (Fisher exact test).

In the hospital conditions evaluations, there was no relationship between the sleep disturbance and need for sleep medication, pain during sleep, noise-light in the room, presence and type of cancer treatment (Table IV). However, there was a difference in normal bed time and late bedtime according to the frequent vital sign assessments (≥3) (36.4% vs 63.6%, p=0.06).

Discussion

Sleep issues as well as psychiatric symptoms and disorders are prevalent in children with cancer, negatively impacting their quality of life.[4] This study demonstrates that children with cancer who experience sleep problems are more likely to have psychiatric issues compared to those who sleep well. Adjustment disorder diagnosis across all ages and anxiety disorders in pre-schoolers were more common in those with sleep disruptions. Patients with depression exhibited decreased sleep efficiency. Furthermore, frequent vital sign assessments were found to delay bedtime in these hospitalized children.

According to the CSHQ, 69.2% of the children with cancer in this study were diagnosed with sleep disruptions, more than twice the rate in the general pediatric population (20-30%).[35] This aligns with Traube et al.'s findings, where 66% of hospitalized children with cancer had inadequate sleep.[4] In an adult study, 30-75%

Table IV. Comparisons of hospital conditions and types of treatment in patients with and without sleep disruptions according to the CSHQ.

	Sleep disruptions present		No sleep disruptions		P
	n	%	n	%	
Need for sleep medication	3	11.1	0	0	***0.539***[f]
Pain during sleep	4	14.8	2	16.7	***1.000***[f]
Noise, light in the room	4	14.8	1	8.3	***1.000***[f]
Surgical Treatment	2	7.4	0	0	***1.000***[f]
Radiotherapy	2	7.4	0	0	***1.000***[f]
Chemotherapy	11	40.7	5	41.7	***0.957***[f]
Cancer treatment	15	55.6	5	41.7	***0,423***[f]

CSHQ: Children's Sleep Habits Questionnaire, [f] Fisher exact test.

of newly diagnosed or recently treated cancer patients reported sleep disruptions, nearly double the rate of the general population.[6]

As a result of the analysis a significant correlation between actigraphy data and age was revealed, with younger children exhibiting an increased number of awakenings after sleep onset and longer total time spent awake. These findings align with previous research on sleep patterns in hospitalized pediatric populations. For instance, Meltzer et al. observed that school-age children experienced more sleep disturbances compared to adolescents in a hospital setting.[27] Similarly, Stremler et al. reported the most substantial decrease in sleep duration among the youngest age group of hospitalized pediatric patients.[5] These consistent results suggest that younger children may find hospitalization more distressing and struggle to cope with unfamiliar environments.

Le Guen et al.'s study on cancer patients revealed disrupted nocturnal sleep patterns, including difficulty initiating sleep, frequent awakenings, and reduced sleep efficiency.[36] Similarly, our study demonstrated that patients who napped during the day exhibited prolonged sleep latency, decreased sleep efficiency, and increased WASO. These results suggest a vicious cycle in which interrupted nighttime sleep leads to daytime sleepiness, further exacerbating nighttime sleep problems.

Our study revealed that patients in the newly diagnosed group exhibited low sleep efficiency and high WASO values. Similarly, Le Guen et al. reported similar patterns of low sleep efficiency and high WASO in newly diagnosed cancer patients compared to a control group.[36] Additionally, Chang et al. observed poorer sleep quality in adult patients with newly diagnosed lung cancer relative to healthy controls.[37] Collectively, these results suggest that the uncertainties and stress associated with diagnosis and treatment initiation may significantly disrupt sleep.

Interestingly, our study found that patients with recurrent hospitalizations due to relapse exhibited shorter sleep latency, higher sleep efficiency, and lower WASO, which is contrary to some previous findings.[38] This may be due to better disease interpretation and adaptation to hospital routines in older, experienced patients.[39] Our findings suggest that older patients with recurrent relapses may have a more sophisticated understanding of their condition, potentially easing adaptation to hospital routines. This familiarity, combined with consistent care, may facilitate quicker adjustment to hospital environments, including sleep patterns, potentially preventing sleep disorders in this population.

While the prevalence of psychiatric diagnoses in the general child and adolescent population is estimated to be approximately 20%, studies have demonstrated that this rate increases 2 to 2.5-fold in children and adolescents diagnosed with chronic diseases such as cancer, compared to their healthy peers.[8,10,40] Consistent with these findings, the current study observed a prevalence of psychiatric diagnoses in children with cancer of 64.1%.

The group with sleep disruptions exhibited a significantly higher prevalence of psychiatric diagnoses, with adjustment disorder being the most common diagnosis at the rate of 29.6%. This finding aligns closely with a study by Rait et al., which reported a 31% rate of adjustment disorder with depressive features in children with cancer.[41] Importantly, Kouros et al. highlighted a bidirectional relationship between sleep disorders and adjustment disorders, suggesting that these conditions may influence each other through mood alterations such as tension and anger.[42] This interplay is particularly relevant in our context, as sleep disturbances, including frequent awakenings and reduced sleep duration, may exacerbate adjustment disorders by elevating perceived stress levels and diminishing coping abilities in children. Conversely, symptoms associated with

adjustment problems, such as pain and fatigue, may also contribute to sleep disorders, creating a potential cycle of mutual reinforcement.

Roy-Byrne et al. reported that the prevalence of any anxiety disorder in cancer patients ranges from 6% to 33%.[43] In the present study, anxiety disorders were the most common psychiatric diagnosis among children with cancer, occurring in 33.3% of cases. Previous literature has indicated that symptoms related to sleep disturbance can affect up to 80-90% of children diagnosed with anxiety disorders.[38,40] Thus, the high rates of sleep disruptions observed in our study sample may be associated with the increased prevalence of anxiety disorder diagnoses.

This study revealed that children younger than 6 years who experienced sleep disruptions exhibited a higher prevalence of anxiety disorders and elevated scores for specific phobia associated with shorter total sleep duration, an association not observed in children older than 6 years. The concurrent diagnosis of sleep disruptions and anxiety disorders in young children may be attributed to their heightened sensitivity to diagnostic procedures and treatment side-effects, as well as their increased vulnerability to the distress of hospitalization.[39,44,45] Furthermore, sleep disturbances in this age group may be exacerbated by fear associated with intensive interventional procedures and frightening thoughts or visual images related to themes such as darkness and sleeping alone.

Depression significantly impacts sleep patterns, affecting both quality and quantity. Depressed individuals often experience delayed sleep onset, reduced deep sleep, frequent awakenings, and daytime drowsiness.[46] This relationship is particularly evident in adolescents, with 88% of depressive disorders accompanied by sleep issues. Chronic insomnia is associated with a 2-3 fold increased risk of depression.[47,48] Our study corroborates existing research, demonstrating that depressed patients exhibit longer sleep onset latency and decreased sleep efficiency compared to non-depressed counterparts. These findings highlight the importance of sleep regulation, especially for vulnerable groups like cancer patients. The link between sleep quality, depression recurrence, and suicidal behavior underscores the critical nature of this relationship.[49]

Our study revealed higher rates of affective and behavioral problems and lower psychosocial subscale scores on the PedsQL in the group with sleep disturbances. These findings corroborate previous research demonstrating increased affective and behavioral problems in children with sleep issues[50,51] and diminished psychosocial subscale scores on the PedsQL among adolescents undergoing chemotherapy.[52] These results further underscore the detrimental effects of sleep disruption in this population.

Previous research has demonstrated that frequent nighttime vital sign assessments are associated with sleep disturbance in hospitalized children with cancer.[4] Our study corroborates and extends these findings, revealing that such assessments were linked to delayed bedtimes and reduced total sleep time. Interestingly, while existing literature has emphasized the role of environmental factors (e.g., noise and light), cancer treatment modalities, and pain levels in disrupting sleep for these children[3-5,53], our results did not show significant effects of these variables. This discrepancy may be attributed to our study's limited sample size, which potentially attenuated the detectable impact of these factors.

Our study's primary strength lies in its comprehensive approach to sleep assessment in pediatric cancer patients, employing both objective and subjective measures. The use of 5-day actigraphy records under controlled hospital conditions minimized environmental variability and ensured consistent data collection. Furthermore, the integration of detailed psychiatric evaluations, including semi-structured interviews and standardized scales, distinguishes this research from previous studies in the field.

However, several limitations warrant consideration. The study was conducted during the COVID-19 pandemic, potentially influencing children's sleep patterns. The absence of pre-hospitalization sleep data and the heterogeneity of cancer stages among participants limit our ability to draw definitive conclusions about cancer-specific sleep disruptions. Additionally, the lack of information on hospitalization duration and comorbidities constrains the depth of our analysis. Finally, the small sample size and limited representation in ceratin subgroups restrict the generalizability of our findings. Future research should address these limitations by employing larger, more homogeneous samples and accounting for pre-existing sleep patterns and comorbidities.

Pediatric cancer patients undergoing inpatient treatment experience a markedly higher prevalence of sleep disturbances compared to healthy children. These disruptions can significantly impact psychiatric symptoms, treatment adherence, and hospitalization duration. However, sleep disorders and associated psychiatric conditions in this population are often overlooked, being mistakenly attributed solely to cancer diagnosis and treatment. To address this issue, a comprehensive approach is crucial. This includes providing targeted sleep education, optimizing hospital environments, increasing awareness among healthcare providers about the sleep-psychiatric symptom relationship, and facilitating timely child psychiatry consultations. Implementation of these strategies can lead to earlier detection and management of sleep problems, ultimately enhancing the quality of life for pediatric cancer patients.

Ethical approval

The study was approved by Ethics Committee of Trakya University (date: 14.06.2021, number: 2021-278).

Author contribution

The authors confirm contribution to the paper as follows: Study conception and design: BGY, HCA, TE; data collection: BGY; analysis and interpretation of results: BGY, HCA; critically reviewing the work for important intellectual content: BGY, HCA, TE; draft manuscript preparation: BGY. All authors reviewed the results and approved the final version of the article.

Supplementary materials

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Conflict of interest

The authors declare that there is no conflict of interest.

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