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# Evaluating Sleep Habits and Related Factors in Childhood Cancer Survivors: A Cross-Sectional Study

Fahimeh Soheilipour[1], Mohammad Faranoush[1], Atefeh Ghanbari Jolfaei[2], Roya Isa Tafreshi[3], Fatemeh Kashaninasab[4,*]

1. Pediatric Growth and Development Research Center, Institute of Endocrinology and Metabolism, Iran University of Medical Sciences, Tehran, Iran
2. Minimally Invasive Surgery Research Center, Iran University of Medical Sciences, Tehran, Iran
3. Iran University of Medical Sciences, Aliasghar Children's Hospital, Tehran, Iran
4. Mental Health Research Center, Tehran Institute of Psychiatry, Iran University of Medical Sciences, Tehran, Iran.
*Corresponding author: Dr Fatemeh Kashaninasab, Assistant Professor of Psychiatry, Sleep Medicine Fellowship, Mental Health Research Center, Tehran Institute of Psychiatry, Iran University of Medical Sciences, Tehran, Iran. Email: kashaninasab.f@iums.ac.ir, ghazalehkashani@yahoo.com. ORCID ID: 0000-0003-4463-7399

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**Abstract**

**Background:** Sleep habits may play a role in the onset of sleep disorders. Several factors affect sleep habits. This study aimed to investigate sleep habits and related factors in childhood cancer survivors (CCS).

**Materials and Methods:** This cross-sectional study was performed on 400 children (age range: 5-15 years) who recovered from cancer in Tehran, Iran, in 2020. A 35-item Children's Sleep Habits Questionnaire (CSHQ) was used to determine children's sleep habits. Correlation coefficient test, independent t-test, and one-way analysis of variance (ANOVA) were used to determine the correlation between results.

Results: Participants' mean age was 10.45± 12.3 years (49% males vs. 51% females). The mean total score of the CSHQ was 58.53±7.8. There was a negative and significant relationship between age and the total score of CSHQ (P=0.009). Independent t-test showed that the subscales and the total score of the CSHQ were not significantly different between males and females (P=0.834). There was no significant relationship between the total score of the CSHQ and the duration after recovery (P=0.08).

**Conclusions:** The CCS are at higher risk of sleep disorders and the possibility of sleep disorders is higher in younger patients. Girls and boys who have survived cancer are equally prone to sleep disorders. There is a possibility of developing sleep disorders at any time during the recovery period. Factors such as the family's socioeconomic status, level of physical health, duration of cancer, and the age of the children should be considered when assessing and treating sleep problems in CCS.

**Keywords:** Cancer survivors, Child, Habits, Sleep

## Introduction

Cancer is one of the most common diseases and the leading cause of death in all age groups (1). Nowadays, the risk of childhood cancer is increasing. The most common childhood cancers are leukemia and brain cancer (1-2). The surging prevalence of cancer imposes high costs on countries' health care systems (3). Recent advances in cancer treatment have significantly improved the percentage of childhood cancer survivors (CCS) (4) so that about 75% of these children experience long-term survival (5). However, children recovering from cancer are more likely to be diagnosed with chronic diseases such as cardiovascular disease, hypertension, dyslipidemia, and psychiatric disorders, affecting their lives (6-7). Recently, a surge in the onset of sleep disorders among children has been witnessed, and numerous studies have reported its prevalence up to about 30%. This is very important in children recovering from cancer (8-10), as sleep disorders in children can impair the functioning of the immune, cardiovascular, and endocrine systems, which can lead to incurable cancer and even affect the function of the child in chronic cases (11-12).



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There are no accurate statistics on the prevalence of sleep disorders in children with cancer or CCS. However, a study on children with cancer found that daytime sleepiness was one of the most common sleep-related problems, occurring in more than 60% of the patients (13). Sleep-related disorders and habits are influenced by biological, psychological, environmental, and social factors (14). The leading causes of sleep disorders in children with cancer include the neurological damage caused by neoplasms, the side effects caused by medical treatment, hospitalization, anxiety, depression, and pain. It should also be noted that some of these children had sleep problems before the onset of the disease (13).

Considering the critical role of culture in children's sleeping habits, the distinction between normal and abnormal sleeping habits and behaviors is affected by the community's culture. Hence, it is essential to have accurate information about children's sleeping habits and behaviors in the communities to assess their sleep problems (15). A qualitative study in the United States on preschoolers in 2018 explored Brazilian immigrant mothers' beliefs, attitudes, and practices related to their children's sleep and bedtime routines. The results showed that most mothers were aware of the importance of sleep and sleep duration for their children's healthy growth and development; they also highlighted the importance of consistent bedtime routines. Nevertheless, many mothers reported inconsistent and suboptimal bedtime routines, including the lack of predictable and orderly bedtime activities such as bath, reading, and using electronics in bed (16).

Jalilolghadr et al. (2012) evaluated the sleep habits of Iranian pre-school children and reported that Iranian children had shorter night sleep duration than expected for their age group. The bedtime of the majority (85%) of nap-takers was 22:00 or later. This might be attributed to cultural characteristics, climate differences, or harmful sleep habits (17).

In many cases, the presence of a medical illness crisis can form co-sleeping (the need for another person to be present during sleep). One study found that 22% and 8% of parents whose children had recently been diagnosed with epilepsy and diabetes, respectively, slept in their children's bedroom since they were anxious about their children's physical illness (18). Therefore, when examining and treating sleep disorders in children with complex physical diseases such as cancer, it is essential to consider the factors influencing the formation and persistence of sleep disorders and the children's physical illness. It seems that considering the sleep habits of these children can play an important role in identifying sleep problems as accurately as possible. Due to the dependence of sleep habits on various environmental and cultural factors, the results of most non-Iranian studies cannot be generalized to the Iranian population. In addition, so far, no study has examined the sleep habits in Iranian CCS. Hence, no information is available about the role of physical illness and demographic factors affecting sleep habits among Iranian CCS cases. Accordingly, this study aimed to investigate sleep habits in children who recovered from cancer in Tehran, Iran.

## Materials and Methods

This cross-sectional descriptive study was performed on 400 children recovered from any type of cancer from March to May 2020 in Tehran, Iran. The research samples consisted of all children referred to Rasool-e-Akram Hospital and the Society to Support Children with Cancer (MAHAK) for cancer treatment. Sampling was done by a simple random method in which the selection of individuals from each treatment center was proportional to the center's share from the total number of patients. First, all eligible individuals were estimated separately in both centers. Then,



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each center's share in the number of referred patients was considered, and the samples were selected from the center. Finally, a list was prepared using the total number of individuals chosen from both centers. The researchers choose samples using random number generator software to minimize any biases.

Inclusion criteria were: under 15 years of age, being diagnosed with cancer at least for five years, and recovery from cancer at the time of participation in the study. Samples were excluded from the study if cancer recurred in participants. The criteria for recovery from cancer were determined by a pediatric oncologist and recorded in patients' records.

After explaining the research objectives to the parents and children and obtaining written consent from parents, the questionnaires were provided to the parents (mother or father), and the research was conducted in a private environment. Parents were also assured that their children's identities would remain confidential. The researchers completed the questionnaires while meeting the parents and children during the interviews. If it was not possible for parents to attend the center and complete the questionnaire, the researchers collected the answers by making phone calls.

The tools used in this study included the Children's Sleep Habits Questionnaire (CSHQ) and a demographic questionnaire. The demographic questionnaire included questions about the children's age; education and occupation of parents; socioeconomic status of the family; type of cancer, duration of recovery from cancer, history of psychiatric disorders, and parental relationship. The CSHQ was used to determine children's sleep habits and patterns. In 2000, Judith Owens first developed this questionnaire in the United States to record American school children's sleep habits and rate their sleep quality based on parents' responses. This questionnaire consists of two parts. The first part contains demographic information, and the second part includes 35 questions about children's sleep habits and patterns. The questions are completed by asking parents how they assess their children's sleep over the past week. Parents have three options to choose from: usually (5-7 nights per week), sometimes (2-4 nights per week), and rarely (0-1 night per week). The answer "usually" has three scores, "sometimes" 2, and "rarely" 1. The questionnaire's 35-item section has eight subsets: bedtime resistance, sleep onset delay, sleep duration, sleep anxiety, frequent nocturnal awakenings, parasomnia, sleep-related respiratory disorders, and daytime sleepiness. The higher scores in each subset indicate a more severe problem. Scoring is from 33 to 99. The two questions in the sub-categories "bedtime resistance" and "sleep anxiety" under the heading "the need for parents to be in the room while sleeping and the fear of sleeping alone" in this set of questions are repeated. A score equal to 41 or higher indicates the possibility of sleep disorders in children (19). The validity and reliability of this questionnaire have been confirmed in several studies (19-22). Fallahzadeh et al. standardized CSHQ in the Persian language and calculated Cronbach's alpha coefficient of the questionnaire as 0.80 (23). In this study, Cochran's formula (n= z2pq/d2) was used to determine the sample size. For this purpose, in line with the research objectives and based on the studies, the P-value for estimating sleep disorders was equal to 0.5, the value of q was equivalent to 0.5, and the accuracy or d at 95% confidence level was equal to 0.05.

Data analysis was performed using SPSS software version 18. Quantitative findings were reported as mean and standard deviation, and qualitative findings were reported as frequency and percentage frequency. The correlation coefficient, independent t-test, and one-way analysis of variance (ANOVA) were used to determine the relationship between the



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items. The significance level was considered less than 0.05 (P<0.05).

**Ethical Consideration**

The Research Ethics Committee approved the study of Iran University of Medical Sciences (IR.IUMS.REC.1399.281).

## Results

This study was performed on 400 children aged 5 to 15 years old. The mean age of children was 10.45±3.12 years (49% (n=196) males and 51% (n=204) females). The mean age of mothers was 37.48±6.72 years, and the mean age of fathers was 41.09±9.37 years. The study population had been treated for cancer for an average of 23.19±11.95 months, and at the time of the study, an average of 33.68±11.92 months had passed since the cure of cancer.

According to the results, leukemia (n= 94, 23.5%) and brain cancer (n=91, 22.8%) were the most common cancers in the study population. Other cases included cancer in other parts of the body. The frequency distribution of socioeconomic status variables in the CCS is shown in Table I.

The distribution of CSHQ scores and their subscales in pediatric cancer survivors are presented in Table II.

The comparison of the mean total score of the CSHQ in the CCS based on the parents' educational status, the children's birth order, and the family's economic status is presented in Table III. Based on one-way ANOVA results, the total score of the CSHQ was not significantly different between the groups of mothers and fathers in terms of educational status (P>0.05). However, the mean total score of CSHQ based on children's birth order and economic status was significantly different (P<0.05).

The correlation between the subscales and the total score of the CSHQ with the age of the CCS is shown in Table IV. Based on the results of the correlation coefficient test, there was a negative and significant relationship between age and the total score of the CSHQ and the bedtime resistance, sleep onset delay, and sleep anxiety (P<0.05).

Also, based on the results of the correlation coefficient test, there was a negative and significant relationship between the total score of the CSHQ and the duration of cancer treatment (months) (P<0.05). However, there was no significant relationship between the total score of the CSHQ and the duration after recovery (P=0.08). A comparison of the mean of the subscales and the total score of the CSHQ in the CCS by gender is shown in Table V. Based on the independent t-test, subscales and total score of CSHQ were not significantly different between females and males (P>0.05).

Also, the independent t-test showed that the mean score of CSHQ in the CCS based on the history of psychiatric illness, history of marital conflict, and having a separate bedroom did not differ significantly (P>0.05).



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*Table I: Frequency distribution of variables of socioeconomic status in the CCS*

| Variable | | N=400 | |
|---|---|---|---|
| | | **N** | **Percentage** |
| **Place of birth** | City | 210 | 52.5 |
| | Village | 190 | 47.5 |
| **Fathers' occupation** | Unemployed | 37 | 9.3 |
| | Employed | 363 | 90.7 |
| **Mothers' occupation** | Housewife | 366 | 91.5 |
| | Employed | 34 | 8.5 |
| **Fathers' level of education** | Illiterate | 20 | 5.0 |
| | Elementary | 149 | 37.3 |
| | Diploma | 119 | 29.8 |
| | University | 112 | 27.9 |
| **Mothers' level of education** | Illiterate | 17 | 4.3 |
| | Elementary | 126 | 31.5 |
| | Diploma | 175 | 43.8 |
| | University | 82 | 20.4 |
| **House ownership status** | Owner | 187 | 46.8 |
| | Tenant | 213 | 53.2 |
| **Insurance status** | No | 35 | 8.8 |
| | Yes | 365 | 91.2 |
| **Separate bedroom** | No | 357 | 89.3 |
| | Yes | 43 | 10.7 |
| **Marital conflict** | No | 287 | 71.7 |
| | Yes | 133 | 28.3 |
| **Birth order** | 1st | 191 | 47.8 |
| | 2nd | 137 | 34.3 |
| | 3rd | 53 | 13.3 |
| | 4th | 12 | 3.0 |
| | 5th | 7 | 1.8 |
| **A history of psychiatric illness in children** | Yes | 44 | 11.0 |
| | No | 356 | 89.0 |
| **Economic status of the family** | Low | 129 | 32.3 |
| | Middle | 255 | 63.8 |
| | High | 16 | 3.9 |

*Table II: Distribution of CSHQ scores and their subscales in the CCS*

| Variable | N = 400 | | | |
|---|---|---|---|---|
| | **Min** | **Max** | **Avg.** | **SD** |
| **Bedtime Resistance** | 6 | 17 | 11.31 | 1.97 |
| **Sleep Onset Delay** | 1 | 3 | 2.52 | 0.71 |
| **Sleep Duration** | 3 | 9 | 6.11 | 1.11 |
| **Sleep Anxiety** | 4 | 12 | 8.01 | 2.21 |
| **Nocturnal Awakenings** | 3 | 9 | 4.47 | 1.47 |
| **Parasomnia** | 7 | 20 | 9.34 | 2.30 |
| **Sleep-Disordered Breathing** | 3 | 9 | 3.59 | 1.17 |
| **Daytime Sleepiness** | 8 | 22 | 13.15 | 2.79 |
| **Total Score** | 37 | 96 | 58.53 | 7.80 |

Min; minimum, Max; maximum, Avg; average, SD; standard deviation



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*Table III: Comparison of the mean total score of CSHQ in the CCS based on parents' educational status, children's birth order, and economic status.*

| Variable | | *N = 400* | | | | |
|---|---|---|---|---|---|---|
| | | **SS** | **df** | **MS** | **F** | ***Sig*** |
| **Children's birth order** | Between groups | 77.051 | 36 | 2.140 | 3.001 | < 0.001 |
| | In groups | 258.859 | 363 | 0.713 | | |
| | Total | 335.910 | 399 | | | |
| **Mothers' education** | Between groups | 417.53 | 4 | 69.58 | 1.145 | 0.336 |
| | In groups | 23893.90 | 395 | 60.79 | | |
| | Total | 24311.43 | 399 | | | |
| **Fathers' education** | Between groups | 457.27 | 4 | 66.75 | 1.097 | 0.364 |
| | In groups | 23844.16 | 395 | 60.82 | | |
| | Total | 24311.43 | 399 | | | |
| **Economic status** | Between groups | 17.371 | 36 | 0.483 | 1.830 | 0.003 |
| | In groups | 95.707 | 363 | 0.264 | | |
| | Total | 113.077 | 399 | | | |

N; Number, SS; Sum of Squares, df; degrees of freedom, MS; Mean Square, F; F value, Sig; Significance.

*Table IV: The correlation between subscales and total score of CSHQ with the age of the CCS*

| **Variable** | *N = 400* | |
|---|---|---|
| | **r** | **Sig** |
| **Bedtime Resistance** | - 0.228 | < 0.001 |
| **Sleep Onset Delay** | - 0.191 | < 0.001 |
| **Sleep Duration** | - 0.041 | 0.413 |
| **Sleep Anxiety** | - 0.239 | < 0.001 |
| **Nocturnal Awakenings** | 0.060 | 0.228 |
| **Parasomnia** | - 0.073 | 0.145 |
| **Sleep-Disordered Breathing** | 0.064 | 0.200 |
| **Daytime Sleepiness** | 0.061 | 0.221 |
| **Total Score** | - 0.131 | 0.009 |

r; Pearson Correlation, Sig; Significance.

*Table V: The comparison of the mean of subscales and total score of CSHQ in the CCS by gender*

| Variable | Gender | *N*=400 | | | | |
|---|---|---|---|---|---|---|
| | | **M** | **SD** | **t** | **df** | ***Sig*** |
| **Bedtime Resistance** | Male | 11.24 | 1.91 | - 0.671 | 398 | 0.503 |
| | Female | 11.37 | 2.03 | | | |
| **Sleep Onset Delay** | Male | 2.57 | 0.69 | 1.409 | 398 | 0.160 |
| | Female | 2.47 | 0.73 | | | |
| **Sleep Duration** | Male | 6.15 | 1.11 | 0.668 | 398 | 0.504 |
| | Female | 6.07 | 1.11 | | | |
| **Sleep Anxiety** | Male | 7.98 | 2.16 | - 0.245 | 398 | 0.807 |
| | Female | 8.04 | 2.26 | | | |
| **Nocturnal Awakenings** | Male | 4.43 | 1.39 | - 0.581 | 398 | 0.562 |
| | Female | 4.51 | 1.55 | | | |
| **Parasomnia** | Male | 9.43 | 2.35 | 0.797 | 398 | 0.426 |
| | Female | 9.25 | 2.25 | | | |
| **Sleep-Disordered Breathing** | Male | 3.59 | 1.23 | 0.032 | 398 | 0.974 |
| | Female | 3.59 | 1.12 | | | |
| **Daytime Sleepiness** | Male | 13.02 | 2.80 | - 0.907 | 398 | 0.365 |
| | Female | 13.27 | 2.79 | | | |
| **Total Score** | Male | 58.45 | 7.55 | - 0.209 | 398 | 0.834 |
| | Female | 58.61 | 8.05 | | | |

N; Number, M; Mean, SD; Standard Deviation, t; t Value, df; degrees of freedom, Sig; Significance.



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## Discussion

This study was performed on the CCS to examine their sleep habits. The mean total score of the CSHQ was estimated to be 58.53±7.8, which indicates the possibility of sleep disorders.

The mean scores of daytime sleepiness, bedtime resistance, and parasomnia were higher than other subscales. This might be attributed to the fact that these cases are the most common sleep disorders in this age group. In a study by Shoghy et al. (2005) to determine children's sleep habits aged 6 to 11 years in Tehran, the subscales insomnia, bedtime resistance, and parasomnia were identified as the most common sleep habits (24). On the other hand, a study by Surani et al. (2015) on Japanese students' sleep habits in Texas, bedtime resistance, sleep onset delay, and nocturnal awakenings in elementary school students and daytime sleepiness in high school students school students were the most common sleeping habits (25). In a study by Yoshitaka Iwadare (2012) on the sleep habits of Japanese students, the mean age of participants was 9.3±1.7 years, and it was found that bedtime resistance and sleep anxiety were more common in younger students (26).

The effect of culture on children's sleep habits and behaviors can be considered as one of the reasons for the difference between the results of different studies. The norms and beliefs that society has about health and sleep status can be influenced by culture and race, which vary from one society to another (27). Previous studies indicated that Asian children, in general, have higher total CSHQ scores than those in Western countries. Asian preschoolers sleep more in their parents' beds and bedrooms than children in Western countries. In a study by Takahashi et al. (2018) on Japanese and Chinese preschoolers, bedtime resistance was more severe in Japanese children, and Chinese children had more severe nighttime awakenings and sleep-disordered breathing; such differences may be due to differences in co-sleeping practices, bedtime routines, and/or environmental conditions (28). In our study, bedtime resistance and parasomnia were the most common behaviors, consistent with the study by Shoghy et al. (2005); this might be attributed to study location because both studies were conducted in Tehran, Iran (24).

The presence of chronic physical illness in children can increase the risk of behavioral and emotional problems, which play a role in forming sleep patterns. In some studies, symptoms of depression and anxiety were reported to be more pronounced in the CCS; these people had more complaints of fatigue, sleep problems, and daytime sleepiness. Therefore, it seems that in addition to the role of cancer history and the type of treatment in the CCS, such factors as health status, sleep patterns, and fatigue also greatly impact their psychological performance (27-30).

In the present study, leukemia and brain cancer were identified as the most common cancers. According to the results of previous studies, the most common sleep-related complaint in children with brain cancer is daytime sleepiness. In a study by Rosen et al. (2011), daytime sleepiness was the most common sleep-related complaint, which is in line with the present study results. In these patients, the possibility of damage to the hypothalamic/pituitary glands can be one of the causes of daytime sleepiness (13, 31).

On the other hand, many cancer patients suffer from fatigue and cannot differentiate between "fatigue" and "sleepiness." Fatigue is considered a lack of energy and can even be a complication of cancer treatment and continue for a long time after treatment. Although fatigue and sleepiness can be related, they have different definitions and causes (32). In our study, the inability of children's parents to distinguish between these two



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symptoms may be considered one of the possible reasons for reporting a higher prevalence of sleepiness during the day. Besides, daytime sleepiness has a variety of causes that should be determined in the differential diagnosis. A study conducted in 2016 on children's sleep habits with controlled asthma reported that daytime sleepiness among these children is significantly different from healthy children (33). Therefore, when examining daytime sleepiness, one should consider other causes like obstructive sleep apnea, psychiatric illnesses (such as depression, taking sleeping pills, circadian rhythm disorders, and insomnia), and any other causes that may interfere with nighttime sleep (34).

However, according to our results, it seems that sometimes children with cancer suffer from a wide range of sleep-related problems such as insomnia and daytime sleepiness. They suffer from these problems even months after the cancer treatment. In this study, the mean recovery time from cancer was 33.86±11.92 months, and there was no significant relationship between the total score of the CSHQ and the duration after cancer recovery. One of the reasons for this result could be the evaluation of samples at different times of cancer recovery because the prevalence and severity of cancer-related sleep disorders are highly dependent on the time of patient evaluation. For example, assessment before the diagnosis of cancer, after the diagnosis of cancer, during the treatment, and even different times after the recovery can produce different results (32). On the other hand, it may indicate that children's sleep disorders after cancer recovery are similar to adults'. (35-37).

Many studies have highlighted the role of socioeconomic status of the family in the formation of sleep habits. Low socioeconomic status is more prevalent, especially in children with cancer (38). Studies have shown that economic problems also cause many sleep problems. Although the underlying mechanism of this relationship has not been clearly established yet, factors such as low income, lack of independent sleeping rooms for children, poor management of physical illness, and psychological stresses can play an important role in shaping children’s sleeping habits (27). On the other hand, economic problems cause marital conflicts (39). Some studies revealed that the number of nocturnal awakenings increases with increasing family quarrels and marital discord (40,41). In our study, only 3.9% of households were in good financial conditions, and 89.3% of children did not have a separate bedroom. Also, 28.3% of families clearly mentioned marital conflicts.

Therefore, by combining these findings, it is expected that the study population scores high in the CSHQ, and the possibility of sleep disorders is high in them. Our study showed a negative and significant relationship between age and total score of CSHQ and subscales of bedtime resistance, sleep anxiety habits, and sleep onset delay. A previous study found an association between age and bedtime resistance, nocturnal awakenings, and more sleep problems (19). Shoghy et al. (2005) also showed that with aging, bedtime resistance, frequent nocturnal awakenings, and sleep anxiety decrease (24). It seems that autonomy and independence in the sleep process are age-dependent and play a role in forming sleep habits. In this context, the children’s cognitive level and development are important. In younger children, sleep anxiety is more common due to separation from parents and the perception of scary objects in the room. Also, bedtime resistance during infancy is about 14%, and about 50% in children up to 5 years old. Then, as the child gets older, bedtime resistance gradually tends to sleep late. However, some studies have not found an age difference for sleep onset delay (26).



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Parents whose children have a chronic physical illness often change their sleep patterns to take more care of their children; for example, they are more inclined to sleep in the same environment with their children. This issue, along with children's age, can be useful in forming children's sleep habits (27).

One of the strengths of this study is that it simultaneously considered demographic, social, biological, and physical health issues in forming sleep habits. Meanwhile, the main limitation is the lack of knowledge about the population's sleep habits and behaviors before cancer. Future studies might investigate whether some of these habits already existed in the children before the onset of cancer or intensified or decreased with the onset of the disease. The absence of a control group and the possibility of confounding factors are other limitations of the present study. Another limitation of this study is the lack of considering the ethnicity of the study population. In Tehran, numerous ethnic groups with different cultural backgrounds live together. Determining and comparing the likelihood of these differences affecting children's sleep habits can be valuable. Another limitation of the study is the lack of consideration for the parents' sleep habits of these children. Since this was a cross-sectional study, we can conclude an association between sleep habits and cancer. However, we cannot have a cause-and-effect relationship because of the study design. Hence, it is suggested to have a control group in future studies. This group can include siblings of patients with cancer. It is recommended that this study be performed on a larger scale and children receiving cancer treatment or those with other chronic physical illnesses to compare the results. The possibility of sleep disorders is higher in younger patients, so it is suggested that more serious measures and more research be done to be aware of other emotional problems of these ages. It is recommended that in future studies, more risky and vulnerable age groups be identified.

## Conclusion

According to our results, sleep problems have several negative outcomes in all children. The CCS are at higher risk of sleep disorders, and the possibility of sleep disorders is higher in younger patients. Girls and boys who have survived cancer are equally prone to sleep disorders. Also, there is a possibility of developing sleep disorders at any time during the recovery period. In each periodic visit, clinicians treating CCS should routinely screen the patients for sleep problems. Factors such as the family's socioeconomic status, level of physical health, duration of cancer, and the age of the children should be considered when assessing and treating sleep problems in CCS. Further studies are needed to address the limitations of this study.

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## Conflict of interest

The authors declare no conflict of interest.

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