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Patterns and Consequences of Inadequate Sleep in College Students: Substance Use and Motor Vehicle Accidents

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Abstract We examined college sleep patterns and consequences using a cross-sectional design. We found that students get insufficient sleep and frequently use medication and alcohol as sleep aids, use stimulants as alertness aids, and fall asleep at the wheel, or have motor vehicle accidents due to sleepiness. Future studies should focus on effective interventions for sleep in college students. © 2010 Society for Adolescent Health and Medicine. All rights reserved.

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Although recommended sleep durations for adolescents are 8 hours 30 minutes to 9 hours 15 minutes [1], college students' sleep decreased from 7 hours 45 minutes in 1969 [2] to 7 hours in 2009 [3]. The college transition presents many challenges (e.g., reduced parental supervision, new social opportunities, difficult studies), which can lead to irregular sleep schedules and sleep deprivation. Sleep deprivation in turn can cause driving accidents [4], depression [5], and worse academic performance [6].

Little normative sleep data exist for college students, most of which is from single item/time-point retrospective estimates, which lack prospective detail and can be biased toward the worst night of sleep [7]. The current study provides the most detailed and valid normative values for sleep in college, using daily sleep diaries, which are the most efficient, commonly used prospective measure of subjective sleep, and are highly correlated with the "gold standard" measure of sleep, polysomnography [8].

Method

Participants

Undergraduates (N = 1,039, 72% female; age: M = 20.39 years, standard deviation = 3.93) completed questionnaires and 1 week of daily sleep diaries. The sample was 67% European American, 13% African American, 10% Latino(a), and 10% other.

Materials

Sleep diary. Participants were asked, each morning upon awakening, to complete daily sleep diaries which asked about nightly bedtime, wake time, sleep onset latency, nighttime awakenings, wake after sleep onset, time awake prior to arising, nap time, and sleep quality. Participants also reported medication and alcohol used as sleep aids, and stimulants used to increase alertness.

Other questions. Participants reported ideal amount of sleep and minimum amount of sleep to function during the day. Additionally, they were asked "Have you ever fallen asleep while driving?" and "Have you ever gotten in a motor vehicle accident due to sleepiness?"

Procedure. Students in psychology courses earned extra credit for completing the questionnaire and sleep diary. During both fall and spring semesters, data collection ended prior to the final week so data were not influenced by final exams.

Results

Table 1 shows sleep diary data calculated according to standard sleep research procedures. No significant differences were found between gender, ethnicity, or class rank

This study was conducted at the University of North Texas, Denton, TX.

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Table 1
Means and standard deviations for sleep variables and substance use

	M	SD
Sleep variables		
Time in bed (TIB)	8 h 11 min	64 min
Total sleep time (TST)	7 h 27 min	64 min
Sleep onset latency (SOL)	21.12	20 min
#Awakenings (NWAK)	0.85	0.79
Wake time after sleep onset (WASO)	7 min	10 min
Time awake prior to rising (TWAK)	16 min	13 min
Sleep efficiency (SE)	90.84%	5.97%
Nap time	27 min	33 min
How did you feel during the day? (1–10)	6.46	1.35
How did you feel when you woke up this morning? (1–10)	5.66	1.60
What was the quality of your sleep last night? (1–10)	7.01	1.52
Weekday bedtime	12:20 A.M.	129 min
Weekday wake time	8:25 A.M.	94 min
Weekend bedtime	1:34 A.M.	137 min
Weekend wake time	10:30 A.M.	140 min
Weekday TST	7 h 33 min	136 min
Weekend TST	8 h 33 min	163 min
Ideal amount of sleep	8 h 25 min	69 min
Minimum amount of sleep needed to function during the day	5 h 45 min	89 min
Substance use for wake and sleep		
Stimulant use to increase daytime alertness		
Percent (%) of sample who use	60.06	
Average no. of stimulants taken per week within users	8.13	8.07
Caffeinated drinks (per week)	6.17	7.82
Rx medication as a sleep aid		
Percent (%) of sample who use	4.81	
Average no. of nights per week within users	2.20	1.54
OTC medications as a sleep aid		
Percent (%) of sample who use	2.02	
Average no. of nights per week within users	3.62	2.44
Alcohol as a sleep aid		
Percent (%) of sample who use	11.36	
Average no. of nights per week within users	2.24	1.39
Average no. of drinks per week within users	6.97	7.75

TST calculation: TST = TIB–SOL–WASO–TWAK. Sleep efficiency calculation: SE = (TST/TIB)*100.
hrs = hours; min = minutes; Rx = prescription; OTC = over-the-counter.

on total sleep time (TST). Ideal TST was approximately 1 hour longer than the actual TST ($p < .001$; $\eta^2 = .35$) and insufficient sleep was a frequent occurrence (70% slept < 6 h and 43% slept < 5 h at least once per week). Weekday-weekend comparisons found a significant difference between TST, bedtime, and wake time ($p < .001$; Table 1). Sixteen percent of participants reported falling asleep while driving and 2% reported a motor vehicle accident due to sleepiness; men (21%) were significantly more likely to fall asleep at the wheel than women (14%; $\chi^2 = 6.07$, $p = .014$).

Medication was used as a sleep aid by 6.83% (prescription = 4.81%; over-the-counter = 2.02%) of participants. Among alcohol users, alcohol was used as a sleep aid by 11.36% of participants; men (16.1%) were significantly more likely to use alcohol as a sleep aid than women (9.8%; $\chi^2 = 6.92$, $p = .006$). Stimulants were used to increase alertness in 60% of participants—soda (39%) and coffee (37%) were the most common.

Demographics and sleep

Women had significantly earlier average bedtimes (12:49 A.M. vs. 1:10 A.M.) and wake times (8:45 A.M. vs. 9:00 A.M.) than men. Women also had more WASO (7.54 min vs. 5.27 min) than men (all $ps < .05$). No other gender differences were found. Several significant differences were seen between ethnic groups on sleep-related variables, which are detailed in Table 2.

Discussion

This study found a significant discrepancy between students' actual TST and their ideal TST. While TST was similar to other college samples [2, 3, 6, 9] it was well below both the National Sleep Foundation's recommended duration [1] and students' self-reported ideal amount of sleep. This discrepancy likely accounted for the high levels of medication and alcohol use as sleep aids and stimulant use to increase alertness, and the high rates of falling asleep at the wheel and motor vehicle accidents due to sleepiness, which were consistent with previous studies of college students and adults [4, 10]. Weekend bedtimes and wake times were significantly delayed and TST was extended an hour compared to weekday sleep. This sleep pattern may be partially responsible for the sleep deprivation during the week, where there is a mismatch between delayed sleep phase and school schedule demands.

Overall, the results seen in this college sample highlight that sleep problems are an important issue to address, considering insufficient sleep results in drowsy driving [4], reduced cognitive function [9] and productivity [4], and increased interpersonal problems [5].

Limitations

Some participants may have completed their sleep diaries once at the end of the week, which would lead to retrospective reporting bias. However, we are confident that this did not generally happen and that the large sample size would overcome this difficulty. Further, the estimates from using one week of daily diaries are a significant improvement over the previously used methods of single-time point retrospective estimates (e.g., estimated sleep over past month). Another limitation of this study is the female bias in sample size, which may have contributed to less reliable measurement of sleep variables (i.e., WASO, bedtime, wake time), and drowsy driving and substance use (e.g., alcohol and stimulants), especially since males were significantly more likely to fall asleep at the wheel and use alcohol as a sleep aid.

Table 2
One-way analysis of variance (ANOVA) for sleep diary and substance use variables by ethnicity

	European American[a] (n = 690)		African American[b] (n = 134)		Latino/a[c] (n = 108)		Other[d](n = 105)		ANOVA	
	M	SD	M	SD	M	SD	M	SD	*F*	*p*
TIB	492.41	62.58	488.43	68.59	493.43	62.69	477.28	70.69	1.81	.140
TST	447.29	63.07	447.51	66.91	450.54	63.42	438.12	69.88	0.78	.510
SOL	21.59	19.49	20.28	18.42	22.07	28.25	18.25	15.76	1.00	.390
WASO	7.64	11.28	7.06	10.13	3.69	4.67	5.92	7.81	4.96[ac]	.002
TWAK	15.74	12.65	13.56	10.60	17.13	17.10	15.00	11.30	1.74	.157
Nap time	24.48	31.39	34.65	30.96	28.65	44.33	30.19	35.36	4.07[ab]	.007
Sleep quality	6.95	1.52	6.92	1.44	7.37	1.40	7.18	1.63	3.07[ac]	.027
ETOH	7.31	7.97	4.08	3.18	7.25	8.13	7.20	7.60	0.63	.590
RX/OTC	2.75	2.09	3.00	1.41	2.20	1.30	2.25	1.89	0.24	.870
Stimulants	9.05	8.61	4.43	3.96	5.50	5.97	6.76	6.57	8.26[ab,ac]	>.001

Letter pairs indicate significantly different groups.

TIB, time in bed; TST, total sleep time; SOL, sleep onset latency; WASO, wake after sleep onset; TWAK, time awake prior to arising; Sleep quality, 1-10 with higher numbers indicating better sleep quality; ETOH, among users, alcoholic drinks used as a sleep aid; RX/OTC, among users, number of Rx and/or OTC medications used as sleep aids; Stimulants, among users, stimulants used to increase alertness.

Future Directions

Future sleep survey studies should try to incorporate online sleep diaries to ensure participants are completing the diaries daily. In addition, longitudinal data are needed to determine which sleep variables are risk factors for decreased academic performance, and increased medical and psychological problems. Studies that follow individuals from high school, through college, and into the job market would be necessary to determine this progression. Future intervention studies should focus on improving sleep duration and consistency, reduction of substance use to combat sleep deprivation, and prevention of drowsy driving. Additionally, exploration of gender and ethnic differences is needed.

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