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Sleep Quality in Undergraduate Students: Examining the Role of Class Rank and Related Individual Differences

Lauren Yocum

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Murray State University Honors College

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Lauren Yocum
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Dr. Gage Jordan, Assistant Professor
Department of Psychology

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Dr. Warren Edminster, Executive Director
Honors College

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Author: Lauren Yocum

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D. Gage Jordan — 04/28/2022
(Dr. Gage Jordan, Advisor) (Date)

Jana Hackathorn — 4/28/22
(Dr. Jana Hackathorn, Committee Member) (Date)

Megan St Peters — 4/28/22
(Dr. Megan St. Peters, Committee Member) (Date)

Sleep Quality in Undergraduate Students: Examining the Role of Class Rank and Related Individual Differences

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Lauren Yocum

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Abstract

College students are likely to experience stress due to increased responsibilities, more demanding coursework, and maintaining a balance between academics and social life. Indeed, college students are at risk for experiencing clinically-significant depressive and anxiety symptoms, as well as sleep disturbances, likely as a result of these challenges. Although the relationship between these affective variables and college stressors are well-documented, less attention has been given to the factors that may help promote better sleep, with the majority of research documenting the intrinsic bidirectional nature of mood and sleep (e.g., lack of sleep leads to worse mood which further exacerbates sleep quality). However, some emergent literature has pointed to individual differences (e.g., stress levels) and class rank as important variables. Thus, this thesis aimed to further delineate and explore relationships between sleep quality and affective variables in college students. There was a marginal association between class rank and sleep quality, such that as class rank increased (e.g., as an upperclassmen) the self-reported sleep quality became worse. Further, the relationships between perceived stress and loneliness with class rank and sleep quality respectively did not have a significant association. However, a positive association between depressive symptoms and poor sleep quality emerged, as well as a mediation relationship wherein social anxiety leads to perceived stress which in turn leads to poor sleep quality was supported.

Introduction

College students are likely to encounter a myriad of stressors that impact their school performance and quality of life, and frequently encounter more complex problems today than they did over a decade ago. Common stressors in college include greater academic demands, being on one's own in a new environment, changes in family relations, changes in social life, and exposure to new people, ideas, and temptations (Bhujade, 2017). Indeed, one of the most robust findings is the prevalence of depressive and anxiety symptoms in college students, likely stemming from or being exacerbated by the aforementioned stressors. One recent, large-scale epidemiology survey of 196 U.S. campuses (N = 155,026 students) documented that 26.9% of these students screened positive for clinically-significant depressive symptoms and 8.2% reported recent suicidal thoughts (Lipson et al., 2019). Furthermore, this survey documented an increase in mental health service utilization within a 10-year period, with rates of past-year treatment nearly doubling within this timeframe (Lipson et al., 2019), suggesting a growing concern of affective symptomology (e.g., depression and anxiety) within college populations. Similar trends have been documented in countries outside of the U.S., with a recent survey from the United Kingdom suggesting that the rates of depression and anxiety in college students in this country are in line with U.S. and global estimates (Jenkins et al., 2020). Furthermore, greater severity of depressive and anxiety symptoms, as well as comorbid conditions (i.e., having concurrent clinically-significant depressive and anxiety symptoms), were associated with a greater detriment to quality of life (Jenkins et al., 2020).

Another important facet often examined within college populations is sleep. Regarding depression, sleep is often treated as a primary predictor variable, with recent research documenting the impact of self-reported sleep quality, level of exercise, and gender differences

on depression severity (Cahuas et al., 2019). For example, in male participants, moderate physical activity, along with higher subjective sleep quality, were robustly associated with lower depression severity (although this relationship was non-existent for female participants; Cahuas et al., 2019). Overall, however, rates of sleep difficulties in college student are in line with rates of depressive and anxiety symptoms, as mentioned previously. For example, a recent study examining a sample of junior U.S. college students ($N = 989$) reported that approximately one third of these students experienced clinically-significant insomnia symptoms (Williams et al., 2020). Furthermore, up to one fourth of this sample reported sleeping six hours per night on average, which is below the recommended guidelines of eight hours per night (Watson et al., 2015). Similarly, this pattern of findings appears to be consistent in college students in countries outside of the U.S.; for example, the overall prevalence of insomnia was 30.5% in Norwegian college students in 2018 (Sivertsen et al., 2018). Nigerian undergraduate students also report poor sleep quality and sleep habits, with the mean duration of sleep being approximately six hours per night (Oluwole, 2010). Relating back to the poor sleep and depression severity link, the majority of this research emphasizes intricate bidirectional relationships between sleep and mood (e.g., poor sleep detrimentally impacts next day mood, which can result in poor sleep that night; Kahn et al., 2013). Thus, the co-occurrence of clinically-significant insomnia and depressive symptoms in college students may likely be, in part, explained by the bidirectional nature of these symptoms.

However, there is an emergent literature examining other important relationships impacting sleep, such as perceived stress levels. As stated previously, the sleep and mood research literature often emphasizes a bidirectional relationship between sleep and depressive symptoms, but this relationship is often difficult to disambiguate given the number of possible

moderating factors (e.g., such as stress; Dinis & Barganca, 2018). A recent narrative review offered other explanations, documenting how some findings support the notion that class rank is positively associated with sleep quality as an undergraduate student, such that as one further progresses throughout college (e.g., from a freshman to a senior), their self-reported sleep quality tends to improve (e.g., Asaoka et al., 2014). This relationship is believed to occur, in part, due to being better able to manage stress throughout one's undergraduate career (Dinis & Braganca, 2018). Other studies have taken into account unique trends within college populations, and how these factors may also affect sleep quality and symptoms of depression and anxiety. Indeed, one significant difference between today's college student population and populations of 10-15 years ago is advancements in technology, which may be a potential influence on the relationship between sleep and mood. For example, some authors have found that waking up in the middle of the night to answer one's phone was associated with poorer sleep quality, which in turn was associated with greater depressive symptomology (Adams & Kisler, 2013). Other findings have posited depression as a mediating variable between smartphone overuse and poor sleep quality, such that students who consistently use their smartphone evidence greater depressive symptoms, which are subsequently associated with poorer sleep (Demirci et al., 2015).

Another possibly more straightforward consideration, alluding to some recent findings discussed earlier, is that biological sex differences may also explain college students' sleep difficulties. On average, women have been found to be at greater risk of poor sleep quality, which may be associated with biological underpinnings of sleep (Fatima et al., 2016), or socio-economic factors (e.g., societal pressures and cultural norms; Kabrita & Hajjar-Muça, 2016). However, this specific line of research has not yet delineated the impact of these specific socio-

demographic variables when examining sex differences in sleep (e.g., differences in the sexes' ability to cope with stressors or regulate emotions and how these factors impact sleep quality).

Lastly, one intriguing phenomenon is the association between sleep duration and affective symptomology, such as depression. As noted previously, college students, on average, sleep less than the recommended eight hours a night. Research examining the relationship between sleep duration and depression produce mixed findings. One study suggested that a short sleep duration will have increased depressive symptoms, but in a "U-shaped" manner (Matushita et al., 2014). That is, students who reported sleeping five to six hours per night endorsed significantly higher depressive symptoms than those who reporting sleeping approximately seven to eight hours per night; however, students endorsing sleep *more* than eight hours per night also endorsed significantly more depressive symptoms (Matushita et al., 2014). Taken together, this previous research suggests a multitude of associations that impact sleep. However, it is also important to consider what researchers mean when they refer to sleep and how it is assessed as a predictor variable or an outcome measure.

Sleep as a Heterogenous Construct

The term "sleep" refers to several different facets and subconstructs, and these facets are often isolated and designated as risk factors for medical and psychiatric problems. For example, insomnia (difficulties falling asleep, staying asleep, or waking up too early), mistimed sleep, and sleep deprivation are all associated with increased risks for medical disorders such as cardiovascular disease, diabetes, and hypertension (Dikeos & Georgantopoulos, 2011). Furthermore, these variables are also associated with psychiatric symptomology such as major depression, clinically-significant anxiety, and posttraumatic stress (Mysliwiec et al., 2013; Reddy & Chakrabarty, 2011). Indeed, insomnia severity specificity tends to be positively associated

with depression severity, which in turn can further exacerbate insomnia symptoms (Manber & Chambers, 2009). Sleep can be further divided into clinically-relevant parameters such as sleep onset latency, wake after sleep onset, sleep efficiency, and so forth. Thus, navigating and assessing the parameters of sleep can be undertaken with a variety of instruments, such as self-report measures, actigraphy, or physiological markers.

Existing theoretical and conceptual models take into account these bidirectional relationships and may serve as important frameworks for understanding the relationships under investigation for this thesis. For example, the diathesis-stress model of insomnia posits that stress serves a precipitating factor that interacts with a predisposing factor (e.g., sleep reactivity) to predict onset of insomnia, with insomnia persisting as a result of perpetuating factors such as irregular and mistimed sleep (Spielman et al., 1987). In addition, the cognitive model of insomnia states that insomnia is the result of excessive worry regarding poor sleep and its daytime effects, which in turn leads to increased physiological and psychological arousal that consequently interfere with sleep (Harvey, 2002). Further, Kahn and colleagues (2013) document the "vicious cycle" of sleep loss and emotion regulation, emphasizing the associated mechanisms (e.g., cognitive and physiological) of how increased negative emotions lead to disrupted sleep, which in turn leads to further impairments in emotional well-being.

One important facet of sleep, in college populations, however, is *sleep quality*, which will be an important parameter and a major focus of this thesis. Sleep quality should not be defined as simply sleeping throughout the night. Specifically, sleep quality consists of how well an individual slept and how it made the individual feel afterwards. Sleep quality can be measured through selective indices such as one's depth of sleep, feelings of being rested upon waking, and overall general satisfaction with sleep (Pilcher et al., 1996). One "gold-standard" measure of

sleep quality is the Pittsburg Sleep Quality Index (PSQI; Buysee et al., 1989), which has consistently demonstrated good psychometrics properties (e.g., internal consistency, divergent validity, and well-established cut-offs scores; Mollayeva et al., 2016). Prior research has frequently used the PSQI to further delineate key indices of sleep quality, and these indices have consistently discriminated between "good" and "poor" sleepers, remaining the only standardized clinical instrument covering the broad range of indictors relevant to sleep quality (Mollayeva et al., 2016).

Overview

Sleep is a multifaceted construct that appears to be a growing concern among the adult population, especially college students. Sleep is related to numerous college-related factors and has an intricate link with anxiety and depression. However, there are multiple gaps in the literature that should be explored to expand the knowledge on sleep quality and how it interacts with other variables. As such, this study looks to further explore factors that are related to sleep quality in college student populations. However, given the numerous links between sleep quality and affective experiences of college students, this thesis will maintain a more specific focus. Drawing from recent findings documenting the relationship between sleep, stress, and mood, this thesis will aim to expand upon these prior findings and seek to replicate other findings.

More specifically, this study will seek to replicate the finding that the further along one is in their studies (e.g., as a junior or senior), the better their self-report sleep quality will be (cf. Asaoka et al., 2014). As such, this thesis will also examine the role of college students' perceived stress levels as it impacts this relationship. Furthermore, other variables that may be relevant but have yet to be examined within this literature, such as loneliness and social anxiety, will also be explored as additional stressors or affective experiences that impact students' sleep quality.

Prospective findings may inform interventions that improve college students' overall sleep quality.

Hypotheses

The hypotheses for this thesis include:

1. A student's class standing will be positively associated with sleep quality, such that the further the student is along in school (i.e., upperclassmen), the better their sleep quality will be.
2. This relationship will be moderated by an individual's perceived level of stress, such that the higher reported levels of stress will negatively impact one's sleep quality, regardless of class standing.
3. An individual's level of perceived loneliness will also moderate this relationship, such that higher reported levels of loneliness will result in poorer sleep quality.
4. Higher levels of depression will lead to poorer sleep quality, replicating numerous previous findings.
5. Perceived levels of stress will mediate the relationship between social anxiety (phobia) and sleep quality, such that higher levels of social anxiety will be associated with higher levels of perceived stress, which in turn will lead to poorer sleep quality.

Method

Participants

Participants ($N = 56$) were undergraduate students recruited from the Murray State University campus. Participants for this study were recruited through various means, with the

link to the survey (detailed below) being sent via listservs and in the form of a scannable QR code posted on various flyers throughout campus. Participants were predominately white (80%), identifying as female (n = 44), with a mean age of 18.94 years (SD = 4.13). Class rank was relatively distributed in our sample, with approximately 23% identifying as freshman, 20% as sophomore, 20% as junior, 23% as senior, and 7% as "other (e.g., fifth-year senior)."

Procedure

Participants completed a battery of self-report questionnaires via LimeSurvey, an anonymized online survey software. Interested participants provided informed consent after receiving access to the survey link. Then, participants completed a battery of questionnaires, which are detailed further below. Embedded within this battery was an attention check that required participants to read a paragraph discussing theories of emotions, select "Other" and type in "I've read the instructions." Participants who did not accurately complete this attention check were excluded from the analyses described below. At the end of the study, participants were redirected to a separate page for an opportunity to enter in their information for a raffle drawing for a Murray State Camelbak water bottle (retail price $20). This study was approved by Murray State University's institutional review board (IRB #22-037; see Appendix A). See Appendix B for an overview of the measures detailed below.

Measures

Quick Inventory of Depressive Symptomatology – Self Report (QIDS-SR)

The QIDS-SR (Rush et al., 2003) is a 16-item measure that assesses the symptom domains of major depression: sad mood, concentration difficulties, self-criticism, loss of interest, energy and fatigue, sleep disturbances, weight gain or loss, psychomotor agitation or retardation,

and suicidal ideation (Rush et al., 2003). However, this study used a modified version of this scale sans the original item twelve which inquires about suicidality, as the researchers of this study were not equipped to respond to participants who may have indicated they were experiencing clinically-significant distress. The scale inquired about certain symptoms during the past seven days (e.g., "Falling Asleep: I never take longer than 30 minutes to fall asleep, I take at least 30 minutes to fall asleep, less than half the time, I take at least 30 minutes to fall asleep, more than half the time, I take more than 60 minutes to fall asleep, more than half the time"). The measure's total score ranges from 0-27, with higher scores indicating more severe depressive symptoms. The QIDS-SR has demonstrated good internal consistency in previous research ($\alpha = 0.86$; Rush et al., 2003). The QIDS-SR demonstrated acceptable internal consistency in this sample ($\alpha = 0.79$).

Generalized Anxiety Disorder Scale (GAD-7)

The GAD-7 (Spitzer et al., 2006) is a seven-item self-report measure designed as a brief screening tool and severity indicator for generalized anxiety disorder. Higher scores on this scale indicate more severe anxiety symptoms (e.g., "Over the last two weeks, how often have you been bothered by the following problems"). The GAD-7 has demonstrated good internal consistency in previous research ($\alpha = 0.86$; Spitzer et al., 2006). Although there are no specific hypotheses associated with the GAD-7, sum scores from this measure may be entered into the aforementioned models as a control variable, if there is adequate power to detect these effects. The GAD-7 demonstrated good internal consistency in this sample ($\alpha = 0.89$).

The Pittsburg Sleep Quality Index (PSQI)

The PSQI (Buysse et al., 1989) is a 19-item measure inquiring about the participant's sleep habits within the past month (e.g., "During the past month, how often have you had trouble sleeping because you cannot get to sleep within 30 minutes?"). The PSQI incorporates both open-ended questions (e.g., "When have you usually gone to bed?") but provides a four-point Likert-type scale (i.e., 0 = "Not during the past month" to 3 = "Three or more times a week") for the majority of items. As such, numerous component scores can be derived (e.g., subjective sleep quality, sleep duration, and so forth), yielding one global score. Recent meta-analytic findings suggest the PSQI demonstrates good internal consistency (Mollayeva et al., 2015). The PSQI demonstrated modest internal consistency in this sample ($\alpha = 0.66$).

Perceived Stress Scale (PSS)

The PSS (Cohen et al., 1983) is a 10-item questionnaire measuring how the respondent has felt nervous, "stressed," or in control of their emotions within the past month (e.g., "In the last month, how often have you felt that you were on top of things?"). The PSS is scored on a Likert-type scale, wherein 0 = "Never," and 4 = "Very Often." Four items on this measure are reverse scored prior to computing a sum score for the measure. Higher scores on the PSS indicate greater levels of perceived stress. The PSS has demonstrated good to adequate internal consistency in previous research (e.g., $\alpha = .69$ to $\alpha = .88$; Lee, 2012) and in this sample ($\alpha = 0.84$).

Social Phobia Inventory (SPIN)

The SPIN (Tulbure et al., 2012) is a 17-item questionnaire that measures the perceived severity, during the past week, that an individual has encountered feelings of embarrassment and other negative feelings while in a social setting and/or near others (e.g., "parties and social events

scare me"). The SPIN is scored on a Likert scale wherein 0 = "Not at all," and 4 = "Extremely." The SPIN has demonstrated good internal consistent in previous research (α = .82 to α = .95; Tulbure et al., 2012). The SPIN demonstrated good internal consistency in this sample (α = 0.89).

UCLA Loneliness Scale

The UCLA Loneliness Scale (Russell, 1996) is a 20-item questionnaire that measures the perceived amount of time that an individual feels that they are alone and how often they feel disconnected from social groups and/or settings (e.g., "I feel isolated from others"). This scale is based on a Likert-type format ("O," "S," "R," or "N"), wherein O = "I often feel this way," S = "I sometimes feel this way," R = "I rarely feel this way," and N = "I never feel this way". When scoring participants' responses, these numbers are coded as numerical (O = 3, S = 2, R = 1, N = 0) so that the scale becomes continuous. The UCLA Loneliness Scale has demonstrated good to excellent internal consistency in previous research (α = .89 to α = .94; Russell, 1996). The UCLA Loneliness Scale demonstrated good internal consistency in this sample (α = 0.90).

Data Analysis

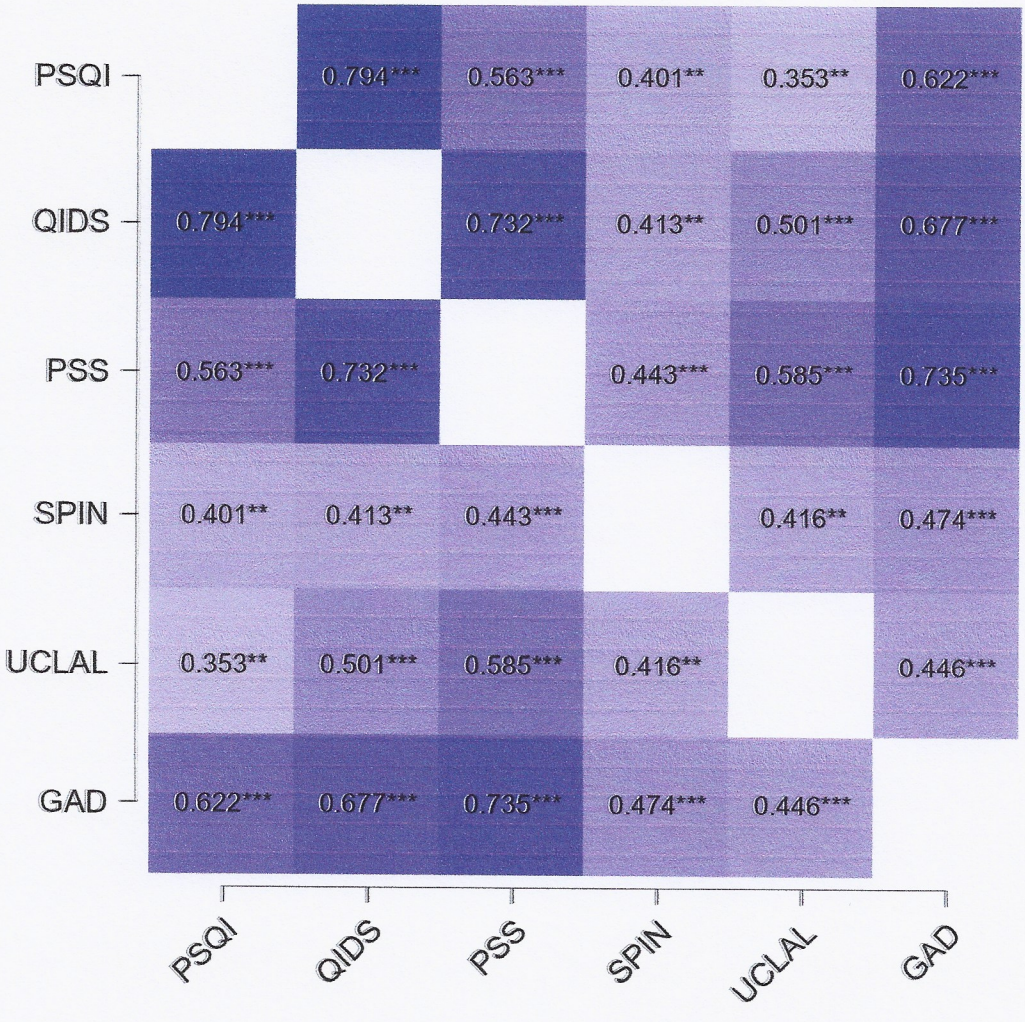
To examine Hypothesis 1, a linear regression model was conducted with class rank as the predictor variable and sleep quality as the criterion variable. Hypotheses 2 and 3 were examined via moderation models using the PROCESS macro (v. 4; Hayes, 2017) for SPSS (v. 27). Hypotheses 4 was examined in a similar manner to Hypothesis 1 (depressive symptoms as a predictor variable and sleep quality as the criterion variable. Lastly, Hypothesis 5 was examined via a simple mediation model using PROCESS.

Results

Prior to our primary data analyses, data were assessed for normality. The distribution of all scales used in this thesis were all within normal limits (skew < ± 1, kurtosis < ± 1; Tabachnick & Fidell, 2013). See Figure 1 for a correlation heatmap depicting Pearson's *r* correlations between all variables used in this study.

Figure 1

Correlations Among All Measures



Note. PSQI = Pittsburgh Sleep Quality Index. Higher scores on the PSQI are indicative of poorer sleep quality. QIDS = Quick Inventory of Depressive Symptomatology, PSS = Perceived Stress Scale, SPIN = Social Phobia Inventory, UCLAL = UCLA Loneliness Scale, GAD = Generalized

Anxiety Disorder Questionnaire. The purple-shaded cells indicate positive associations. The darker and more saturated the cell, the stronger the correlation. ** $p < 0.01$, *** $p < 0.001$.

Hypothesis 1

A linear regression model was used to test Hypothesis 1; that class rank would predict better sleep quality, such that the further along the student is in school, the greater their self-reported sleep quality would be.[1] In this model, class rank did not predict sleep quality, $\beta = .25$, $t(55) = 1.92$, $p = .06$, contrary to Hypothesis 1. Class rank again did not significantly predict sleep quality, $\beta = .09$, $t(55) = .67$, $p = .50$. This non-significance could stem from the lack of variability of class rank in the sample (e.g., fewer upperclassmen than underclassmen).

Hypothesis 2

A moderation model in the SPSS PROCESS macro (Model 1) was used to test Hypothesis 2. Class rank and sleep quality again served as the predictor and criterion variables, with perceived stress serving as a moderator. Overall, the model accounted for 57.16% ($F = 8.41$) of the variance in sleep quality ($p < .001$). Class rank again did not evidence a significant direct effect on sleep quality ($b = 1.13$, $p = .47$). Furthermore, perceived stress did not significantly moderate the relationship between class rank and sleep quality ($b = -.03$, $p = .73$), contrary to Hypothesis 2. Perceived stress alone, however, did evidence a significant direct effect on sleep quality ($b = .54$, $p < .05$).

Hypothesis 3

[1] One participant endorsed "N/A" for the class rank question and was thus excluded from this analysis.

Similarly, a moderation model in PROCESS was used to test Hypothesis 3. Class rank and sleep quality again served as the predictor and criterion variables, with loneliness functioning as the moderating variable. Overall, the model accounted for 40.79% ($F = 3.46$) of the variance in sleep quality ($p < .001$). Class rank again did not evidence a significant direct effect on sleep quality ($b = 1.05$, p = .44), and loneliness did not significantly moderate the relationship between class rank and sleep quality (b = .001, $p = .98$), contrary to Hypothesis 3.

Hypothesis 4

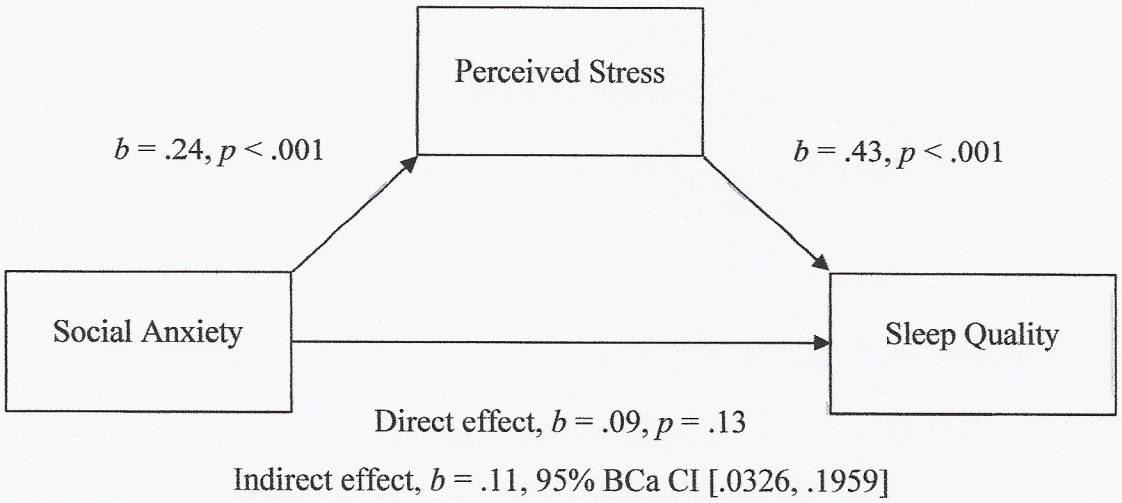
A linear regression model was used to test Hypothesis 4; that depressive symptoms would predict poorer sleep quality. In this model, depressive symptoms significantly predicted sleep quality, $\beta = .78$, $t(55) = 9.73$, $p < .001$, supporting Hypothesis 4.

Hypothesis 5

Lastly, it was expected that perceived stress would mediate the relationship between social anxiety and sleep quality, such that higher scores of social anxiety would be associated with greater perceived stress and in turn, poorer sleep quality. This hypothesis was tested via the simple mediation model (Model 4 in PROCESS). Overall, the model accounted for 44.30% (F = 13.43) of the variance in sleep quality ($p < .001$). Social anxiety evidenced a significant direct effect on perceived stress ($b = .24$, $p < .001$), whereas social anxiety did not significantly predict sleep quality ($b = .09$, $p = .13$). However, perceived stress evidenced a significant indirect effect, b = .11, 95% confidence interval (CI) [.0326, .1959] between social anxiety and sleep quality. As the 95% CI does not include 0, it is assumed that mediation has occurred in this model (Hayes, 2017), supporting Hypothesis 5 (see Figure 2 for an overview of this mediational model).

Figure 2

Hypothesis 5 Results



Note. Higher scores on the PSQI ("Sleep Quality") are indicative of poorer sleep quality.

Discussion

Literature concerning variables that impact sleep is vast; however, recent reviews have isolated key factors that may impact poor sleep quality in college students. One interesting previous study suggested that sleep quality was positively associated with one's standing as an undergraduate student (Asaoka et al., 2014). However, when assessing this relationship in our sample, results suggested no significant association between class rank and sleep quality. Interestingly, when looking at the beta coefficient from the regression model, it appeared that the further along one is in school (e.g., as a junior), the *worse* their self-reported sleep quality was. One explanation is that juniors and seniors may be experiencing qualitatively different stressors (e.g., finding post-education employment or applying to graduate programs). Indeed, the *quantity* of stressors likely do not diminish as one progresses throughout their undergraduate education. For example, although juniors and seniors may be better able to manage sleep-related issues and

educational stressors (e.g., studying and maintaining their GPA), juniors and seniors are introduced to new stressors that involve a college-to-work transition. Notwithstanding this explanation, these findings may also be the result of low statistical power or an artefact of the sample itself. For example, the modest sample size likely resulted in the non-significance of this association, and there was a spread of self-reported sleep quality in the sample overall (e.g., many freshmen and seniors reported poor overall sleep quality).

Similarly, Hypotheses 2 and 3 were also not supported, which proposed that perceived stress and loneliness would moderate the relationship between class rank and sleep quality, respectively. These null findings may also stem from a lack of power to detect moderating effects; however, it is also possible that because class rank was not significantly associated with sleep quality, there would also not be a respective moderating effect as well. Interestingly, perceived stress alone was significantly associated with sleep quality, suggesting one's stress levels have explanatory power in predicting poor sleep quality. This association is a well-documented finding within sleep literature (e.g., Harvey, 2002). Indeed, regarding well-documented associations, Hypothesis 4 was supported, which proposed a positive association between depressive symptoms and poor sleep quality. This finding replicates several other studies (e.g., Bhujade et al., 2017; Demirci et al., 2015), and future research may benefit from continuing to explore this link even further. For example, depression is a heterogeneous syndrome, and consists of sleep-related symptoms (e.g., insomnia or hypersomnia). Furthermore, many persons with depression may not share a single symptom, due to the make-up of the syndrome (Fried & Nesse, 2015). Thus, future studies may examine the effects of specific symptoms of depression on sleep quality (independent of depression's own sleep-related

symptoms), such as anhedonia, fatigue or concentration difficulties, and/or psychomotor retardation.

Lastly, Hypothesis 5, which proposed a path model wherein social anxiety leads to perceived stress, which in turn, leads to poor sleep quality, was supported. In fact, this model was a *full* mediation model, as there no significant direct effect of social anxiety on sleep quality. As such, the mediating effect of perceived stress appears to add explanatory value above-and-beyond the effect of social anxiety alone. This finding suggests that socially anxious persons may experience greater levels of stress, which in turn impacts their sleep quality. That is, it is not the individual's social anxiety symptoms *per se* that leads to impairment associated with sleep; rather, it is the effect of these symptoms on other areas of their life (e.g., interpersonal relationships), which may contribute to poorer sleep quality. As noted above, the association between depression and sleep has been consistently investigated, but these findings suggest that anxiety symptomology may also play an important role in sleep. Recent findings highlight the importance of intervening on sleep difficulties in the context of social anxiety disorder treatment (e.g., Zalta et al., 2013), with these findings suggesting that a primary focus on social anxiety symptomology may in turn help alleviate difficulties associated with sleep. However, further replication is encouraged, as this cross-sectional mediation cannot confirm causality or temporal ordering of the variables. For example, it could be that poor sleep quality leads to perceived stress, which in turn can exacerbate existing social anxiety symptoms.

Limitations

As mentioned previously, some of these results may not have reached statistical significance due to the modest sample size. In addition, these results may not be generalizable to other college populations, as this sample was drawn from students attending a moderately-sized

university in the midwestern U.S. Thus, future research may benefit from continuing to examine these associations in larger and more diverse sample. Relatedly, the recruitment efforts associated with this study may also be a limitation. For example, this study was distributed via listservs and flyers posted around campus. It is possible that the incentive for completing the study may not have been perceived as adequate compensation for the participants' efforts. However, we sought to obtain a relatively equal distribution of class rank within our sample and were able to achieve this goal. Distributing the survey via SONA may have oversaturated our sample with freshman participants (as the majority of SONA users are enrolled in the introductory psychology course). In future studies it may be beneficial to exclude the "Other" variable and rerun the analyses to determine if that had an impact on the non-significant finding of this study.

Although Hypothesis 5 was supported, a limitation associated with this model is that this is an *atemporal* mediation model (Winer et al., 2016). That is, mediation models imply a causal pathway, wherein the ordering of the variables are thought to have temporal precedence. Put another way, the proposed model suggests that social anxiety leads to stress, which in turn leads to (or causes) poor sleep quality. As such, only longitudinal data can provide insight into the temporal ordering of these variables. A final limitation is that this study did not assess possible variables that *help* improve one's sleep quality. For example, it may also be relevant to explore how coping mechanisms relate to sleep quality in future studies, and whether or not underclassmen, compared to upperclassmen, engage in specific coping strategies. Nonetheless, this study is important to the field as it adds to our knowledge on sleep quality and its relationship with a myriad of factors (e.g., class rank, stress, loneliness, depression, and social anxiety).

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Appendix A: IRB Approval

MURRAY STATE UNIVERSITY

Institutional Review Board

328 Wells Hall
Murray, KY 42071-3318
270-809-2916 • msu.irb@murraystate.edu

TO: D. Gage Jordan, Psychology

FROM: Jonathan Baskin, IRB Coordinator JB

DATE: 10/1/2021

RE: Human Subjects Protocol I.D. – IRB # 22-037

The IRB has completed its review of your student's Level 1 protocol entitled *Exploring Quality of Sleep in Undergraduate Students*. After review and consideration, the IRB has determined that the research, as described in the protocol form, will be conducted in compliance with Murray State University guidelines for the protection of human participants.

The forms and materials that have been approved for use in this research study are attached to the email containing this letter. These are the forms and materials that must be presented to the subjects. Use of any process or forms other than those approved by the IRB will be considered misconduct in research as stated in the MSU IRB Procedures and Guidelines section 20.3.

Your stated data collection period is from 10/1/2021 to 5/31/2022.

If data collection extends beyond this period, please submit an Amendment to an Approved Protocol form detailing the new data collection period and the reason for the change.

This Level 1 approval is valid until 9/30/2022.

If data collection and analysis extends beyond this date, the research project must be reviewed as a continuation project by the IRB prior to the end of the approval period, 9/30/2022. You must reapply for IRB approval by submitting a Project Update and Closure form (available at murraystate.edu/irb). You must allow ample time for IRB processing and decision prior to your expiration date, or your research must stop until such time that IRB approval is received. If the research project is completed by the end of the approval period, then a Project Update and Closure form must be submitted for IRB review so that your protocol may be closed. It is your responsibility to submit the appropriate paperwork in a timely manner.

The protocol is approved. You may begin data collection now.

Appendix B: Survey

Pittsburg Sleep Quality Assessment (PSQI)

INSTRUCTIONS:

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

During the past month,

1. When have you usually gone to bed?

2. How long (in minutes) has it taken you to fall asleep each night?

3. What time have you usually gotten up in the morning?

4. A. How many hours of actual sleep did you get at night?

   B. How many hours were you in bed?

5. During the past month, how often have you had trouble sleeping because you...	Not during the past month (0)	Less than once a week (1)	Once or twice a week (2)	Three or more times a week (3)
A. Cannot get to sleep within 30 minutes				
B. Wake up in the middle of the night or early morning				
C. Have to get up to use the bathroom				
D. Cannot breathe comfortably				
E. Cough or snore loudly				
F. Feel too cold				
G. Feel too hot				
H. Have bad dreams				
I. Have pain				
J. Other reason (s), please describe, including how often you have had trouble sleeping because of this reason (s):				
6. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?				
7. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?				
8. During the past month, how much of a problem has it been for you to keep up enthusiasm to get things done?				
9. During the past month, how would you rate your sleep quality overall?	Very good (0)	Fairly good (1)	Fairly bad (2)	Very bad (3)

Quick Inventory of Depressive Symptomatology – Self Report

Directions: Choose the one response to each item that best describes you for the past seven days.

During the past seven days…

1. Falling Asleep:
    a. I never take longer than 30 minutes to fall asleep.
    b. I take at least 30 minutes to fall asleep, less than half the time.
    c. I take at least 30 minutes to fall asleep, more than half the time.
    d. I take more than 60 minutes to fall asleep, more than half the time.
2. Sleep During the Night:
    a. I do not wake up at night.
    b. I have a restless, light sleep with a few brief awakenings each night.
    c. I wake up at least once a night, but I go back to sleep easily.
    d. I awaken more than once a night and stay awake for 20 minutes or more, more than half the time.
3. Waking Up Too Early:
    a. Most of the time, I awaken no more than 30 minutes before I need to get up.
    b. More than half the time, I awaken more than 30 minutes before I need to get up.
    c. I almost always awaken at least one hour or so before I need to, but I go back to sleep eventually.
    d. I awaken at least one hour before I need to, and can't go back to sleep.
4. Sleeping Too Much:
    a. I sleep no longer than 7-8 hours/night, without napping during the day.
    b. I sleep no longer than 10 hours in a 24-hour period including naps.
    c. I sleep no longer than 12 hours in a 24-hour period including naps.
    d. I sleep longer than 12 hours in a 24-hour period including naps.
5. Feeling Sad:
    a. I do not feel sad.

b. I feel sad less than half the time.
c. I feel sad more than half the time.
d. I feel sad nearly all of the time.

Please complete either 6 or 7 (not both).

6. Decreased Appetite:
    a. There is no change in my usual appetite.
    b. I eat somewhat less often or lesser amounts of food than usual.
    c. I eat much less than usual and only with personal effort.
    d. I rarely eat within a 24-hour period, and only with extreme personal effort or when others persuade me to eat.

-- OR --

7. Increased Appetite:
    a. There is no change from my usual appetite.
    b. I feel a need to each more frequently than usual.
    c. I regularly eat more often and/or greater amounts of food than usual.
    d. I feel driven to overeat both at mealtime and between meals.

Please complete either 8 or 9 (not both).

8. Decreased Weight (within the last two weeks):
    a. I have not had a change in my weight.
    b. I feel as if I have had a slight weight loss.
    c. I have lost 2 pounds or more.
    d. I have lost 5 pounds or more.

-- OR --

9. Increased Weight (within the last two weeks):
    a. I have not had a change in my weight.
    b. I feel as if I have had a slight weight gain.
    c. I have gained 2 pounds or more.
    d. I have gained 5 pounds or more.
10. Concentration / Decision Making:
    a. There is no change in my usual capacity to concentrate or make decisions.

b. I occasionally feel indecisive or find that my attention wanders.

c. Most of the time, I struggle to focus my attention or to make decisions.

d. I cannot concentrate well enough to read or cannot make even minor decisions.

11. View of Myself:

a. I see myself as equally worthwhile and deserving as other people.

b. I am more self-blaming than usual.

c. I largely believe that I cause problems for others.

d. I think almost constantly about major and minor defects in myself.

12. General Interest:

a. There is no change from usual in how interested I am in other people or activities.

b. I notice that I am less interested in people or activities.

c. I find I have interest in only one or two of my formerly pursued activities.

d. I have virtually no interest in formerly pursued activities.

13. Energy Level:

a. There is no change in my usual level of energy.

b. I get tired more easily than usual.

c. I have to make a big effort to start or finish my usual daily activities (for example, shopping, homework, cooking, or going to work).

d. I really cannot carry out most of my usual daily activities because I just don't have the energy.

14. Feeling Slowed Down:

a. I think, speak, and move at my usual rate of speed.

b. I find that my thinking is slowed down, or my voice sounds dull or flat.

c. It takes me several seconds to respond to most questions and I'm sure my thinking is slowed.

d. I am often unable to respond to questions without extreme effort.

15. Feeling Restless:

a. I do not feel restless.

b. I'm often fidgety, wringing my hands, or need to shift how I am sitting.

c. I have impulses to move about and am quite restless.

d. At times, I am unable to stay seated and need to pace around.

Generalized Anxiety Disorder Scale

Directions: Answer the following questions.

Over the last two weeks, how often have you been bothered by the following problems?	Not at all	Several days	More than half the days	Nearly every day
1. Feeling nervous, anxious, or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it is hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid, as if something awful might happen	0	1	2	3

If you checked any problems, how difficult have they made it for you to do your work, take care of things at home, or get along with other people?

a. Not difficult at all
b. Somewhat difficult
c. Very difficult
d. Extremely difficult

Perceived Stress Scale

The questions in this scale ask you about your feelings and thoughts **during the last month.** In each case, you will be asked to indicate by circling *how often* you felt or thought a certain way.

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

1. In the last month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
2. In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
3. In the last month, how often have you felt nervous and "stressed"?	0	1	2	3	4
4. In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
5. In the last month, how often have you felt that things were going your way?	0	1	2	3	4
6. In the last month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
7. In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4
8. In the last month, how often have you felt that you were on top of things?	0	1	2	3	4
9. In the last month, how often have you been angered because of things that were outside of your control?	0	1	2	3	4
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

Social Phobia Inventory (SPIN)

Circle the number that best describes how much the following problems have bothered you during the past week:

	Not at all	A little	Moderately	A lot	Extremely
1. I am afraid of people in authority	0	1	2	3	4
2. I am bothered by blushing in front of people	0	1	2	3	4
3. Parties and social events scare me	0	1	2	3	4
4. I avoid talking to people I don't know	0	1	2	3	4
5. Being criticised scares me a lot	0	1	2	3	4
6. Fear of embarrassment causes me to avoid doing things or speaking to people	0	1	2	3	4
7. Sweating in front of people causes me distress	0	1	2	3	4
8. I avoid going to parties	0	1	2	3	4
9. I avoid activities in which I am the centre of attention	0	1	2	3	4
10. Talking to strangers scares me	0	1	2	3	4
11. I avoid having to give speeches	0	1	2	3	4

12. I would do anything to avoid being criticised	0	1	2	3	4
13. Heart palpitations bother me when I am around people	0	1	2	3	4
14. I am afraid of doing things when people might be watching	0	1	2	3	4
15. Being embarrassed or looking stupid are my worst fears	0	1	2	3	4
16. I avoid speaking to anyone in authority	0	1	2	3	4
17. Trembling or shaking in front of others is distressing to me.	0	1	2	3	4

UCLA LONELINESS SCALE

Scale:

INSTRUCTIONS: Indicate how often each of the statements below is descriptive of you.

O indicates "I often feel this way"

S indicates "I sometimes feel this way"

R indicates "I rarely feel this way"

N indicates "I never feel this way"

1. I am unhappy doing so many things alone	O S R N
2. I have nobody to talk to	O S R N
3. I cannot tolerate being so alone	O S R N
4. I lack companionship	O S R N
5. I feel as if nobody really understands me	O S R N
6. I find myself waiting for people to call or write	O S R N
7. There is no one I can turn to	O S R N
8. I am no longer close to anyone	O S R N
9. My interests and ideas are not shared by those around me	O S R N
10. I feel left out	O S R N
11. I feel completely alone	O S R N
12. I am unable to reach out and communicate with those around me	O S R N
13. My social relationships are superficial	O S R N
14. I feel starved for company	O S R N
15. No one really knows me well	O S R N

16. I feel isolated from others	O S R N
17. I am unhappy being so withdrawn	O S R N
18. It is difficult for me to make friends	O S R N
19. I feel shut out and excluded by others	O S R N
20. People are around me but not with me	O S R N

In psychology, emotion is often defined as a complex state of feeling that results in physical and psychological changes that influence thought and behavior. Emotionality is associated with a range of psychological phenomena, including temperament, personality, mood, and motivation. One theory suggests that seeing an external stimulus leads to a physiological reaction. Your emotional reaction is dependent upon how you interpret those physical reactions. For example, suppose you are walking in the woods and see a grizzly bear. You begin to tremble, and your heart begins to race. This theory (the James-Lange theory) proposes that you will conclude that you are frightened ("I am trembling. Therefore, I am afraid"). Further, according to this theory of emotion, you are not trembling because you are frightened. Instead, you feel frightened because you are trembling. Despite the fact that emotions impact every decision we make and the way we see the world, there is still a lot of mystery surrounding why we have emotions. What emotion do you experience more frequently out of the list below? As opposed to selecting a specific emotion, select Other from the list below, and type I've read the instructions.

Anger _____

Fear _____

Sadness _____

Happiness _____

Other:

What is your gender?

What is your age?

Please indicate your ethnicity by checking the appropriate description:

_____ American Indian or Alaskan Native

_____ Asian or Pacific Islander

_____ Black, not of Hispanic origin

_____ Hispanic or Latino

_____ White, not of Hispanic origin

_____ Other

If you are currently in college, what is your class standing? 1. Freshman 2. Sophomore 3. Junior 4. Senior 5. Other (please describe, e.g., "a fifth year senior"): _____ 6. N/A

Are you currently in the Honors College at Murray State University?

1. Yes

2. No

What is your current marital status? 1. Single 2. In a committed relationship 3. Married 4. Separated 5. Divorced 6. Widowed

What is your religious preference? 1. Protestant Christian 2. Roman Catholic 3. Evangelical Christian 4. Jewish 5. Muslim 6. Hindu 7. Buddhist 8. Atheist/Agnostic 9. Other (please describe): _____ 10. I prefer not to specify

What is the total yearly income (in US dollars) for everyone in your household put together? (If you are a dependent of your parent(s), select their household income.)

Less than 10,000

10,000-14,999

15,000 – 24,999

25,000 – 34,999

35,000 – 49,000

50,000 – 74,999

75,000 – 99,999

100,000 – 149,999

150,000 – 199,999

200,000 or more

Don't know

What is your current job or occupation status?

Working full time

Working part time

Homemaker

Student

Looking for work, unemployed

Retired

Disabled – unable to work

How would you describe the place, or the type of place, that you most closely identify with (e.g., your hometown)? (please choose one)

Rural (2,500 or fewer residents)

Small town (more than 2,500 but fewer than 20,000)

Town/small city (20,000-100,000 resident)

Large city (more than 100,000 residents)