Article

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Cross-Sectional Study on Analysis of the Prevalence and Influencing Factors of Sleep Disorders among College Students in a Certain University in China

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Abstract

Background: Maintaining good sleep quality is crucial for improving the efficiency of college students. Therefore, this cross-sectional study aims to elucidate the prevalence of sleep disorders among students and analyze its risk factors.

Methods: A cross-sectional study was conducted on college students between March 2022 and December 2022. A well-designed questionnaire was filled out by college students from a certain university in China. Students whose scores on the Pittsburgh Sleep Quality Index (PSQI) scale exceeded 8 were included in the sleep disorder group (SD group), while those with lower were included in the non-sleep disorder group (ND group). Furthermore, single-factor analysis was used to investigate the relationship between general information and sleep disorders. Additionally, multifactor logistic regression was utilized to identify the independent risk factors contributing to the occurrence of sleep disorders among college students.

Results: We observed that the total PSQI score was 7.00 ± 2.17, and the incidence of sleep disorders was 38% among 326 college students. The level of sleep disorders was low (35.89%), scoring 2 or 3 in each component. A high number of students (78.22%) did not use sleep medication in the past 1 month. The level of daytime dysfunction was low (25.76%), scoring 2 or 3 in each section. The differences between the two groups in terms of academic performance, economic level, risk of smartphone addiction, pressure level, family relationship, and physical activity were statistically significant ($p < 0.05$). Furthermore, multifactor logistic regression analysis indicated that several factors, such as academic performance, smartphone addiction risk, pressure level, and family relationship, were independent risk factors affecting the occurrence of sleep disorders among college students ($p < 0.05$).

Conclusion: The prevalence of sleep disorders among students in a certain university is 38%. Factors affecting sleep disorders include poor academic performance, high smartphone addiction risk and stress levels, and challenging family relationship.

Keywords

college students; sleep disorders; influencing factors

Introduction

Sleep quality refers to the overall satisfaction of sleep experience. It includes various aspects, such as the individual's ease of falling asleep, staying asleep, sleep duration, and feeling refreshed after waking up. Considerable reduction in sleep duration and deterioration of sleep quality indicate underlying problems [1,2]. Sleep disorders are increasingly becoming a public health problem. Long-term sleep disorders can result in considerable implications for physical and mental health. Persistent sleep issues can lead to tiredness, inattention, anxiety, depression, cognitive impairment, compromised immune function, impaired work performance, an increased risk of accidents while driving or working, and decreased quality of life [3,4].

College students form a particular demographic. They are in the late stages of adolescence and on the cusp of adult-

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hood. They face crucial challenges and uncertainties, making them vulnerable to external influences [5]. The Annual Sleep Report of China 2022, issued by the Chinese Academy of Social Sciences on World Sleep Day, demonstrated that over 90% of Chinese college students experience average (49%) or poor (45%) sleep quality [6]. Research has shown that a substantial proportion of college students, ranging from 36.1% to 50.1%, suffer from a range of sleep quality issues and daytime dysfunction [7]. Insufficient sleep is correlated with poor mental health, lower quality of life, and impaired academic performance. Therefore, improving sleep quality is crucial for college students [8,9].

The Pittsburgh Sleep Quality Index (PSQI) is a widely used standard for assessing adult sleep quality. By evaluating various sleep components and the overall PSQI score, the occurrence of sleep disorders among college students can be effectively monitored [10]. While 40%–65% of American college students have been found to meet the criteria for sleep disorders, there are limited studies exploring the prevalence of overall and specific sleep problems as measured by the PSQI, as well as the occurrence and consequence of sleep disorders among college students without pre-existing health issues [11].

Therefore, a cross-sectional study was conducted to describe the sleep patterns and issues of college students, assess the prevalence of sleep disorders, identify the relevant factors among college students at Qiqihar medical college in China, and provide a reference point for the clinical prevention of sleep disorders in healthy college students.

Materials and Methods

Study Design

This cross-sectional study relied on a completely random sampling approach. A well-designed questionnaire was distributed among college students at a specific university in China between March 2022 to December 2022. Participation in this study was voluntary and anonymous. Consequently, 360 questionnaires were filled and collected during this survey, of which 326 were found valid, resulting in a validity rate of 90.56%.

Research Methods

Sample Size

The sample size was calculated using the formula $n = [\mu^2 \alpha\pi \{1 - \pi\}]/\delta^2$, where π represents the sleep disorder detection rate among college students (0.4) [12] and δ denotes the allowable error, which determines the maximum acceptable difference between the sample rate and the overall rate. The allowable error was set to 0.01π. Moreover, α represents the desired significance level, which was set to 0.05 for a 95% confidence interval, with the corresponding value of μ being 1.96.

The calculated sample size was 261, and to account for a 20% loss to follow-up, 326 individuals were surveyed. Before the study, the participants were screened based on specific selection criteria. Inclusion criteria included students who were currently enrolled, in good health, completed at least one semester and had a telephone. However, the students who suffered from anxiety, depression, sleep apnea syndrome, other diseases affecting sleep, severe problems in vital organs, or a primary disease with malignant neoplasm were excluded from the study.

Questionnaire Development

A general information questionnaire was developed using the web-based survey design tool So jump (https://www.wjx.cn/; Changsha Ranxing Information Technology Co., Ltd., Changsha, Hunan, China). The questionnaire's reliability and validity were tested through literature review, discussion, and verification by clinical experts. The PSQI scale was used to assess sleep disorders among college students [10]. This experimental study complies with ethical exemptions. All subjects participate voluntarily and signed informed consent.

Questionnaire Quality Control

The questionnaire quality was ensured through literature review, discussion, and verification by clinical experts. The validity of the completed questionnaires was confirmed by verifying their logical coherence. Specific questions were mutually excluded or included, and the total time to complete the questionnaire was less than 10 min. Paper questionnaires were distributed among students and collected on-site. After this, the questionnaires were manually screened, and those that were disorganized or incomplete were discarded.

General Information

(1) The following baseline information about college students was collected: gender, age, body mass index (BMI), grades, ethnicity, tobacco use (always indicates smoking >10 days per month, sometimes shows smoking 1–10 days per month, and never means smoking 0 days per month), alcohol use (often represents alcohol drinking >10 days per month, sometimes shows alcohol drinking 1–10 days per month, and never means alcohol drinking 0 days per month), academic performance, economic status (monthly living expenses), smartphone addiction risk, coffee/strong tea drinking habits (always, sometimes, or never), late-night habits (common means staying up for >10 days per month, sometimes means staying up 1–10 days per month, and never indicates staying up 0 days per month), stress level, family relationships (good, average, or poor), and physical exercise status (times/week, none/≤3/>3).

(2) The PSQI scale, established by Buysse *et al*. [10] in 1989, is widely used to evaluate the sleep status of various groups of individuals over the past month. This scale includes seven dimensions and nine items: sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disorders, sleep medications, and daytime dysfunction. Each item is rated on a scale of 0–3, with a total score ranging from 0 to 21. A high score indicates poor sleep quality [13]. The PSQI scale has a Cronbach's alpha coefficient of 0.840. Students with a total PSQI score of ≥8 were categorized as having sleep disorders (SD) group. However, students with scores 0 to 7 were classified as non-sleep disorders (ND) group [10].

(3) Academic performance was assessed based on the grades achieved by the research subjects in the previous semester and categorized into three levels: high (Grade Point Average (GPA) >4/5), medium (GPA from 3.5/5 to 3.9/5), and low (GPA <3.5/5) [14].

(4) Economic status was evaluated based on the monthly living expenses of the research subjects, which were divided into three categories: high (monthly living expenses ≥3000 CNY), medium (monthly living expenses 1501–2999 CNY), and low (monthly living expenses ≤1500 CNY) [15], 1 USD = 6.48 CNY.

(5) The Smartphone Addiction Scale Short Version (SAS-SV) was used to evaluate the risk of smartphone addiction among college students. This scale was developed by Kwon *et al*. [16], and it includes various factors such as daily life interference, positive expectations, withdrawal, and cyberspace orientation. The initial version of the Smartphone Addiction Scale consisted of relationship, overuse, and tolerance factors using six dimensions, each containing 10 items. Each item is rated on a six-point Likert scale, ranging from 1 (strongly disagree) to 6 (strongly agree), with a total score of 60 points. The Cronbach's alpha coefficient for this scale is 0.911. A higher score indicates a higher risk of addiction, while a lower score indicates a lower risk of addiction. The risk of smartphone addiction was divided into the following three categories: low (SAS-SV score ≤30), medium (SAS-SV score 31–39), and high (SAS-SV score ≥40).

(6) The Perceived Stress Scale (PSS) was used to assess the stress levels of college students, indicating how often they have felt or thought in a certain way in the past month [17]. The PSS consists of 10 items. Each item uses a five-point Likert scale ranging from 0 (never) to 4 (often), with a total score of 40. The Cronbach's alpha coefficient for this scale is 0.850. A high score indicates high perceived stress levels. Stress levels were divided into the following three categories: low (PSS score <12), medium (PSS score 12–15), and high (PSS score >15).

Data Analysis

Data analysis was conducted using SPSS 21.0 software (IBM Corporation, Armonk, NY, USA). The Shapiro–Wilk test was employed to assess the normality of continuous variables. Measurement data satisfying normal distribution were represented as ($\bar{x} \pm s$), and comparisons between the two groups were performed using the *t*-test. Categorical data were described as [*n* (%)], and the χ^2 test was used for comparison between groups. Variables with statistical significance in the univariate analysis were further analyzed for factors influencing sleep disorders among college students utilizing multivariate logistic regression analysis. A $p < 0.05$ indicated statistical significance.

Results

Comparison of the Occurrence of Sleep Disorders among College Students

We observed that the total PSQI score was 7.00 ± 2.17, and the incidence of sleep disorders was 38% among 326 college students. Most students had good sleep quality (69.02%, with each component scoring 0 or 1). The average sleep latency was (34.97 ± 23.44) minutes. Approximately 58.59% of students had a latency of less than 30 minutes. The average sleep duration was 6.81 ± 1.23 hours, and approximately 59.90% of students had a sleep

Table 1. Scores for each component of the PSQI scale (*n* = 326).

Variable	Score	Frequency (*n*)	Percentage (%)
Sleep quality			
Very good	0	37	11.35
Fairly good	1	188	57.67
Fairly bad	2	84	25.77
Very bad	3	17	5.21
Sleep latency			
≤15 min	0	71	21.78
16–30 min	1	120	36.81
31–60 min	2	76	23.31
>60 min	3	59	18.10
Sleep duration			
>7 h	0	134	41.10
6–7 h	1	97	29.75
5–6 h	2	81	24.85
<5 h	3	14	4.29
Sleep efficiency			
≥85%	0	184	56.44
75%–84%	1	78	23.93
65%–74%	2	40	12.27
<65%	3	24	7.36
Sleep disturbances			
Very good	0	16	4.91
Fairly good	1	193	59.20
Fairly bad	2	111	34.05
Very bad	3	6	1.84
Sleep medication			
Not during the past month	0	255	78.22
Less than once a week	1	38	11.66
Once or twice a week	2	18	5.52
Three or more times a week	3	15	4.60
Daytime dysfunction			
Very good	0	85	26.07
Fairly good	1	157	48.16
Fairly bad	2	67	20.55
Very bad	3	17	5.21

PSQI, Pittsburgh Sleep Quality Index.

time of less than 7 hours. The average sleep efficiency was 82.20% ± 9.62%, with 56.44% of students having a sleep efficiency of ≥85%. The level of sleep disorders was low (35.89%, scoring 2 or 3 in each component). A high number of students (78.22%) did not use sleep medication in the past 1 month. The level of daytime dysfunction was low (25.76%, scoring 2 or 3 in each section) (Table 1).

Comparison of General Information between the SD and ND Groups of Students

Based on the stratified characteristics of sleep disorders, described by a total PSQI score ≥8, 49.69% of the 326 college students were female. The study participants were aged 17–23 years, with an average age of 20.13 ± 1.14 years. Moreover, the average BMI among them was 21.35 ± 1.89 kg/m^2. Furthermore, there were significant differences between the two groups regarding academic performance, economic level, smartphone addiction risk, stress level, family relationship, and physical activity ($p < 0.05$). However, no statistically significant differences were observed in age, BMI, ethnicity, grade, smoking history, drinking history, coffee, or strong tea consumption, and staying late ($p > 0.05$, Table 2).

Multifactor Logistic Regression Analysis of Factors Affecting Sleep Disorders among College Students

The PSQI score was used as the dependent variable (with assignment: ND group = 1, SD group = 2). Gender, academic performance, economic status, smartphone addiction risk, stress level, family relationship, and physical activity were independent variables in the multifactor logistics regression analysis (inclusion criterion: $p < 0.05$). The findings indicated that academic performance, smartphone addiction risk, stress level, and family relationship were independent risk factors affecting the occurrence of sleep disorders among college students ($p < 0.05$, Table 3).

Discussion

This cross-sectional study assessed sleep issues among college students in a certain university in China, using the total PSQI score and its components. The incidence of sleep disorders among the 326 college students was approximately 38%, with a lower level of daytime dysfunction. This finding highlights the prevalent issue of sleep quality within this demographic. Previously, Tong *et al.* [18] found a sleep disorder prevalence of 18.2%, Lund *et al.* [19] reported a rate of 60%, and Li *et al.* [20] reported a rate of 31.0% among college students. Despite these numerical variations, the consistency across study [21] indicates a commonality of sleep issues among college students, potentially influenced by different study designs and assessment tools. These incidence rates are crucial for understanding the sleep patterns and issues of college students. Research has shown that reduced sleep duration and decreased sleep efficiency are associated with different levels of sleep disorders among college students. Addition-

Table 2. Comparison of general information between the SD and ND groups [$\bar{x} \pm s$, *n* (%)].

Factors	Variables	Total (*n* = 326)	SD group (*n* = 124)	ND group (*n* = 202)	t/χ^2	*p*-value
Gender	Male	164 (50.31)	51 (41.13)	113 (55.94)	6.743	0.009
	Female	162 (49.69)	73 (58.87)	89 (44.06)		
Age (years)			20.26 ± 1.14	20.04 ± 1.14	1.643	0.101
BMI (kg/m^2)			21.47 ± 1.87	21.28 ± 1.91	0.859	0.391
Nationality	Han Chinese	283 (86.81)	111 (89.52)	172 (85.15)	1.280	0.258
	Others	43 (13.19)	13 (10.48)	30 (14.85)		
Grade	First	73 (22.39)	20 (16.13)	53 (26.24)	9.384	0.052
	Second	97 (29.75)	32 (25.81)	65 (32.18)		
	Third	101 (30.98)	45 (36.29)	56 (27.72)		
	Fourth	40 (12.27)	19 (15.32)	21 (10.40)		
	Other	15 (4.60)	8(6.45)	7 (3.46)		
Tobacco use	Always	13 (3.99)	5 (4.04)	8 (3.96)	0.487	0.784
	Sometimes	37 (11.35)	16 (12.90)	21 (10.40)		
	Never	276 (84.66)	103 (83.06)	173 (85.64)		
Alcohol use	Always	26 (7.98)	11 (8.87)	15(7.42)	0.223	0.895
	Sometimes	79 (24.23)	30 (24.19)	49 (24.26)		
	Never	221 (67.79)	83 (66.94)	138 (68.32)		
Academic performance	High	115 (35.28)	38 (30.65)	77 (38.12)	13.222	0.001
	Medium	162 (49.69)	56 (45.16)	106 (52.48)		
	Low	49 (15.03)	30 (24.19)	19 (9.40)		
Economic status	High	64 (19.63)	21 (16.94)	43 (21.29)	11.541	0.003
	Medium	159 (48.77)	50 (40.32)	109 (53.96)		
	Low	103 (31.60)	53 (42.74)	50 (24.75)		
Smartphone addiction risk	High	77 (23.62)	42 (33.87)	35 (17.32)	11.690	0.003
	Medium	175 (53.68)	57 (45.97)	118 (58.42)		
	Low	74 (22.70)	25 (20.16)	49 (24.26)		
Coffee/strong tea habit	Always	102 (31.29)	38 (30.65)	64 (31.68)	0.307	0.858
	Sometimes	157 (48.16)	62 (50.00)	95 (47.03)		
	Never	67 (20.55)	24 (19.35)	43 (21.29)		
Late night condition	Always	77 (23.62)	27 (21.78)	50 (24.75)	0.491	0.782
	Sometimes	147 (45.09)	56 (45.16)	91 (45.05)		
	Never	102 (31.29)	41 (33.06)	61 (30.20)		
Stress level	High	162 (46.69)	75 (60.48)	87 (43.07)	10.409	0.005
	Medium	93 (28.53)	31 (25.00)	62 (30.69)		
	Low	71 (21.78)	18 (14.52)	53 (26.24)		
Family relationship	Good	200 (61.35)	64 (51.61)	136 (67.33)	11.153	0.004
	Average	91 (27.91)	39 (31.45)	52 (25.74)		
	Bad	35 (10.74)	21 (16.94)	14 (6.93)		
Physical activity (times/week)	0	32 (9.82)	17 (13.71)	15 (7.43)	12.086	0.002
	1–3	156 (47.85)	69 (55.65)	87 (43.07)		
	>3	138 (42.33)	38 (30.65)	100 (49.50)		

Note: SD group, sleep disorder group; ND group, non-sleep disorder group; BMI, body mass index.

ally, adopting healthy sleep patterns can substantially reduce the risk of depression among them. Furthermore, one study [22] has demonstrated the substantial impact of poor sleep quality, reduced sleep duration, and delayed sleep onset on various daytime functions among college students. These factors have been associated with poor learning abil-

Table 3. Multifactor logistic regression analysis of factors affecting sleep disorders among college students.

Factors	Variables	β	SE	Wald	OR (95% CI)	*p*-value
Gender	Female	0.517	0.360	2.062	1.677 (0.907–2.793)	0.174
Academic performance	Low	1.220	0.394	9.584	3.389 (1.565–7.339)	0.002
	Medium	0.150	0.288	0.274	1.162 (0.661–2.043)	0.601
Economic status	Low	1.188	0.634	3.511	3.282 (0.965–6.739)	0.054
	Medium	0.022	0.354	0.004	1.023 (0.511–2.046)	0.950
Risk of smartphone addiction	High	0.916	0.383	5.732	2.499 (1.181–5.290)	0.017
	Medium	0.044	0.328	0.018	1.045 (0.550–1.988)	0.892
Stress level	High	0.903	0.353	6.523	2.466 (1.234–4.930)	0.011
	Medium	0.123	0.387	0.102	1.131 (0.529–2.417)	0.750
Family relationships	Bad	1.157	0.420	7.591	3.179 (1.396–7.237)	0.006
	Average	0.428	0.297	2.078	1.534 (0.857–2.746)	0.149
Physical activity	0 times/week	0.700	0.436	2.584	2.014 (0.858–4.731)	0.108
	1–3 times/week	0.558	0.298	3.506	1.748 (0.714–3.013)	0.054
Constants		−2.732	0.551	24.62	0.065	<0.001

ity, emotional instability, increased daytime sleepiness, and the occurrence of adverse events such as motor vehicle accidents.

Previous research has revealed that students with poor academic performance often experience severe insomnia symptoms. They cannot fall asleep within 30 minutes and wake up frequently at night. Moreover, the pressure to maintain average grades can adversely affect their sleep quality [23]. Furthermore, a significant relationship has been identified between sleep disorders and academic performance. Poor academic performance is a common and serious issue among college students, leading to increased academic pressure. As a result, students may prioritize studying to cope with their demanding workload. Research has indicated a positive correlation between poor academic performance and the incidence of sleep disorders [14]. This study suggests a close association between poor academic performance and an elevated risk of sleep disorders among college students. Li DL *et al*. [24] found that academic burden is the most common cause of poor sleep quality. Low academic performance is associated with poor sleep quality and high stress before exams, leading to a vicious cycle. These observations indicate that worsened sleep quality is associated with reduced academic performance and vice versa, increasing the risk of developing disorders.

The increasing popularity of smartphones has made using them before bed a common habit among students [25]. A study has found that adolescents who have difficulty falling asleep or maintaining sleep are more likely to become addicted to the Internet, which can change their basic circadian rhythm [21]. Research has shown that excessive Internet use can considerably affect one's sleep cycle, leading to insomnia, irregular sleep patterns, and excessive daytime sleepiness [26]. The findings of our study indicate that the smartphone addiction risk among college students in the SD group was significantly higher than that in the ND group. This condition may be a crucial factor in the occurrence of sleep disorders among college students. Tahir *et al*. [27] found that Internet addiction is a significant predictor of poor sleep quality, leading to a 13.2% difference in poor sleep quality. Pathological Internet use can adversely affect circadian rhythm, leading to insomnia and other sleep disorders. High levels of smartphone addiction led to high PSQI scores, possibly due to the blue light emitted by smartphones inhibiting melatonin production in the brain, thereby affecting the body's biological clock and being detrimental to sleep [28].

Stress can impact the release of neurohormones, such as brain-derived neurotrophic factors, which may improve insomnia but can also cause sleep disorders and substantially affect sleep [29]. One study has found that insomniacs experience greater stress than noninsomniacs, with a close relationship existing between insomnia, stress, nighttime awakenings, and emotional responses to stress [30]. Stress is often considered a cause of sleep disorders, as the appraisal of stressors and perception of a lack of control over stressful events can increase the risk of these disorders. The findings of our study revealed that high stress levels were an independent risk factor for sleep disorders in students. Exam periods can increase stress among college students, leading to poor sleep quality. Ahrberg *et al*. [31] reported that students' sleep quality was significantly worse 5 weeks before exams than during the semester or 4 weeks after exams.

Negative changes in parental relationship can disrupt family processes and deteriorate the family atmosphere, adversely impacting students' physiological functions. Additionally, research has demonstrated that the marital difficulties of parents are a significant risk factor for sleep disorders [32]. Similarly, we observed that stressful relationship within low-income families may increase the risk of sleep disorders among college students. Li *et al*. [20] indicated that disharmonious family relationship and limited communication with parents may increase the incidence of sleep disorders among students, suggesting that a harmonious family environment is crucial for the healthy physical and mental development of family members. Conflicts or rifts in parent-child relationship can substantially affect the sleep quality of students.

This study has certain limitations that need to be addressed. Firstly, its cross-sectional design prevents making directional and causal claims. Future research should use multimethod and longitudinal designs to increase representativeness. Secondly, this study included a limited number of study participants and applied simplistic research method. The use of the PSQI scale, a self-reported questionnaire, relies on participants' recollections and subjective perceptions of their sleep status, introducing potential reporting biases. Subsequent studies should expand their scope, increase sample sizes, and use objective sleep monitoring tools. Moreover, a comprehensive analysis of the relationship between research indicators will expand the breadth and depth of findings. Lastly, this study could not assess changes in sleep status over time.

Conclusion

The prevalence of sleep disorders among healthy college students in a certain university is 38%. Factors contributing to these disorders include poor academic performance, a high smartphone addiction risk, high stress levels, and challenging family relationship.

Availability of Data and Materials

The corresponding author will provide the data that underpin the study's conclusions with a reasonable application.

Author Contributions

LH, GF and HW designed the study; all authors conducted the study; KW and YW collected and analyzed the data, KW and GF participated in drafting the manuscript, and all authors contributed to critical revision of the manuscript for important intellectual content. All authors gave final approval of the version to be published. All authors participated fully in the work, take public responsibility for appropriate portions of the content, and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or completeness of any part of the work are appropriately investigated and resolved.

Ethics Approval and Consent to Participate

This experimental study complies with ethical exemptions. All subjects participate voluntarily and signed informed consent.

Acknowledgment

Not applicable.

Funding

This research was funded by Education and research project of Qiqihar Medical College (Research on the Application of BP Network Neural Model in Student Comprehensive Ability Evaluation), Grant No. QYJY20210208; Social Science Fund Project of Qiqihar Medical College (Research on the Integration of Efficient Psychological Education into the Three Comprehensive Education Mechanism), Grant No. QYSKL2021-12ZX.

Conflict of Interest

The authors declare no conflict of interest.

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