

University Student Sleep Quality: Some Health Insights regarding Light Exposure

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Abstract

Young adult sleep quality is reported to be compromised in the literature with shortened sleep intervals, daytime napping, excessive daytime sleepiness and excessive wakeups. The description of young adult sleep quality commonly includes the rationale that the independent schedule of the young adults coupled with their preferred social schedule, work and academic schedules leaves the planning for sleep to last place. Despite mentation and memory reductions with sleep deprivation secondary to poor sleep quality documented in young adults, the poor sleep quality prevails. This study is focused on the elements of arousal during a young adult's day that may predispose them to elevated activation and difficulty relaxing sufficiently to fall asleep. It was hypothesized that light exposure was elevated in young adults with poor sleep quality. Light exposure in terms of overhead bright lights in classrooms and laboratories of the academic environment, bright light in terms of video monitors/TVs/tablets/phone exposure is sufficiently stimulating to cause cognitive activation was light exposure.

Keywords

Sleep, Young Adults, Adolescence, Sleep Loss, Sleep Quality, Light Levels, Physical Activity/Exercise and Sleep

1. Background

Sleep quality has been identified as "poor" overall, in young adults. Traditionally, sleep hygiene rules composed of a set of positive health habits conducive to relaxation and falling asleep are provided to address poor sleep [1] [2] (See Appendix 1). To the young adult population of 18 - 30 years, poor sleep quality is also related to variable sleep patterns (*i.e.*, late bedtime-early wakeup, next day late bedtime-late wakeup) [1]. Researchers have reported that the constant tech-

nology use (*i.e.*, smartphone, tablet) by young adults interferes with their sleep [3] [4]. The modification of a sleep schedule is regularly exercised by young adults; they give up sleep for social activities in person or online [1]. Additionally, survey findings of young adult university student perceptions of their peers' sleep as worse quality than their own sleep quality [5].

Some 13% of their interviewed sample of college students met criteria for the Insomnia diagnosis [6]. They attributed the poor sleep quality to the frequent engagement in inconsistent sleep-wake schedules and lounging and worry/thinking about academic stress. With a sleep hygiene instruction, variable sleep scheduling was reported to remain in this sample of college students [7] [8] [9] [10] [11]. The utility of a sleep education workshop for college students in reducing sleep loss and negative mood has been examined. Reported success of a six-week educative and hypnotherapy intervention for university students has added support to issue of providing sleep health/health instruction to university young adults [12]. Some 60% of their participants sample had poor sleep quality with 51% meeting DSM5 Insomnia criteria with reductions of total sleep time and excessive time to fall asleep consistently [12].

2. Effects of Poor Sleep Quality

Sleep deprivation and its adverse effects on college student quality of life has become a pervasive and widespread health concern. Erratic sleep schedules, tendencies toward delayed circadian rhythms, newfound autonomy, academic and social pressures are among the myriad contributing factors that lead to sleep complaints among this subgroup [1]. Compromised academic performance, impaired functioning, increased somatic complaints, and increased use of caffeine and alcohol often accompany their sleep deprivation [1]. College is an opportune time to address the sleep needs of these young adults, develop preventive strategies for, and provide early cognitive and behavioral intervention for emerging sleep problems as they launch into adulthood [10] [13] [14].

Young adults are notorious for having irregular sleep habits (*i.e.*, variable sleep), including a more evening chronotype, disturbed sleep, and inadequate quality and quantity. Sleep quantity and academic performance among undergraduate college students are significantly related, with less sleep generally associated with lower grade point average (GPA) [1]. Napping has been shown to improve alertness and performance; however, the prevalence of napping among college students and the relation to GPA and circadian rhythm type has been identified to be an evening type chronotype [1] [11] [15] [16]. The American Psychological Association release of the "Stress in America" poll in 2020 presented findings of the general public's identification of leading sources of stress on their lives by age cohort. The poll referred to "Millennials" (classification of age closest to the young adult 18 - 30 years) survey responses with an overall stress level of 5.4 on a 10-point scale [16]. This score places them higher than the Baby boomers, Matures, and Generation Xers classifications. Fifty-two percent

of the Millennials responded that the stress caused them to lay awake at night in the past month [16]. A survey of Chilean College students indicated an Eveningness Chronotype, common complaints of poor sleep, feelings of anxiety and upset and worry related to academic performance [17]. The results indicated approximately 70% of the participants had sleep onset insomnia secondary to academic worries. Studies of sleep problems in college students, it was determined, result in an overall decrease from 7.4 hours to 6.8 hours of sleep per night [17].

3. Young Adult Sleep Quality & Self-Selected Light Exposure

As light is a primary signal entraining the circadian system in humans, modification of light by self-selection will result in variations. Laboratory studies have established the phase angle of entrainment for young adults [11] [13] [14]. However, the broadly variable schedules of young adults have not been fully accounted for. Typically, young adults are sleep deprived secondary to their selection of social opportunities and fulfillment of obligations. This situation places them in a dynamic state of varying levels of sleep deprivation—and misalignments of their basic rest sleep cycle. A survey of environmental light levels in university young adult students aged 17 - 26 years on average and concluded that age and occupation are best associated with likelihood of light exposure low in the morning and high at night [18]. Higher fragmentation of light exposure associated with more fragmentation in sleep as measured by light exposure intervention has been reported [18]. Intermittent daily ambient light exposure coincided with irregularity in circadian rhythm [19]. To date, the self-selection of light exposure in a young adult population as a primary research focus has not been addressed. While a 3 - 8 p.m. moderate light exposure in young adults has been reported; the specific amounts of light exposure by the self-selection of a young adult population has not been established. Investigating self-selected light exposure in young adults in the context of their self-reported sleep related variables and measured sleep quality will address this void in the literature.

The target population is young adults, both traditional aged college student and same aged peers that are not college students (*i.e.*, age inclusion criteria: 18 - 30 years).

This study examined self-selected light exposure levels and sleep quality in residence hall and community-dwelling young adults. Further understanding of the sources of their poor sleep quality as a group in terms of measurement of their sleep quality and amount of light exposure will provide a better understanding of their sleep pattern.

4. Method

Participants: Participants were university students with no pre-existing sleep disorder(s), and all constantly worked 12 - 20 hours per week. There was a total of twenty-four participants, 54% were female. The ages ranged from 18 - 27 years. The participants responded to a Qualtrics survey posted on an Instagram page

that announced the study. The participant demographics are presented in **Table 1**.

Instruments: A survey was developed to measure general demographics, sleep history and the participants viewpoints on the amount of light and noise encountered during their day. Thirty-one survey questions were organized for responses in a Likert rating scale format and a QR code to the survey was generated. The survey was composed of four sections 1) Informed consent 2) Exclusion questions a) Due to the focus being on employed college students 3) Questions a) Sleep related b) Bright light exposure related c) Covid related 4) Demographic. A pilot sampling of the survey lead to the revision of several statements and the consolidation of the survey to thirty-one questions. An announcement of the survey was placed on an Instagram page along with the QRcode scan box for a six-month interval of time from the months of June to November of 2021.

Procedure: An announcement of the survey was placed on the Instagram page along with the QRcode scan box for a six-month interval of time.

5. Results

Main findings: The participants' demographic data indicated that 75% of respondents slept 1 - 4 hours per night. 37.5% of respondents had difficulty falling and staying asleep.

A multiple regression was carried out to investigate whether light exposure could significantly predict sleep quality. The results of the regression indicated that the model explained 36.1% of the variance and the model was significant predictor of sleep quality, $F(1,24) = 3.77$, $p = 0.027$. While the amount of the bright light in the evening has contributed to poor sleep quality ($B = 0.238$, $p = 0.016$), bright light exposure during the day and dim light exposure in the evening hours did not. **Table 2** provides a listing of the multiple regression analysis.

Table 1. Participants demographics.

Gender	n
Female	13
Male	7
Non-binary/third gender	2
Prefer not to say	2
Age	
18 - 27 years; Median = 21 years	
Location	
Midwest	62.5%
Southwest	16.7%
Northwest	12.5%
West	4.2%

Table 2. Effect of light exposure on sleep quality.

Independent variable(s):	Slope	Error	t-ratio	probability
How much bright light exposure on daily basis?	-0.267	0.134	-1.989	0.0611
How much dim light exposure in evening hours?	-0.167	0.134	-1.245	0.227
How much bright light exposure in evening hours?	0.238	0.090	2.640	0.016
Dependent variable(s):				
Satisfaction with Sleep Quality				
Constant = 1.657				
$R^2 = 0.361$				
F-ratio = 3.77, p = 0.027				
N = 24				

Note: Bright light exposure refers to classroom/laboratory lighting, fitness center, student center and lighting in other academic buildings as well as self-directed light exposure with cell phones, tablets, video gaming monitors, big screen televisions and work lighting.

However, the findings imply, we think, some further investigation in terms of the identification of the correspondence between sleep quality and light exposure in naturalistic settings. It may be the case that information or education would prepare the university student for improving their sleep health/health [14] [20]. A six week course of sleep education along with hypnotherapy helped direct the university students to improve their sleep quality [12].

Health Decision making in young adult's university students.

The strength of the model further indicates, we believe, that the university student participants' poor sleep quality and erratic light exposure are related. We think that the erratic nature of the reported light exposure could be modified. University students that self-rated themselves as evening types had difficulty with morning social and familial demands. That is, that their poor sleep health impacted them as they personalized, yet they persisted with this behavior [21]. A crossover design of bright light exposure and reported reductions in sleepiness levels with melatonin reduction as well. They proposed that a controlled exposure to bright light not only muted their melatonin levels thus perturbing their circadian rhythm but also affected the sensitivity of pineal gland to release melatonin. We concur and suggest this means to improve sleep health, to improve health by more judicious, planned use of bright light for when alertness is needed (e.g., homework, study) and not as much for lesser tasks [22]. Researchers have reported study findings from ten minutes of exposure to bright light versus a control with university student participants. Participants of the study in the benefit light condition reported reduced subjective sleepiness. Thus, a direct health benefit, if a university student has sufficient sleep education and effective decision making about their health would be to strategically use bright light ex-

posure to increase alertness, decrease sleepiness. This practice could become a countermeasure to improving alertness, attentiveness to academic tasks and reduce sleepiness [22] [23]. The current state, as measured by this naturalistic study is erratic with bright light from classrooms, laboratories, constant cell phone use, video screens of streamed shows and video games. To improve university student health and their sleep health, the insights of both naturalistic light exposures queried in this study and laboratory studies referred to necessitate this focus on health, on sleep health for University Students.

6. Implications of This Study

Importantly, specific information about how much light (*i.e.*, intensity) and duration of light exposure and type of light is unanswered. A current study is underway to investigate the timing and intensity of light as it corresponds to the young adult college students' sleep quality [24] [25] [26]. What remains to conclude, however, from this study is that young adult college students perceive that they have an increased exposure to light and that it is detrimental to their sleep quality. Therefore, in addition to measure of light exposure, further exploration of young adult student perceptions about factors that disturb their sleep quality is needed. The methodology of this study provided a naturalistic response to uncommonly measure lifestyle factors related to sleep. The exacting nature of capturing the young adults sleep experiences and related wake day factors will yield a better understanding of sleep in general. The demographics of the current sample matches studies in this area and is representative of young adult sleep. With additional study, further investigations of light exposure and the variations of light exposure to young adult sleep quality will indicate a larger, more substantial conclusion, an understanding of how to affect/increase young adult health/ sleep quality.

Insights for Sleep Health/Health of University Young Adults.

Early morning daily light exposure will help to signal the university student circadian rhythm to the “wake” setting. *Natural light exposure throughout the day* and safe levels/amounts of light will contribute to alertness and the circadian rhythm wake setting. *Reductions in the amount of dim light exposure* during evening hours (*i.e.*, creating a movie theatre like setting for watching television in the evening), will also help to contribute to the wake mode of our circadian rhythm. Health insights also include following *good sleep hygiene* as listed in **Appendix 1** where a *regular wakeup time* helps to setup a sleep wake rhythm that the sleep circuits in the brain can become used to rather than a variable, erratic sleep schedule. And finally, we feel that the insight of the impactful role of late evening light exposure and sleep quality suggests the need to attend and monitor the evening light exposure so that it does not become excessive. While more investigations to the mechanisms specific to how much is too much bright light and the time interval within the evening hours that makes the university student most vulnerable to its effects is unknown, we concede with a healthy in-

sight of reasonable awareness and monitoring until those findings become known [1] [14]. Taken together, we think the health insights about light exposure and sleep quality illuminate a circumstance for the university student to become aware of for their sleep health/health [1] [14] [20].

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix 1. Sleep Hygiene

Good sleep habits (sometimes referred to as “sleep hygiene”) can help you get a good night’s sleep.

Some habits that can improve your sleep health:

- Be consistent. Go to bed at the same time each night and get up at the same time each morning, including on the weekends
- Make sure your bedroom is quiet, dark, relaxing, and at a comfortable temperature
- Remove electronic devices, such as TVs, computers, and smart phones, from the bedroom
- Avoid large meals, caffeine, and alcohol before bedtime
- Get some exercise. Being physically active during the day can help you fall asleep more easily at night.

Source: https://www.cdc.gov/sleep/about_sleep/sleep_hygiene.html.