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Brief Report

Screen Time and Objectively Measured Sleep of U.S. College Students: A Brief Report

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Abstract

International Journal of Exercise Science 18(4): 747-756, 2025. https://doi.org/10.70252/XDUT8341 The objective was to investigate screen time (ST) and objectively measured sleep quality in college students. Participants were undergraduate students attending a large metropolitan public university in the southeastern U.S. Participants wore accelerometers on their wrist for 24hr/day for 14 days to capture sleep outcomes, and completed a survey reporting ST duration. Analyses explored weight-status, race/ethnicity, and sleep patterns (presence of daytime sleep) differences among students. Participants (n=29, 86% female, ~21.5 years old, 38% White, 35% Overweight/Obese) slept for an average of 433.8 minutes/night, reported 419.1 minutes of daily ST, and 112 minutes of ST after $10:00_{PM}$. College students with daytime sleep (i.e., napping) reported approximately -92 minutes less of daily ST than peers (p=0.04; effect size=0.86). Further studies in larger, diverse samples are needed to explore ST and sleep, specifically the causal relationship and its potential to impact the health of college students at greatest risk of poor health outcomes.

Keywords: Evening media use, sleep health, technology, young adults

Introduction

Over recent years smartphone technology and social media use has drastically increased with people using their electronic devices to engage in screen time (ST) now more than ever.[1] Young adults, many of whom are college students, are especially prone to excessive ST, as they are the largest demographic of smartphone owners, and have the highest percentage of smartphone dependency.[2] College students are more likely to have irregular sleep patterns compared to peers of a similar age who do not attend college.[3-4] Existing research has shown that excessive ST can adversely impact an individuals' sleep and, thus, influence critical biological processes in the body that occur during sleep, such as memory, learning, and the release of important

hormones.[5] This can ultimately contribute to poor health, such as an increased risk of type 2 diabetes and heart disease, and a negative impact on mood.[6]

There are a lack of data on United States (US) college students' ST and sleep, specifically in students who may be at greater risk of poor health outcomes, such as college-students who are a racial/ethnic minority or who are overweight or obese.[7-8] Studies in college students have reported a positive association between increasing ST and stress levels, the onset of negative emotions, and a potential influence of ST on sleep habits/patterns (e.g., irregular bed and wake times, poor sleep quality).[9-10] Studies that incorporate free-living objective measures of sleep (i.e., wrist-worn sleep devices) and studies exploring ST and sleep of high-risk subgroups (e.g., minority students, students who are overweight or obese) are warranted. The aim of this cross-sectional brief report is to explore ST and objectively measured sleep outcomes in a sample of US college students, exploring differences by high-risk subgroups.

Methods

Participants

The target sample for this study was junior or senior students attending a large metropolitan public university located in the southeast of the US in spring 2023. Eligibility criteria to participate in this study were the participant had to be ≥18 years of age and have an academic standing of junior or senior, otherwise identified as third- or fourth-year university students, respectively. Exclusion criteria consisted of individuals who 1) had any diagnosed sleep disorders (e.g., sleep apnea), 2) were taking medications that affect sleep, or 3) had a job that requires frequent overnight shifts. Participants were recruited from six upper-level health science classes offered at the university over a two-week period. Interested participants completed an online pre-registration sheet to schedule an appointment time for a one-on-one participant information session where a research assistant explained the study in more detail and reviewed the informed consent form with the participant. Students received a $10 gift card for their participation in this study. The institutional review board (IRB) of the corresponding author approved all consent documents, the data collection procedures, and materials to be used for this study (IRB Approval Number: 00004924). IRB approval ensures ethical research practices involving human subjects participating in this study. This research was carried out fully in accordance to the ethical standards of the *International Journal of Exercise Science*.[11]

Protocol

Consenting participants had their height and weight measured by trained research assistants in a private room in the Health Sciences building located on the university campus in the Department of Health Sciences. Participants were given a wrist-worn accelerometer and were instructed to wear the water-proof device for 14 days, 24 hours per day. Participants were also sent (via their student e-mail address) a Qualtrics (Qualtrics, Provo, UT) link to complete a short survey to capture daily and evening ST estimates. This survey was completed once at the beginning of the study. Compliance was monitored by students entering their names both when they received the accelerometer, and when completing the survey. The first section of the

Qualtrics survey had participants answer questions such as sex and race/ethnicity. After 14 days, participants returned the accelerometers and received their gift card incentive ($10).

Body mass index (BMI) was calculated after measuring height and weight of the participants. This was done using standard procedures; the height was measured using a portable stadiometer (Model S100, Ayrton Corp., Prior Lake, Minn.) and the weight was measured using a bioelectrical impedance device (Tanita DC-430U, Tanita Corporation of America, Inc). Participants were asked to remove shoes and any heavy clothing prior to being measured. BMI was calculated by weight (kg)/height (m^2). Participants were classified as overweight (BMI ≥ 25 and <30) or obese (BMI ≥30) in accordance with the Centers for Disease Control and Prevention definition.[12]

Sleep outcomes were measured using a wrist-worn accelerometer (ActiGraph Link GT9X+ accelerometer, Shalimar, FL).[13] This device has shown to produce valid and reliable estimates of free-living sleep of adult populations.[14] Participants were asked to wear the accelerometer on their non-dominant wrist during a 14-day period. The accelerometers were secured to the wrist with an adjustable and removable watch band. The device measures sleep duration (mins/night), awakenings (length and number), sleep efficiency (total time asleep as a % of total time in bed), and bedtimes and waketimes. Valid sleep data for participants consisted of five or more nights with ≥4 and ≤15 hours per day of sleep recorded.[15] Daytime sleep is common in college students (i.e., napping), thus daytime sleep was classified as sleep bedtimes recorded on the device occurring after 6:00$_{AM}$ and before 6:00$_{PM}$.[16] All sleep data were processed and analyzed using the Cole-Kripke sleep algorithms in the Actilife software (v6.13.4, ActiGraph LLC, Pensacola, FL).[17]

An average assessment of daily and evening screen time was assessed via the Qualtrics survey using the following two questions, adapted from the Centers for Disease Control and Prevention (CDC) Youth Risk Behavior Survey[18]: 1) approximately, how much time do you spend on electronic device(s) (e.g., TV, cell phone, computer, tablet) for an entire day, and 2) approximately, how much time do you spend on electronic device(s) (e.g., TV, cell phone, computer, tablet) in the evening after 10:00$_{PM}$.

Statistical Analysis

Due to the accelerated study timeline and short data collection window (~2 weeks), an a-priori power analysis was not conducted, but the student study team aimed to recruit and retain as many study participants as possible. Post-hoc power analysis indicated a final sample size of 44 study participants was needed to attain statistical power>0.80 (present study final sample size = 29; power=0.68). Accordingly, basic descriptive statistics (means, standard deviations) were computed for all demographic variables, ST, and sleep outcomes. Independent sample t-tests and accompanying Cohen D effect sizes explored differences in sleep outcomes (duration, number of awakenings, length of awakenings, and sleep efficiency) and screen time (daily ST, ST after 10:00$_{PM}$) by college student weight status (overweight or obese versus not), race/ethnicity (minority versus not), and sleep habit subgroups (daytime sleepers versus not).

All statistical analyses were conducted using Stata (v.16.1, College Station, TX) and statistical significance was set at $p<0.05$.

Results

A total of 36 junior or senior standing college students were recruited for this study over a two-week period. Out of the 36 participants that were recruited, seven participants were excluded from data analysis due to an insufficient number of valid sleep days (<5 nights) (n=5), device malfunction (n=1), or incomplete ST estimates (n=1). Approximately one-third (34.5%) of the participants were classified as overweight or obese, 86.2% were female, and 62% were a racial/ethnic minority. Average daily ST of participants was 419.1 minutes (SD = ±123.0 minutes), and their average ST in the evening after $10:00_{PM}$ was 112.2 minutes (SD = ±75.4 minutes). The average bed and wake times recorded by the accelerometer were $2:26_{AM}$, and $8:01_{AM}$ respectively, and for daytime sleep were $11:43_{AM}$ and $3:37_{PM,}$ respectively. Table 1 presents additional descriptive data regarding sleep and screen time estimates from the sample.

Table 1. Study sample descriptives and characteristics (N=29)

Sex	**N**			**%**
Male	4			13.8
Female	25			86.2
Race/Ethnicity				
White	11			37.9
Black	5			17.2
Hispanic	7			24.1
Asian	3			10.3
Multi-racial	3			10.4
	Mean	**±SD**	**Min**	**Max**
Body Mass Index (BMI)	23.8	3.8	17.3	31.6
Age (years)	21.5	1.5	19.0	26.0
Accelerometer wear nights	7.8	1.9	5.0	14.0
Screen Time				
Daily Screentime (mins)	419.1	123	0	600
Evening Screentime (mins) - After $10:00_{PM}$	112.2	75.4	0	360
Night Sleep				
Sleep Duration (mins)	433.8	107.3	240.0	850.0
Number of Awakenings	22.3	10.4	0	50
Length of Awakenings (mins)	3	1.7	0	9.8
Sleep Efficiency (%)	87.3	6	67.9	100
Average Bedtime (HH:MM)			2:26 AM	
Waketime (HH:MM)			8:01 AM	
Day Sleep				
Sleep Duration (mins)	314.1	89.1	182	452
Number of Awakenings	4.5	5.4	0	17
Length of Awakenings (mins)	3.5	2.6	0	8
Sleep Efficiency (%)	95.8	4.8	81	100
Average Bedtime (HH:MM)			11:43 AM	
Waketime (HH:MM)			3:37 PM	

Table 2. Sleep and screentime differences by weight-status, sleep habits, and race/ethnicity minority status

	BMI Classification						Daytime Sleepers						Race/Ethnicity					
	OWOB (n=10)		Non-OWOB (n=19)		P value [a]	ES[b]	Yes (n=19)		No (n=10)		P value [a]	ES[b]	Minority (n=18)		Non-minority (n=11)		P value [a]	ES[b]
	M	SD	M	SD			M	SD	M	SD			M	SD	M	SD		
Screen Time																		
Daily Screentime (mins)	411.0	99.0	429.5	133.4	0.7	0.16	388.3	134.0	480.0	69.7	**0.04**	**0.86**	428.3	139.1	414.5	89.8	0.8	0.12
Evening Screentime (mins) - After 10:00$_{PM}$	123.0	100.4	102.1	55.9	0.47	0.26	94.4	81.7	133.6	50.8	0.17	0.58	116.7	81.6	97.3	58.4	0.498	0.27
Night Sleep																		
Sleep Duration (mins)	418.8	44.1	431.5	59.1	0.55	0.24	420.2	61.3	438.4	39.2	0.39	0.35	423.1	65.3	433.8	28.7	0.61	0.21
Number of Awakenings	22.7	6.5	22.0	6.0	0.76	0.11	22.0	5.8	22.6	6.6	0.78	0.10	21.9	7.1	22.8	4.1	0.68	0.16
Length of Awakenings (mins)	3.4	0.8	2.9	1.2	0.22	0.49	3.2	1.2	2.9	0.9	0.51	0.28	3.2	1.1	2.8	1.1	0.36	0.36
Sleep Efficiency (%)	86.1	3.8	87.4	4.7	0.44	0.30	86.4	4.6	87.9	4.1	0.4	0.34	86.6	5	87.7	3.1	0.51	0.26
Average Bedtime (HH:MM)	2:24 AM		2:28 AM		-	-	2:42 AM		2:07 AM		-	-	2:37 AM		2:14 AM		-	-
Waketime (HH:MM)	8:00 AM		8:01 AM		-	-	8:09 AM		7:54 AM		-	-	8:03 AM		7:58 AM		-	-
Day Sleep																		
Sleep Duration (mins)	301.3	67.8	320.9	100.1	0.62	0.23	314.1	89.1	N/A		-	-	306.4	93.9	331.6	80.9	0.54	0.29
Number of Awakenings	3.5	5.6	5.0	5.4	0.53	0.27	4.5	5.4	N/A		-	-	5.1	6.0	3.1	3.7	0.44	0.40
Length of Awakenings (mins)	3.4	2.6	3.5	2.6	0.94	0.04	3.5	2.6	N/A		-	-	3.4	2.6	3.7	2.6	0.79	0.12
Sleep Efficiency (%)	96.7	4.4	95.3	5.2	0.53	0.29	95.8	4.8	N/A		-	-	95.2	5.6	97.1	2.3	0.4	0.44
Average Bedtime (HH:MM)	11:42 AM		11:44 AM		-	-	11:43 AM		N/A		-	-	11:37 AM		11:49 AM		-	-
Waketime (HH:MM)	3:36 PM		3:38 PM		-	-	3:37 PM		N/A		-	-	3:34 PM		3:40 PM		-	-

M=Mean; SD=Standard Deviation; ES=Effect Size; BMI=Body Mass Index; OWOB = Overweight or Obese

[a] Independent samples t-test, bolded values indicate statistically significant difference at $p<0.05$

[b] Cohen's D Effect Size (ES)

Table 2 presents sleep and ST differences by subgroups. Nineteen of the 29 participants had at least one valid daytime sleep period. No statistically significant findings were observed by race/ethnicity or weight status. However, participants who recorded daytime sleep reported -92 minutes less of daily ST compared to those who did not record a daytime sleeping occasion (p=0.04; Effect size=0.86).

Discussion

Preliminary findings from this brief report highlight differences in daily ST duration between those who recorded daytime sleep versus those who did not. Specifically, students who engage in daytime sleep report lower levels of ST. This study provides objective, free-living estimates of college students' sleep. The sample size is small, thus, further investigation into the relationship between ST and sleep in high-risk college students is warranted.

In our current data, self-reported daily ST duration was greater than seven hours per day, with nearly two hours coming after $10:00_{PM}$. This is marginally lower than previous studies that have reported college students' average daily ST to be 8 to 10 hours.[19] While previous studies have examined ST within the two hours before students' reported bedtimes, exploring ST after $10:00_{PM}$ may be a novel component of this study as it provides a degree of confirmation of late average bedtimes recorded from the wrist-worn sleep device in our sample of college students ($2:26_{AM}$).[5] High ST duration before bed has several health implications. First, it promotes increased sedentary behavior as well as prolonged exposure to blue light, which ultimately disrupts the sleep wake cycle.[20] Coexisting behaviors that accompany excessive nightly ST, such as late-night snacking, can also lead to increased obesity.[21] Furthermore, engaging in emotionally stimulating content is known to potentially prolong sleep onset and could have a harmful impact on sleep quality.[3] Recent studies show that when people sleep with multiple electronic devices present in their bedroom there are more nightly disturbances (i.e., awakenings), and decreased sleep duration.[22] Lastly, no differences were observed in our data for sleep or ST by weight-status or race/ethnicity. However, previous studies have found shorter sleep and frequent sleep disturbances are associated with overweight/obesity in college students and longer ST and shorter sleep durations among non-Hispanic black college students.[8, 23-25]

Our study provided estimates of several sleep outcomes that provides insight of the sleep patterns and behaviors of college students, albeit in a small sample. Average sleep duration in our sample was 433 minutes (~7.2 hours) captured by the wrist-worn sleep device, an unbiased objective measure of free-living sleep. Based on national recommended sleep guidelines for young adults (college-aged adults) of ≥7 hours per night, participants in this sample are meeting sleep duration guidelines, albeit on the lower end of the recommendation. Participants' average bedtime was $2:26_{AM}$, which aligns with a previous study that found college students' average bedtime to be $1:54_{AM}$.[26] Thus, this current study supports existing research reporting that late bedtimes are not uncommon in college students perhaps due to the nexus of academic, work, and social demands.[27] Previous studies also had similar findings in sleep parameters such as frequent nightly awakenings and poor sleep quality.[28-29] What is less known is the impact of this trait on biological processes in the human body – such as the circadian rhythm – that rely on

timing and consistency of sleep-eat-movement 24-hour cycles to perform optimally. Disrupted or inconsistent patterns in sleep and other behaviors day-to-day can lead to social jetlag, where there is a discrepancy between an individual's circadian clock and social rhythm.[30] The circadian clock regulates sleep and wakefulness over a 24-hour cycle, and social rhythm is the regularity of one's daily social habits. Studies have shown a discrepancy between these two can lead to negative health consequences such as weight gain and obesity.[30-32]

Significant daytime sleep was recorded in 19 of our 29 participants, with participants sleeping for an average of five hours on at least one of the days they wore the wrist-worn sleep device. Interestingly, those who recorded a daytime sleep episode had statistically significant less reported daily ST (-92 minutes less per day) compared to peers who did not record a daytime sleep episode. The magnitude of this difference is supported by the large observed effect size (ES>0.8) which is greater than previous literature exploring differences in screen time estimates in adults.[33] This difference may be attributed to a simple displacement of activities. Put simply, those students who sleep during the day fill a portion of time that may otherwise be filled with ST activities. This aligns with theories such as the 'filled-time perspective' – where time filled with favorable activities cannot be filled with unfavorable activities – and this mechanism may hold true for college students.[34] It must be noted, that 'daytime sleepers' in our study sample did have later bedtimes than their non-napping peers, and relatively similar wake times, thus, there may have been compensatory sleep taking place during the day.[35] Further, college students can exhibit an irregular sleep-wake cycle characterized by longer sleep phase delays on weekend days and short sleep length on weekdays, and studies show that this can differ according to study schedules and work obligations.[4] Given that this college sample was homogenous in nature (i.e., same academic major), future longitudinal studies are necessary to capture a large sample of students with a variety of academic and social schedules to better explore ST and sleep differences, and how these interact to impact physical and mental health outcomes in college students.

Strengths of this study include the objective measures for sleep, and the investigation of a relatively understudied population with regards to sleep, US college students. Limitations of this study include a small sample size, which presents the possibility of Type II error. In addition, the sample consisted of students from a single major, thus, result may not be generalized to college students pursuing other academic disciplines. Due to participants being from the Health Sciences major, they may have a greater understanding or awareness of healthy behavior patterns. This could cause their behavior to be different from other university students from other majors. Further, the sample consisted of mostly females (>85%), who have higher levels of melatonin compared to males, so differences in their sleep cycles may exist.[36] Finally, the cross-sectional nature of this study design does not allow for any causal conclusions to be drawn from these data.

This study provided preliminary evidence of ST and objective sleep outcomes of US college students. There are several opportunities for further research in this area that incorporates objective estimates of ST duration and content (e.g., leveraging ST monitoring applications on smartphones), examination of sleep patterns during weekdays versus weekends, and the

routines/schedules (e.g., employed, transportation mode, living situation) of college students and its relationship with sleep (e.g., nighttime and daytime sleep frequency and duration), ST, and health outcomes.

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