

Examining Sleep and Sleep Hygiene in a Sample of College Students and Differences
Between On and Off-Campus Housing

by

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Abstract

Insufficient sleep poses risks to mental health, physical health, and overall well-being but is often overlooked, particularly in young adults and college students whose academic success may also be impacted. Improving sleep health of students is therefore paramount to improving student success and well-being, but little information exists on student's existing sleep habits. Sleep hygiene practices are associated with better sleep, but may not be common in students, particularly among those who live in dorms and have little control over their environment. This study aimed to analyze sleep habits in a sample of 74 students at Middle Tennessee State University and determine if differences exist between those who live on-campus and those who live off-campus after accounting for the impact of anxiety. Results indicated that worse sleep hygiene was significantly correlated with lower sleep efficiency. Additionally, anxiety was negatively correlated with sleep hygiene, time asleep, and sleep efficiency. No differences were found between students who live on-campus and off-campus after controlling for the influence of anxiety, although future studies should further examine this using larger samples.

Keywords: Sleep Hygiene, Insufficient Sleep, Sleep Efficiency, Sleep Quality, Anxiety, College Students, Young Adults, GAD-7, Sleep Hygiene Index

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Examining Sleep and Sleep Hygiene in a Sample of College Students and Differences Between On and Off-Campus Housing

The National Sleep Foundation defines sleep quality as a measure of how restful and restorative one's sleep is, with poor sleep quality characterized by taking more than 30 minutes to fall asleep and waking up more than once during the night ("What is Sleep Quality", 2020). Sleep deprivation and poor-quality sleep has several detrimental effects but is often overlooked. As such, the Centers for Disease Control and Prevention (2009) have declared insufficient sleep, characterized by shorter than recommended sleep duration and/or poor sleep quality, as an under-recognized public health concern.

Of particular concern is the sleep of adolescents and young adults, including college students, who appear to be one of the most sleep-deprived groups in the United States (Forquer, Camden, Gabriela, & Johnson, 2008). A 2010 study found that only 29.4% of college students surveyed reported getting the recommended amount of eight or more hours of sleep a night, along with only 34.1% reporting good quality sleep in addition to a high reliance on over the counter and prescription medications to aid sleep (Lund, Reider, Whiting, & Prichard, 2010). Sleep deprivation and poor-quality sleep can have detrimental effects on cognitive functioning, mental health, and physical health, all domains that are important to college students' success. Additionally, long-term sleep issues in adolescents and young adults can interfere with brain development and lead to an increased risk of adjustment problems, suicidal thoughts, and drug and alcohol abuse (Liu, Kahathuduwa, & Vazsonyi, 2021).

Sleep Among College Students and Factors Affecting Sleep Quality

Sleep among college students is generally poor, and sleep measures such as sleep efficiency and duration appear to worsen in adolescents following high school and during transition into young adulthood (Park et al., 2019). Lund et al. (2010) found that over 60% of college students in their sample had poor quality sleep, with only 29.4% getting at least eight hours of sleep each night and irregular sleep schedules being common. The spring 2019 American College Health Association's National College Health Assessment (ACHA-NCHA) found that 90% of students reported having problems with daytime sleepiness (McNeil & Davidson, 2021).

One explanation for poor sleep among adolescents and young adults is changes in physiology. Adolescents and young adults are more physiologically inclined to be "night owls", with circadian rhythms that are typically 24.27 hours long while the adult circadian rhythm is typically 24.1 hours long (Hershner & Chervin, 2014). Indeed, young adults are twice as likely to have symptoms of delayed sleep phase syndrome than adults (Sexton-Radek & Hartley, 2013). Young adults may therefore be more likely to sleep later on the weekends and not get enough sleep when having to wake up early during the week.

One factor that can contribute to poor sleep is anxiety, defined by the American Psychological Association as an emotion involving feelings of tension, worried thoughts, and physical changes such as increased blood pressure and heart rate ("Anxiety"). Gould and colleagues found that the physical symptoms of anxiety were associated with overall poor sleep quality, but cognitive symptoms had no association with sleep disturbances (Gould et al., 2018). Furthermore, Knowlden, Sharma, & Bernard (2012) found that the

most commonly reported sleep disruptors in a sample of college students were factors that related to stress and anxiety, such as going to bed feeling stressed, angry, or nervous.

Some students' sleepiness and/or poor-quality sleep could be explained by sleep disorders, which may be underdiagnosed. Gaultney (2010) found that, among a sample of undergraduate students in introductory psychology labs, 27% were at risk for having at least one sleep disorder. The same study found that those with no sleep disorder had a higher GPA than those with at least one sleep disorder, with those at risk of at least one sleep disorder significantly overrepresented among those with a GPA below 2.0. Additionally, first-year students that are at risk of a sleep disorder are more likely to drop out in the next three years than their peers (Gaultney, 2016).

There is little research on the most effective ways to improve sleep among students. Some suggestions include setting assignment deadlines at 10 PM instead of midnight, encouraging faculty to include a statement on syllabi discouraging poor sleep habits such as staying up all night, having advisors promote good sleep, and making changes to dorms (McNeil & Davidson, 2021; Qin & Brown, 2017; Dusselier, Dunn, Wang, Shelley, & Whalen, 2005). More research on the sleep habits of college students could be used to aid in finding better ways to improve sleep among this population.

Effects of Insufficient Sleep

The importance of sufficient sleep is made evident by the effects of poor sleep and sleep deprivation. Humans spend an average of one-third of their lives asleep (Hodgson, 1991), and although the exact reasons why we sleep are not well-understood, the effects of poor sleep have been noted for decades. The brain is the only organ that

enters a physiological state that is unique to sleep (Hodgson, 1991). Thus, brain functions are typically the most obviously impaired by insufficient sleep, although insufficient sleep has widespread effects.

Among college students, sufficient sleep is associated with better academic performance (Qin & Brown, 2017) while poor sleep is associated with poorer academic performance and a greater risk of academic failure or dropout (Hershner & Chervin, 2014; Prichard, 2020; McNeil & Davidson, 2021). Gilbert & Weaver (2010) found that among college students without depression, students that had poor sleep quality had significantly lower GPAs compared to those with good sleep quality. Analysis of the American College Health Association's National College Health Assessment (ACHA-NCHA) from spring 2019 suggests that undergraduate students' GPAs drop by 0.02 for every day per week that they reported having a sleep problem (Prichard, 2020).

Insufficient sleep can also affect mood and mental health. For instance, much research has been dedicated to investigating the relationship between sleep and symptoms of depression. While there appears to be a bi-directional relationship in which sleep affects depressive symptoms and depressive symptoms affect sleep, there is more evidence to suggest that poor sleep quality predicts depressive symptoms rather than depression predicting sleep (Lovato & Gradisar, 2014). There is also some research to suggest that cognitive behavioral therapy for insomnia (CBT-I) could be more effective at improving symptoms of depression in students than interventions focused on stress reduction and mood (Trockel, Manber, Chang, Thurston, Taylor, 2011).

Research often focuses on the negative impact that sleep has on mood and mental health, though some research has been devoted to investigating sleep's positive impact on

mental health. Findings suggest that good sleep is directly associated with better well-being, although the relationship may be bi-directional (Steptoe, O'Donnell, Marmot, & Wardle, 2008). A 2016 study found that sleep quality predicted both positive and negative aspects of mental health, with poor sleep quality being associated with lower well-being and greater symptoms of depression (Peach, Gaultney, & Gray, 2016). Sleep deprivation is also associated with aggressiveness, irritability, and may increase the risk of suicide in adolescents (Hodgson, 1991; Chattu et al., 2018).

Insufficient sleep also raises concern about physical health. For instance, insufficient sleep among adolescents has been associated with higher levels of inflammation that predicts future chronic health problems such as cardiovascular disease (Park et al., 2016). A lack of sleep has previously been linked to 7 out of the 15 leading causes of death in the United States, including diabetes and cardiovascular disease, and appears to negatively impact the immune system and increase risk of respiratory infections (Chattu et al., 2018). Chattu et al. (2018) also reports that insufficient sleep is related to an increased risk of obesity, diabetes, and cancer. Additionally, students in high school and college with sufficient sleep report fewer sports injuries and have healthier blood glucose levels (Prichard, 2020). Other physiological effects of sleep deprivation include less efficient body temperature regulation, hormonal changes, and changes in respiratory and cardiovascular functioning (Hodgson, 1991).

Poor sleep can also have negative consequences for driving. Sleep deprivation increases the risk of a motor vehicle accident, and performance of adults who have sustained wakefulness for 24 hours is equivalent to a 0.1% blood alcohol concentration (BAC) (Hershner & Chervin, 2014; Chattu et al., 2018). This is especially concerning

considering Lund et al. (2010)'s finding that 20% of students surveyed reported staying awake all night one or more times in the last month.

Sleep Hygiene

Better sleep quality is often associated with good sleep hygiene practices. Sleep hygiene is defined by the American Academy of Sleep Medicine (AASM) as habits that can improve one's ability to fall and stay asleep. The AASM recommends setting a consistent schedule, getting out of bed if one cannot fall asleep after 20 minutes, only using the bed for sleep and sex, turning off electronic devices at least 30 minutes before bed, exercising regularly, and avoiding caffeine and alcohol in the evening ("Healthy Sleep Habits", 2021). Knowlden et al. (2012) found that college students with adequate sleep had statistically better sleep hygiene than those with inadequate sleep.

Sleep hygiene is also associated with better well-being in college students (Moses, Bradley, & O'Callaghan, 2016). Indeed, Peach and colleagues found that sleep hygiene had effects on depressive symptoms in a sample of college students and noted that sleep hygiene may act as a protective factor against depressive symptoms (Peach, Gaultney, & Gray, 2016). However, the aforementioned study did not measure anxiety which could be a confounding factor.

College students living in residence halls may have a harder time practicing good sleep hygiene and creating an environment that promotes good sleep, although this has not been a large area of study. Students living in on-campus dorms/residence halls often do not have control over aspects of their environment that affect sleep, such as room temperature and bed/mattress comfort. Among environmental factors on college students'

sleep hygiene, Knowlden et al. (2012) found that using the bed for things other than sex and sleeping, such as reading or studying, was particularly influential on overall sleep hygiene. Since students living in on-campus dorms often have a much smaller living space than those living in on-campus apartments or off-campus, they may be more likely to report studying or doing schoolwork in their bed. However, research has not been dedicated to comparing students living in dorms to other living arrangements.

Sexton-Radek & Hartley (2013) found that the five sleep disturbances most commonly reported from students in residence halls were disturbances within the room, sunlight in the room, noise in the hallway, lights on in the room, and cell phone notifications. Another study by Qin & Brown (2017) found that 58% of students sampled in residence halls had concerns about their sleep environment, with room temperature and noise being the most reported complaints. Most students living in on-campus dorms have at least one roommate and often do not have separate rooms or much choice over their roommate(s). Therefore, students living in dorms may have more complaints about noise and light in the room than those in other living arrangements.

It has also been noted that students who report more stress also report more difficulty sleeping, and those who are more comfortable living in their house or feel that they cannot study in residence halls report more stress (Dusselier et al., 2005).

Understanding more about the sleep habits of college students living in dorms could be useful in improving sleep quality in this population.

Statement of the Study

The goal of this study is to investigate if there is a difference in sleep quality and sleep hygiene practices among college students based on living arrangements. This study

will also provide insight on the sleep quality and hygiene practices in college students and if these two variables are related in this population. A covariate of anxiety symptoms will be controlled for in order to better examine the relationship between sleep quality and sleep hygiene. The research poses the following question: Are there differences in sleep quality and sleep hygiene among college students who live on-campus vs. those who live off-campus?

It is predicted that students living on-campus will have poorer sleep hygiene than those who live off-campus. Furthermore, it is predicted that those who live in on-campus dorms will have worse sleep hygiene and sleep quality than those who live in on-campus apartments. Based on previous research, it is predicted that students overall will have poor sleep quality.

Methods

Participants

For this study, 77 undergraduate students at Middle Tennessee State University (MTSU) were recruited via the psychology department's SONA participant pool. An a priori power analysis using GPower (Faul, Erdfelder, Buchner, & Lang, 2009) indicated that a sample size of 159 participants would yield sufficient power to find medium to small effects in the primary analyses of the study. Participants were required to be 18 years old or older, and actively enrolled at and attending MTSU. All participants received course credit applied to their psychology courses for their participation.

Three participants started the survey but did not finish it and were removed from the data, leaving a sample size of 74. All 74 participants who completed the survey passed the attention check questions. Participants were asked for their sex, gender,

race/ethnicity, year in school, and living situation. 52 participants reported living off-campus, 3 participants reported living in an on-campus apartment and 19 participants reported living in an on-campus dorms. Because only 3 participants reported living in an on-campus apartment, those who lived in an on-campus apartment or dorm were combined for data analysis. Participants were primarily female (86.5% and 82.4% for sex and gender, respectively), Caucasian (60.8%), and freshmen (62.2%). Full demographic information is shown in Table 1.

Table 1

Demographics (n = 74)

	On-Campus (n = 22)	Off-Campus (n = 52)	Total
Sex			
Female	21	43	64
Male	1	8	9
Intersex	0	1	1
Gender			
Female	20	41	61
Male	1	9	10
Non-binary	1	1	2
Other	0	1	1
Race			
Black	6	6	12
Asian	1	5	6
Hispanic/Latinx	1	5	6
Pacific Islander	1	0	1
White/Caucasian	12	33	45
Other	1	3	4
Year in School			
Freshman	19	27	46
Sophomore	2	14	16
Junior	1	4	5
Senior	0	5	5
Other/Transfer	0	2	2

Materials

Demographics Questionnaire

Using a 6 question self-report questionnaire, participants were asked for their age, sex, gender, race, ethnicity, and school year.

Living Environment Questionnaire

Participants were asked to report whether they live in an on-campus dorm, on-campus apartment, or off-campus as well as how many people with whom they live, how many people with whom they share a bedroom, and how many pets with whom they share a bedroom.

Pittsburgh Sleep Quality Index (PSQI)

The Pittsburgh Sleep Quality Index (PSQI) is a 19 question self-report questionnaire that assesses sleep quality and disturbance across seven components with a global score ranging from 0-21 (Buysse et al., 1989). Participants were asked about their subjective sleep quality and sleep disturbances, including time spent in bed and time spent asleep, over the past month. Higher scores indicate poorer sleep quality. The PSQI is widely used in clinical and non-clinical samples and has good validity and reliability (Liu et al., 2021).

Sleep Hygiene Index (SHI)

The Sleep Hygiene Index (SHI) is a 13 question self-report questionnaire that assesses the presence of behaviors that are consistent with the diagnostic criteria for inadequate sleep hygiene as defined by the International Classification of Sleep Disorders (Mastin, Bryson, & Corwyn, 2006). The SHI uses a 5-point Likert-style scale where “always” = 4 and “never” = 0. Scores range from 0-52, with higher scores indicating worse sleep

hygiene. The SHI has adequate test-retest reliability ($r = 0.71$) and an internal consistency ($\alpha = 0.66$) that is higher than previously used instruments to measure sleep hygiene (Mastin et al., 2006).

General Anxiety Disorder – 7

The GAD-7 is a 7 question self-report questionnaire that measures the presence of generalized anxiety disorder using the criteria from the DSM-IV (Spitzer et al., 2006). Responses are rated on a 4-point Likert-type scale where “nearly every day” = 3 and “not at all” = 0. Scores range from 0-21 with higher scores indicating more severe anxiety. Scores of 0-4 indicate minimal anxiety, scores of 5-9 indicate mild anxiety, scores 10-14 indicate moderate anxiety, and scores 15-21 indicate severe anxiety (Spitzer et al., 2006). The GAD-7 has good test-retest reliability (ICC = 0.83) and excellent internal consistency ($\alpha = 0.92$) (Spitzer et al., 2006).

Procedures

Students were given an overview of the study and its purpose when signing up to participate on SONA, and they were asked to consent to participation before beginning the questionnaires. Participants were given three questionnaires that assess their sleep hygiene practices, subjective sleep quality, and symptoms of anxiety. Participants also completed a demographics questionnaire and a questionnaire about their living arrangements. These questionnaires were presented in a randomized order for each participant in order to minimize order effects, with the demographics questions asked last for all participants. Two attention check questions were randomly shown.

Results

Data were analyzed using IBM SPSS Statistics (Version 26). Prior to analysis, the data were inspected for quality, missing values, and normality. Upon inspection, it was discovered that some questions from the PSQI were missing from the survey, making it impossible to calculate overall sleep quality scores as originally intended. The available data from that measure, however, were used to calculate two indicators of sleep quality: estimated average sleep time and sleep efficiency. Estimated average sleep time captures the average amount of time per night that participants estimated sleeping, whereas sleep efficiency captures the proportion of time participants spent in bed asleep. Higher values on each of these indicators tend to reflect better sleep quality (Ohayon et al., 2017). With respect to sleep efficiency, eight participants reported spending more time asleep than they did in bed; therefore, they were removed from the sleep efficiency data. Finally, when inspecting the data for normality it was discovered that the sleep efficiency data contained an unacceptable degree of negative skew. Those data were transformed using a square transformation to reduce skew.

In total, the final data set used in the analysis contained data from 74 participants. The descriptive statistics for the variables of interest can be found in Table 2, and the descriptive statistics for the main comparison groups in the study can be found in Table 3.

Table 2*Descriptive statistics*

	Mean	Standard Deviation	Skewness
Anxiety (GAD-7) ($n = 74$)	8.91	5.71	0.47
Sleep Hygiene (SHI) ($n = 74$)	24.05	8.39	-0.01
Time in Bed, minutes ($n = 74$)	475.78	96.18	-0.03
Time Asleep, minutes ($n = 74$)	415.74	83.66	-0.13
Sleep Efficiency ($n = 66$)	0.85	0.13	-1.37
Sleep Efficiency Squared ($n = 66$)	0.74	0.20	-0.92

Note: GAD-7 = Generalized Anxiety Disorder 7. SHI = Sleep Hygiene Index. Higher scores on the GAD-7 indicate more severe anxiety. Higher scores on the SHI indicate worse sleep hygiene

Table 3*Descriptive statistics for the main comparison groups*

	Living Situation	N	Mean	Standard Deviation
Anxiety	On campus	22	9.73	5.85
	Off campus	52	8.56	5.68
Sleep Hygiene	On Campus	22	26.82	7.68
	Off Campus	52	22.88	8.47
Time Asleep, minutes	On Campus	22	423.41	95.76
	Off Campus	52	412.50	78.79
Sleep Efficiency Squared	On Campus	20	0.67	0.20
	Off Campus	46	0.77	0.19

Next, bivariate comparisons were conducted to explore the relationships between the main variables of interest in the study. Older students were more likely to live off-campus than younger students ($r = .26, p < .05$) and had lower scores on the SHI than younger students ($r = -.35, p < .01$), indicating that older students reported having better sleep hygiene. Women also scored higher on the GAD-7 ($r = -.25, p < .05$) and higher on the SHI ($r = -.29, p < .05$) than men, indicating that women reported higher levels of anxiety and worse sleep hygiene than men.

Anxiety was related to sleep hygiene, time asleep, and sleep efficiency, and sleep hygiene was related to sleep efficiency. Those who reported higher levels of anxiety reported worse sleep hygiene ($r = .66, p < .01$), less time asleep ($r = -.30, p < .01$), and lower sleep efficiency ($r = -.28, p < .05$). Sleep hygiene was not related to time asleep, but higher scores on the SHI were related to lower sleep efficiency ($r = -.35, p < .01$), indicating that those with better sleep hygiene had better sleep efficiency. Table 4 shows the results of all correlational analyses.

Table 4
Descriptive statistics and bivariate comparisons

	<i>Pearson r</i>						
	1	2	3	4	5	6	7
1. Age	-						
2. Sex	0.21	-					
3. Living Situation	0.26*	0.17	-				
4. Anxiety (GAD-7)	-0.17	-0.25*	-0.09	-			
5. Sleep Hygiene (SHI)	-0.35**	-0.29*	-0.22	0.66**	-		
6. Time Asleep	-0.16	0.04	-0.06	-0.30**	-0.23	-	
7. Sleep Efficiency Squared	0.03	0.12	0.22	-0.28*	-0.35**	0.56**	-

Note: GAD-7 = Generalized Anxiety Disorder 7. SHI = Sleep Hygiene Index. Higher scores on the GAD-7 indicate more severe anxiety. Higher scores on the SHI indicate worse sleep hygiene. For sex, 1 = female, 2 = male, 3 = intersex. For living situation, 1 = on-campus dorm, 2 = on-campus apartment, 3 = off-campus. * $p < .05$, ** $p < .01$

Finally, a series of one-way between groups ANCOVAs were conducted in order to examine if differences in sleep hygiene, sleep efficiency squared, and time asleep between those who live on-campus vs those who live off-campus is statistically significant, controlling for the influence of anxiety. There was not a significant effect of living situation on sleep hygiene after controlling for anxiety, $F(1, 71) = 3.13, p = .08$ (Table 5). There was not a significant effect of living situation on sleep efficiency squared after controlling for anxiety, $F(1, 63) = 2.46, p = .12$ (Table 6). Lastly, there was

not a significant effect of living situation on time asleep after controlling for anxiety, $F(1, 71) = .62, p = .43$ (Table 7).

Table 5

ANCOVA results with sleep hygiene as the criterion

Predictor	Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	<i>p</i>
(intercept)	5091.61	1	5091.61	129.93	0.000
Anxiety	2112.25	1	2112.25	53.90	0.000
Living Situation	122.49	1	122.49	3.13	0.081
Error	2782.33	71	39.19		

Table 6

ANCOVA results with sleep efficiency squared as the criterion

Predictor	Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	<i>p</i>
(intercept)	11.547	1	11.55	318.86	0.000
Anxiety	0.17	1	0.17	4.65	0.04
Living Situation	0.09	1	0.09	2.46	0.12
Error	2.28	63	0.04		

Table 7

ANCOVA results with time asleep as the criterion

Predictor	Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	<i>p</i>
(intercept)	4088817.10	1	4088817.10	629.61	0.000
Anxiety	48054.60	1	48054.60	0.62	0.43
Living Situation	4013.93	1	4013.93	0.62	0.43
Error	461089.72	71	6494.22		

Discussion

This study investigated sleep habits of college students and if sleep hygiene and sleep efficiency differed based on whether students live on-campus or off-campus. This study was originally supposed to investigate sleep hygiene and subjective sleep quality in students who live in on-campus dorms vs on-campus apartments vs off-campus. However, only three participants who live in an on-campus apartment were recruited so students who live off-campus were compared to students who live on-campus, whether in a dorm or apartment. Additionally, sleep efficiency was looked at in place of subjective sleep quality due to missing Pittsburgh Sleep Quality Index questions in the survey.

Students on average had mild anxiety according to the GAD-7, moderate sleep hygiene according to the SHI, had a sleep efficiency of .85, and reported sleeping for 6.9 hours. These findings are consistent with previous research finding that most students report getting less than the recommended amount of sleep, including Lund et al. (2010), Sexton-Radek & Hartley (2013), and Qin & Brown (2017). As expected, better sleep hygiene was significantly correlated with better sleep efficiency. Sleep hygiene was not significantly related to time spent asleep. This suggests that sleep hygiene may be an effective strategy for increasing the amount of time in bed that is spent asleep, but further strategies would be needed to increase overall time asleep in college students. Students may not have enough time to get enough sleep, and class start times combined with adolescents' longer circadian rhythm (Hershner & Chervin, 2014) could influence sleep time. Anxiety was significantly correlated with sleep hygiene, time asleep, and sleep efficiency, supporting the decision to use anxiety as a covariate. However, future studies

would be needed to investigate whether anxiety worsens sleep, sleep worsens anxiety, or another factor effects both sleep and anxiety.

Students who live on-campus, on average, scored higher on the SHI and had lower sleep efficiency. Students who live on-campus spent, on average, more time asleep than students who live off-campus, which could be explained by the time needed to commute to class. However, ANCOVA analyses showed that there were no significant differences in sleep hygiene, time asleep, or sleep efficiency between students who live on-campus vs off-campus, controlling for the influence of anxiety. Therefore, the null hypothesis that there is no difference in sleep hygiene, sleep efficiency, and time asleep in college students based on living arrangement (on-campus vs off-campus) is retained. However, due to the low sample size, it is possible that this study did not have enough power to find any differences.

If no differences exist in sleep habits between students that live on-campus vs off-campus, it is possible that on-campus living environments are no different than off-campus environments in terms of promoting good sleep. If so, changes to on-campus living environments may not be the most efficient way for universities to promote better sleep among their students and it would be more beneficial to explore other methods. For example, finding effective ways to educate students on healthy sleep habits such as sleep hygiene behaviors and encourage adherence to such behaviors may be more worthwhile. Additionally, it may be more beneficial to explore ways in which university staff and faculty can effectively encourage better sleep habits in students, such as setting

assignment deadlines at 10:00 PM rather than midnight and limiting what on-campus services are open late to discourage students from staying up late.

Limitations

This study had multiple limitations related to the sample and study design. First, one major limitation of this study was its sample size. Less than half the participants that would yield sufficient power to find medium to small effects as indicated by an a priori power analysis were recruited. Therefore, this study may have not been sufficiently powered enough to observe any differences between living situations.

A second limitation is the ability of the sample recruited to be representative of the population of all college students. Participants were only recruited from Middle Tennessee State University (MTSU), and the sample was primarily Caucasian, female, and freshmen. Therefore, the results of this study mainly apply to white women in their first year of college at MTSU. Students at MTSU may vary demographically from other universities, and on-campus living arrangements are not the same at all universities. On-campus living environments at other universities may be better or worse at promoting sleep than those at MTSU. This study also did not have strict inclusion criteria, which could introduce more confounding variables. Participants were only required to be at least 18 years old and actively attending Middle Tennessee State University. For instance, a number of health conditions that weren't controlled for can affect sleep, such as depression, chronic pain, diabetes, substance use, or sleep disorders.

Lastly, this study was limited due its design. Since this study was correlational and not experimental, causal conclusions cannot be drawn. Future studies should explore experimental methods of studying the effect of living arrangement on sleep hygiene in order to make casual conclusions. For example, future studies could randomly assign participants to sleeping arrangements that simulate college dorms and apartments in comparison to a control group. Another possible limitation is the use of self-report measures. Although the measures used have good reliability and validity and were shuffled to avoid order effects, self-report measures are prone to unreliable reporting. Sleep lab studies or using sleep trackers such as fitness bands or smart mattresses may provide ways to measure time asleep and sleep efficiency without having to rely on self-reporting.

Conclusion

Sleep is an underappreciated factor of health, and sleep among young adults and college students is often overlooked in research. This study contributes to the literature on college students' sleep habits by providing further evidence of the linkages between sleep hygiene, sleep quality, and anxiety among this population. Beyond this, the study aimed to determine if significant differences could be observed among different student groups based on their on-campus or off-campus living arrangements across measures of sleep quality and sleep hygiene.

While no significant differences were observed, the data trended in such a way that indicate the need for further research in this area. In facilitation of their goal to create an educated and productive society, institutions of higher education should work towards

improving the health and well-being of their students. Improving students' sleep environments could be a meaningful step in that direction.

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IRB Approval

IRB
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IRBN007 – EXEMPTION DETERMINATION NOTICE

Wednesday, December 08, 2021

Protocol Title **The MTSU undergraduate Sleep Quality Study**
Protocol ID **22-1062 2q**

Principal Investigator **Adam Dockery** (Student) *Faculty Advisor:* James Loveless
Co-Investigators Stevie Nichole (sns6p)
Investigator Email(s) *mhd2q@mtmail.mtsu.edu; james.loveless@mtsu.edu*
Department/Affiliation Psychology

Dear Investigator(s),

The above identified research proposal has been reviewed by the MTSU Institutional Review Board (IRB) through the **EXEMPT** review mechanism under 45 CFR 46.101(b)(2) within the research category **(2) Educational Tests, surveys, interviews or observations of public behavior** (Qualtrics Survey). A summary of the IRB action and other particulars of this protocol are shown below:

<i>IRB Action</i>	EXEMPT from further IRB Review Exempt from further continuing review but other oversight requirements apply
<i>Date of Expiration</i>	6/30/2023 <i>Date of Approval:</i> 12/8/21 <i>Recent Amendment:</i> NONE
<i>Sample Size</i>	500 (FIVE HUNDRED)
<i>Participant Pool</i>	Healthy adults (18 or older) – MTSU SONA
<i>Exceptions</i>	Online consent followed by internet-based survey using Qualtrics is permitted (Qualtrics links on file).
<i>Type of Interaction</i>	<input type="checkbox"/> Non-interventional or Data Analysis <input checked="" type="checkbox"/> Virtual/Remote/Online Interview/survey <input type="checkbox"/> In person or physical– Mandatory COVID-19 Management (refer next page)
<i>Mandatory Restrictions</i>	1. All restrictions for exemption apply. 2. The participants must be 18 years or older. 3. Mandatory ACTIVE informed consent. Identifiable information including, names, addresses, voice/video data, must not be obtained. 4. NOT approved for in-person data collection.
<i>Approved IRB Templates</i>	<i>IRB Templates:</i> SONA Recruitment Script and Online Informed Consent <i>Non-MTSU Templates:</i> NONE
<i>Research Inducement</i>	SONA Credit
<i>Comments</i>	NONE