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The Effects of Mobile Electronic Devices Use on the Sleep States of University Students

ABSTRACT

Objective: In this study, the purpose was to evaluate the effect of mobile electronic devices (MEDs) use on the sleep states of university students.

Methods: The study was conducted in a cross-sectional fashion between April 21, 2019 and May 31, 2019 with the participation of the students registered in a public university at medical faculties and faculty of health sciences. Television viewing, MED and desktop computer use form, Morningness-Eveningness Questionnaire, Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS), and Sleepiness Severity Index (SSI) were used as data collection tools. The data of 752 students (56.5% girls, mean age: 20.57 [SD = 1.54] years) were analyzed.

Results: In this study, overall MED use times and PSQI, ESS, and SSI total scores were higher in students who had an evening-oriented chronotype. There was a negative relationship between overall and evening MED use times and the chronotype scores of the students. As a result of the regression analyses applied to the PSQI, ESS, and SSI dependent variables, a positive and significant relationship was detected with smartphone use times ($P < 0.05$, $P = 0.05$, and $P < 0.001$, respectively). In addition, there was a positive relationship between PSQI and ESS variables and iPod touch use times ($P < 0.001$ and $P < 0.05$, respectively).

Conclusion: Overall MED use times were determined to be higher in students who had Type E chronotype. It was also determined that their sleep quality was poorer and their insomnia severity was higher, and there was more sleepiness in the students with chronotype E. Comprehensive interventions must be planned by professional healthcare staff for students on the topics of sleep hygiene and conscious media use.

Keywords: Screen time, sleep, sleep quality, insomnia, sleepiness

Introduction

Today, the use of mobile electronic devices (MEDs) that have many features such as connecting to the Internet, watching television (TV) programs, reading books, and playing games is increasing among young people with each passing day.[1] MEDs such as tablets, smartphones, laptops, portable handheld game consoles, iPod touch, Tetris, and others offer unique experiences when compared with toys or TVs.[2] Although nonmobile devices such as TVs and desktops emit blue light, MEDs pose a bigger threat to sleep. As MEDs are kept closer to the face when used, exposure to light becomes more severe at shorter wavelengths,[3] and more concentrated blue light levels are absorbed.[4]

The possibility of deterioration in sleep quality in people who are exposed to bright light images from MEDs[5] must always be taken into consideration. As a matter of fact, studies conducted in previous years provided evidence that the time spent in front of the screen affects sleep adversely.[6-9] Randjelović et al[10] conducted a study on medical faculty students and reported that the use of mobile phones disrupted the subjective sleep quality at a significant level and increased daytime sleepiness.

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Sleep is a key factor in strengthening physical growth and academic performance. Children and young people need adequate sleep and rest to perform their developmental functions.[11] In meta-analysis studies, it was reported that children and adults who had low sleeping times had obesity risk,[12] and inadequate sleep increased more risk-taking behavior in adolescents.[13] Owens et al[14] reported that there was a negative correlation between depressive symptoms and sleep durations of adolescents. More recent studies, on the other hand, have shown that the light emitted from media screens may delay the chronotype.[15, 16] Chronotype refers to the period when the person is physically and cognitively active in a day. It is simply the choice of the circadian cycle of a person.[17] Depending on their daily preference, people may have a morning-oriented (M type or Type M) chronotype or an evening-oriented (E type or Type E) chronotype or a neutral chronotype.[18] According to this classification, it is stated that M types sleep early in the evening and get up early in the morning; their performances are better in the morning. The E types sleep late at night and can wake up in the morning with difficulty, and their performances are better in the afternoon.[19]

Fossum et al[20] conducted a study on 532 students (aged 18-39 years) and showed that there is a positive relationship between computer (playing/surfing/reading) and mobile phone (playing/surfing/texting) usage and sleeplessness and a negative relationship with the M type. There are few studies, such as the one conducted by Fossum et al,[20] focusing on the relationship between chronotype and technological device use times.[15, 20, 21] Furthermore, these studies do not focus on MEDs. In this study, when the abundance of available MEDs is considered, the effects of the use of some MED devices, including tablets, smartphones, iPod touch, handheld game players, and laptops, on chronotype were examined. Besides, the relationships between sleep quality, insomnia severity, sleepiness, and MED use were also examined. The purpose of this study was to evaluate the effect of MEDs use on the sleep states of university students.

Methods

The study was conducted in a cross-sectional fashion between April 21, 2019 and May 31, 2019 with the participation of the students registered in a public university at medical faculties and faculty of health sciences. The data were collected from 792 students. The data that were collected from 40 students who had medical problems, psychiatric treatment, and sleep medication and who received treatment owing to sleep-related disorders (insomnia, parasomnia, and others), which would affect their sleep patterns, were excluded from the study. The data of 752 students (56.5% girls, mean age: 20.57 [SD = 1.54] years) were analyzed. In the analyses made with the G*Power Software, the result was a = 0.05, and there was a small effect size (w) of 0.15; the power of 752 sample size was 1-β = 0.89 according to the F-test.

MAIN POINTS

- *Overall MED use times were determined to be higher in students who had Type E chronotype.*
- *It was determined that their sleep quality was poorer and their insomnia severity was higher, and there was more sleepiness in the students with Type E chronotype.*
- *It was found that the students who had two and three MEDs in bedrooms had mostly Type E chronotype.*
- *It was concluded that smartphone and iPod touch use durations were significant predictors for the sleepiness that occurred during daily activities and for sleep quality; and that smartphone use durations were significant predictors for insomnia severity.*

The study was conducted in classrooms that had a capacity of 30 students in idle classes or in break times of the students. Before the application, students were informed about the study, and informed consent forms were received from the students who agreed to participate in the study. One of the researchers accompanied the application of the questionnaire. The permission that was required to conduct the study was received from Ankara Numune Training and Research Hospital Ethics Board on October 04, 2018, with decree number 1989/2018.

Data Collection Tools

MED use: The students were asked to state how long they used the electronic devices (tablet, smartphone, iPod touch, handheld game player, laptop) in a day within the past month in the morning (the time from the moment they woke up until noon), in the afternoon (the time between lunch and dinner), and in the evening (the time between dinner and bedtime). These data were collected from the students separately for each device. The responses given for the morning, afternoon, and evening were collected to calculate the total exposure time of the students to MEDs. Overall MED use times were obtained by adding the tablet, smartphone, iPod touch, handheld game player, and laptop use variables. This approach was used in previous studies to calculate and evaluate media usage.[4, 22]

TV viewing and desktop computer use: As in the case of MED use, overall non-MED use times were obtained by adding the TV viewing and desktop computer use variables.

Morningness-Eveningness Questionnaire (MEQ): MEQ is a self-reported scale that consists of Likert-type 19 questions. According to the total score obtained, morning, evening, or intermediary type is determined. If the total score is between 59 and 86, the individual is considered to be a morning type; if the score is 16-31, the individual is evaluated as the evening type; and if the score is 32-58, the individual is evaluated as the intermediary type.[23]

Sleepiness Severity Index (SSI): This scale can be used in screenings for the normal population and the clinical evaluation of insomnia. It is a 5-point Likert-type scale that consists of seven items. Each item is scored between 0 and 4, and the total score ranges between 0 and 28. High scores show an increase in the severity of insomnia.[24]

Pittsburgh Sleep Quality Index (PSQI): This is a self-reported scale that consists of 19 items evaluating the sleep quality and sleep disorder within the past month. The scale consists of seven components. Each component is evaluated over 0-3 scores. The total score of the seven components yields the total score of the scale, which ranges between 0 and 21. A total score > 5 indicates poor sleep quality.[25]

Epworth Sleepiness Scale (ESS): The validity and reliability study of the ESS, which is a 4-point Likert-type scale, was conducted previously. The scale is scored as 0, 1, 2, and 3, and scores ≥10 points show excessive daytime sleepiness. The total possible score ranges between 0 and 24. High scores show more sleepiness during daily activities.[26]

Statistical Analysis

The data of the study were evaluated in the IBM Statistical Package for the Social Sciences version 25 program (IBM Corp.; Armonk, NY, USA). The data of the study were summarized as numbers, percentages, averages, and standard deviations.

For the purpose of testing the relationship between the number of electronic devices in the bedrooms of the students and their chronotypes, the χ^2 analysis was applied. Spearman's correlation analysis was made to test the relationship between the chronotypes; sleep duration; ESS, SSI, PSQI total scores; and the usage periods of electronic devices during the day and before bedtime.

In this study, multivariate analysis of variance (MANOVA) was used to evaluate the effect of several dependent variables on one single argument. Multivariate and univariate skewness and kurtosis values were examined according to the ±2 rule,[27] and scores showed normal distribution ($P > 0.05$). In the posthoc examination after MANOVA, received α was taken as 0.05/2 to avoid the family-wise effect.

The multiple hierarchical regression analyses were made to predict the sleep quality, sleepiness, and insomnia severity variables in the study. In the first step of the analysis, the demographic variables of the students such as age, sex (1 for female, and 0 for male), and family income were analyzed. In the second step, the variables of satisfaction during watching TV and using desktop computers were included in the analysis. In the third step of the analysis, MED variables were included. Durations of device use were included in the regression models as average daily use in hours.

Results

The descriptive statistics of the students who were included in the study are given in Table 1.

When the MANOVA table was examined, it showed that the overall MED use and overall non-MED use variables showed a significant difference according to the chronotype variables (Pillai's Trace = 0.078 F = 15.20, $P < 0.001$). According to the overall MED use *Tamhane* T2 *test*, a significant difference was detected between the M type and the intermediary type and between the M type and E type groups (F = 23.40, $P < 0.001$). According to the overall non-MED use *Tamhane* T2 *test*, a significant difference was detected between the M type and the intermediary type and between the intermediary type and E type groups (F = 7.85, $P < 0.001$).

The mean ESS, SSI, and PSQI scores showed significant differences according to the chronotype variable (Pillai's Trace = 0.071, F = 9.18, $P < 0.001$). According to the *Tukey HSD (honestly significant difference) test,* the differences between the mean SSI and PSQI scale scores were between M type and intermediary type and intermediary type and E Type and M type and E type students (F = 20.77, $P < 0.001$; F = 13.94, $P < 0.001$, respectively). The differences in the mean ESS scores were considered for the M type and the intermediary type and for the M type and the E type (F = 8.52, $P < 0.001$) (Table 2).

The percentage of the students who had 2 and 3 MEDs in bedrooms and who had chronotype as Type M was 49.2%, and the percentage of the students with the intermediary type chronotype was 65.1%. The rate of the students with Type E chronotype was 72.7%. The differences were found to be statistically significant ($P < 0.001$). The difference between the chronotypes and TV counts in bedrooms was not found to be significant ($P = 0.147$) (Table 2).

It was determined that there were weak, positive, and statistically significant linear relationships between the ESS, PSQI, and SSI total scores and overall MED use times and weak and negative relationships between chronotypes and overall MED use. It was determined that there were weak, positive, and statistically significant linear relationships between SSI total score and evening MED use times and weak and negative relationships between chronotypes and evening MED use times (Table 3).

It is seen that smartphone (PSQI: β = 0.07, $P < 0.05$; ESS: β = 0.08, $P = 0.05$) and iPod touch usage duration (PSQI: β = 0.12, $P < 0.001$; ESS: β = 0.09, $P = 0.03$) variables showed a positive and significant relationship with PSQI and ESS total scores. A positive and significant relationship was detected between the smartphone use (β = 0.13, $P < 0.001$) variable and SSI total scores (Table 4).

Discussion

Genetic, social, and environmental factors are important predictors of the chronotypes.[28, 29] It is reported that light may be the most important environmental factor that is likely to contribute to the variability in the chronotypes.[28, 30] In this study, overall MED usage times were higher in students with E type chronotype. Meanwhile, according to the correlation analysis, as overall and evening MED usage times increase, a shift occurs toward the E type. These results support increasing evidence that E type individuals spend more time in front of the screen.[15, 16] In future studies, it is recommended that the use of MEDs is considered as risky health behavior in this age group.

Rique et al[31] in a study that included 221 medical students, identified the relationship between Type E chronotype and low sleep quality. Similar results were proven in other studies.[18, 32, 33] Similarly, there are studies showing that the evening chronotype is related to sleeplessness.[20, 34] Our study contributes to these results. In our study, similar

Table 1. Descriptive Statistics of All Measures (n = 752)

Electronic devise use (hours/day)	Mean (SD)
Overall TV viewing	1.36 (1.94)
Evening TV viewing	0.58 (0.93)
Overall desktop computer use	0.25 (0.92)
Evening desktop computer use	0.09 (0.42)
Overall tablet use	0.33 (0.99)
Evening tablet use	0.11 (0.47)
Overall smartphone use	6.90 (3.36)
Evening smartphone use	2.34 (1.27)
Overall iPod touch use	0.12 (0.63)
Evening iPod touch use	0.04 (0.33)
Overall laptop use	1.83 (2.38)
Evening laptop use	0.67 (1.02)
Overall handheld game player use	0.13 (0.60)
Evening handheld game player use	0.05 (0.32)
Overall MED use	9.32 (4.71)
Evening MED use	3.22 (1.95)

Abbreviations: SD, standard deviation; TV, television; MED, mobile electronic device.

Table 2. MANOVA and χ^2 Analysis Results of Students' Chronotypes and Time Spent in front of Electronic Devices; PSQI, ESS, and SSI Mean Scores; and Number of Devices in the Bedroom

Variable	Chronotypes	Mean (SD) (hours/day)	F	*P*
Overall MEDs use	TypeM (n = 120)	7.32 (4.36)	23.40	< 0.001[a]
	TypeI (n = 533)	9.44 (4.54)		
	TypeE (n = 99)	11.04 (5.21)		
Overall non-MED use	TypeM (n = 120)	1.16 (1.92)	7.85	< 0.001[b]
	TypeI (n = 533)	1.80 (2.27)		
	TypeE (n = 99)	1.12 (1.77)		
MANOVA Pillai's Trace = 0.078, F = 15.20, *P* < 0.001				
ESS	TypeM (n = 120)	5.60 (3.54)	8.53	< 0.001[a]
	TypeI (n = 533)	7.04 (3.88)		
	TypeE (n = 99)	7.51 (3.83)		
SSI	TypeM (n = 120)	7.11 (4.77)	20.77	< 0.001[c]
	TypeI (n = 533)	9.10 (4.95)		
	TypeE (n = 99)	11.46 (5.37)		
PSQI	TypeM (n = 120)	8.65 (3.15)	13.94	< 0.001[c]
	TypeI (n = 533)	9.72 (3.92)		
	TypeE (n = 99)	11.36 (3.88)		
MANOVA Pillai's Trace = 0.071, F = 9.18, *P* < 0.001				

	Chronotypes				
	Type M	Type I	Type E	Total	
Variable	n (%)	n (%)	n (%)	n (%)	*P* (χ^2)
Number of TV and desktop computer available in bedroom[d]					
0	104 (86.7)	441 (82.7)	90 (90.9)	635 (84.4)	0.147
1	13 (10.8)	84 (15.8)	9 (9.1)	106 (14.1)	
2	3 (2.5)	8 (1.5)	0 (0)	11 (1.5)	
Number of MEDs available in bedroom[d]					
0	0 (0)	10 (1.9)	0 (0)	10 (1.3)	<0.001
1	61 (50.8)	176 (33)	27 (27.3)	264 (35.1)	
2	39 (32.5)	269 (50.5)	49 (49.5)	357 (47.5)	
3	20 (16.7)	78 (14.6)	23 (23.2)	121 (16.1)	
Total	120 (100)	533 (100)	99 (100)	752 (100)	

Abbreviations: MANOVA, multivariate analysis of variance; PSQI, Pittsburgh Sleep Quality Index; ESS, Epworth Sleep Scale; SSI, Sleepiness Severity Index; MED, mobile electronic device; ANOVA, analysis of variance; TV, television; I, intermediary chronotype; E, evening chronotype; M, morning chronotype; SD, standard deviation.
[a]difference between Groups 1 and 2 and 1 and 3.
[b]difference between Groups 1 and 2 and 2 and 3.
[c]difference between Groups 1 and 2, 1 and 3, and 2 and 3.
[d]The number of devices in the bedroom reported by the students was found by summing up. Type M (Group 1), Type I (Group 2), and Type E (Group 3) are described.

to previous studies, high daytime sleepiness scores were detected in the evening types.[32, 35] However, it is known that there are contradictions in the literature in terms of the results of daytime sleepiness.[31, 36, 37] Sleep quality, sleeplessness, and daytime sleepiness are affected by various factors such as lifestyle, environmental factors, work/social life, economic status, stress, anxiety, depression, and general health status.[25, 37] It is not possible to associate the sleep patterns of students with E type chronotype in the study group only with the use of MEDs. However, it is possible to speculate that the time spent in front of the screen is among the factors that adversely affect sleep patterns. Medical help should be sought in extreme evening types because delaying of sleep schedule 3-6 hours later than societal norms may be a manifestation of a delayed sleep-phase syndrome.[38] It may be useful to include such students in sleep hygiene programs.

In our study, it was determined that the students who had two and three MEDs in bedrooms had mostly (72.7%) Type E chronotype. In studies that were conducted, it was reported that having a TV, computer, and mobile phone in bedrooms was associated with sleep disturbances.[39-41] In previous years, it was warned that MEDs could be used in bedroom routines owing to their interactive use and portable features.[4] In line with the literature, our study supports the recommendation that all media products should be removed from the bedroom.[42]

In previous studies, it was reported that mobile phone use negatively affected sleep quality,[8-10, 43-45] and increased daytime weariness[46, 47] and daytime sleepiness.[10, 47] In our study, as a result of the three regression analyses, it was found that the smartphone use times had significant and positive relationships. In addition, there is a positive relationship between the PSQI and ESS variables and iPod touch use times. The iPod touch is a very similar technological device to smartphones with its many features such as being used for music playing, video viewing, Internet, and gaming. Because of this similarity, it was also considered that these two devices (smartphone and iPod touch) are significant predictors between MEDs. However, it must not be ignored that the regression analysis we conducted focused on MED use times, and the relationships we observed were relative at small sizes. For this reason, in future studies, researchers should focus on the relationship between smartphone and iPod touch devices and

Table 3. Correlations Results of Students' Sleep Parameters and Time Spent in front of Electronic Devices

		Overall electronic devise use							
Variable		TV viewing	Desktop computer use	MED use	Tablet use	Smartphone use	Ipod touch use	Laptop use	Handheld game player
Sleep duration	r	0.145	0.014	0.055	0.024	0.050	-0.012	0.024	0.085
	P	< 0.001	0.705	0.133	0.514	0.171	0.734	0.514	0.020
Chronotypes total score	r	-0.014	-0.037	-0.262	0.022	-0.273	-0.004	-0.126	0.035
	P	0.710	0.309	< 0.001	0.553	< 0.001	0.917	0.001	0.339
SSI total score	r	-0.052	0.003	0.135	-0.007	0.149	0.010	0.101	-0.071
	P	0.158	0.925	< 0.001	0.850	< 0.001	0.794	0.006	0.053
PSQI total score	r	-0.034	0.011	0.098	0.056	0.088	0.063	0.049	-0.044
	P	0.346	0.770	0.007	0.122	0.016	0.082	0.179	0.228
ESS total score	r	0.047	0.019	0.082	0.016	0.084	0.013	0.026	-0.017
	P	0.194	0.594	0.024	0.653	0.021	0.728	0.472	0.644
		Evening electronic devise use							
Variable		TV viewing	Desktop computer use	MED use	Tablet use	Smartphone use	Ipod touch use	Laptop use	Handheld game player
Sleep duration	r	0.139	0.052	0.076	-0.038	0.060	0.013	0.055	0.089
	P	< 0.001	0.153	0.020	0.297	0.099	0.723	0.133	0.015
Chronotypes total score	r	-0.023	-0.065	-0.312	-0.026	-0.275	-0.024	-0.129	-0.024
	P	0.527	0.073	< 0.001	0.476	< 0.001	0.517	< 0.001	0.511
SSI total score	r	-0.076	-0.001	0.099	-0.017	0.138	-0.021	0.025	-0.022
	P	0.036	0.977	0.006	0.644	< 0.001	0.569	0.491	0.550
PSQI total score	r	-0.068	0.037	0.048	0.065	0.061	0.043	0.003	-0.017
	P	0.062	0.306	0.185	0.076	0.093	0.239	0.940	0.644
ESS total score	r	0.003	-0.001	0.018	0.046	0.033	0.075	-0.032	0.043
	P	0.939	0.974	0.631	0.211	0.359	0.041	0.388	0.235

Abbreviations: TV, television; MED, mobile electronic device; SSI, Sleepiness Severity Index; PSQI, Pittsburgh Sleep Quality Index; ESS, Epworth Sleepiness Scale.

Table 4. Regression Analysis of the Relationship between Students' MED Use (Hours/Day) and PSQI, ESS, and SSI

	PSQI				ESS				SSI			
	B	SE	β	*P*	B	SE	β	*P*	B	SE	β	*P*
Step 1												
Age (years)	-0.34	0.11	-0.11	< 0.01	0.11	0.11	0.04	0.31	-0.28	0.14	-0.07	0.05
Sex[a]	-0.43	0.29	-0.06	0.13	0.62	0.29	0.08	0.03	0.76	0.38	0.07	0.04
Family income situation	-0.62	0.26	-0.09	0.02	-0.18	0.26	-0.03	0.49	-1.13	0.34	-0.12	< 0.01
R^2	0.02				0.01				0.02			
Step 2												
Age (years)	-0.35	0.11	-0.12	< 0.01	0.12	0.11	0.04	0.29	-0.26	0.14	-0.07	0.07
Sex[a]	-0.42	0.29	-0.05	0.15	0.48	0.29	0.06	0.10	0.76	0.39	0.07	0.05
Family income situation	-0.62	0.26	-0.09	0.02	-0.16	0.26	-0.02	0.54	-1.15	0.35	-0.12	< 0.01
TV viewing	0.11	0.16	0.03	0.46	-0.03	0.16	-0.01	0.87	-0.21	0.20	-0.04	0.32
Desktop computer use	0.01	0.07	0.00	0.89	0.18	0.07	0.09	0.02	-0.05	0.10	-0.02	0.58
R^2	0.02				0.02				0.02			
Step 3												
Age (years)	-0.32	0.11	-0.11	< 0.01	0.15	0.11	0.05	0.19	-0.22	0.14	-0.05	0.13
Sex[a]	-0.50	0.30	-0.06	0.09	0.42	0.30	0.05	0.16	0.61	0.39	0.06	0.12
Family income situation	-0.48	0.26	-0.07	0.07	-0.05	0.26	-0.01	0.86	-1.07	0.35	-0.11	< 0.01
TV viewing	0.08	0.16	0.02	0.60	-0.07	0.16	-0.02	0.65	-0.18	0.21	-0.03	0.39
Desktop computer use	-0.01	0.08	0.00	0.90	0.15	0.08	0.07	0.06	-0.11	0.10	-0.04	0.28
Tablet use	0.02	0.14	0.00	0.91	-0.02	0.15	0.00	0.90	-0.19	0.19	-0.04	0.32
Smartphone use	0.08	0.04	0.07	0.04	0.09	0.04	0.08	0.05	0.19	0.06	0.13	< 0.01
iPod touch use	0.71	0.24	0.12	< 0.01	0.53	0.24	0.09	0.03	-0.03	0.32	0.00	0.93
Laptop use	0.02	0.06	0.01	0.71	-0.03	0.06	-0.02	0.57	0.11	0.08	0.05	0.19
Handheld game player use	-0.47	0.25	-0.07	0.06	-0.17	0.25	-0.03	0.49	-0.18	0.33	-0.02	0.59
R^2	0.04				0.03				0.04			
F/*P*	3.28/0.00				1.99/0.032				3.47/0.00			

Abbreviations: MED, mobile electronic device; PSQI, Pittsburgh Sleep Quality Index; ESS, Epworth Sleepiness Scale; SSI, Sleepiness Severity Index; B, unstandardized beta; SE: standard error, β: standardized beta, *P*: probability value.
[a]Sex: 0 for male, 1 for female; Analyses controlled for age, Sex, family income situation, and TV viewing/computer use.

sleep quality. It can be argued that the students in the study group use media devices unconsciously. These findings raise public health concerns about the lifestyles of young individuals. Students must make changes to reorganize their sleep patterns, and interventions must be planned to ensure that they spend time in a more productive way than if spending time on media devices.

This study had several limitations. Our data were based on student reports rather than observations. The second limitation is that the sampling of the study that only consisted of university students does not represent the general population.

In this study, overall MED use times were determined to be higher in students who had Type E chronotype. It was also determined that their sleep quality was poorer and their insomnia severity was higher, and there was more sleepiness in the students with chronotype E. Comprehensive interventions must be planned by professional healthcare staff on sleep hygiene and conscious media use topics. In addition, there are no adequate studies conducted on the long-term effects of light-emitting diode displays on circadian cycle selection and the changes in the sleep of different age groups. For this reason, more studies are needed on this topic.

Ethics Committee Approval: *Ethics committee approval was received for this study from the Ethics Board of Ankara Numune Training and Research Hospital (Approval Date: October 4, 2018; Approval Number: 1989/2018).*

Informed Consent: *Informed consent was obtained from the patients who participated in this study.*

Peer-review: *Externally peer-reviewed.*

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