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Examination of sleep disturbance, anxiety sensitivity, and depression in an undergraduate sample

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EXAMINATION OF SLEEP DISTURBANCE, ANXIETY SENSITIVITY, AND DEPRESSION IN AN UNDERGRADUATE SAMPLE

by
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Abstract

Sleep contributes to overall well-being, mental health, and daily functioning. Sleep disturbances negatively affect psychological, physiological, and biological processing, and the quality of sleep is similarly affected by these processes. The effects of sleep disturbance call for a greater understanding of depression and anxiety sensitivity among college students. Studies have found that sleep disturbance affects nearly 90% of the college student population. The aims of the current study were to examine: 1) types and rates of sleep disturbance among a sample of college students, 2) associations between sleep disturbance, AS, and depression symptoms, and 3) AS and depression symptoms by comparing college students with high levels of sleep disturbance and those with low levels of sleep disturbance. Similar to predictions, significant positive correlations between all variables were observed. Results suggest a need for treatment related to sleep, anxiety sensitivity and depression. Future research should further investigate the connection between sleep disturbances, AS, and depressive symptoms among college populations.

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Introduction

Sleep is an important factor in mental health, and it plays a primary role in daily functioning. By definition, sleep is the naturally recurring state of mind and body that is characterized by altered consciousness, inhibited sensory activity, inhibited voluntary muscle movement, and reduced interaction with surroundings (Brown et al., 2001). Sleep is commonly conceptualized as a behavior involving a change in body posture and eye state (Irwin, 2015). Just like eating is important, sleep is also a fundamental life process that aids in well-being (Jones, Macphee, & Broomfield, 2005). For example, research indicates that nocturnal sleep plays a homeostatic role in immune response regulation through its role in T-cell production (Irwin, 2015). Conversely, the inability to sleep can be considered a stress trigger, which disrupts health and well-being processes (Jones, Macphee, & Broomfield, 2005). Past research has revealed that disturbances in sleep have a significant influence on the risk of infectious disease and the development of major medical illnesses, such as hypertension, cardiovascular disease, and cancer, as well as mental health issues, such as depression (Irwin, 2015). Thus, it is necessary to consider qualities associated with sleep health, and the effects on psychological, physiological, and biological processing.

Sleep problems occur on a continuum, from infrequent interruptions to chronic interference that disrupts daily life (Edinger et al., 2001). Sleep disturbance has been characterized in the following ways: difficulty falling asleep (i.e., sleep onset latency), staying asleep (i.e., uninterrupted sleep), daytime sleepiness, poor sleep quality, sleeplessness (i.e., difficulty initiating or maintaining sleep), non-restorative sleep, and morning tiredness (Nyer et al., 2013; Vail-Smith, Felts, & Becker, 2009). Disturbances in sleep can contribute to worse overall sleep quality (Blagrove & Akehurst, 2001) including reductions in sleep duration, and

consequently, may contribute to a larger pattern of sleep difficulties (Armstrong & Dregan, 2014).

Representing a more severe form of sleep disturbance, sleep disorders are characterized by a prolonged, persistent pattern of sleep difficulties, and are defined as irregularities in the quality, timing, and duration of sleep (Dale & Nobakht, 2019). Numerous sleep disorders have been identified within the literature including insomnia, hypersomnia, sleep apnea, sleep terror disorder, sleep phase disorders, parasomnias, circadian rhythm disorder, Delayed Sleep Phase Syndrome, and sleep movement disorder (Chiang et al., 2014; Cho & Duffy, 2019; Dale & Nobakht, 2019; Piro et al., 2017). One of the most common sleep disorders is primary insomnia (Terzano & Parrino, 2011), which occurs when sleeplessness persists longer than a month (American Psychiatric Association [APA], 2000). Other sleep related disorders include shift work disorder, and restless leg syndrome (Cho & Duffy, 2019).

Research suggests that sleep disturbances can specifically lead to increased anxiety, increased depression, declined physical health (Irwin, 2015; Lund et al., 2010), and cognitive difficulties (Jansson & Linton, 2007), such as poor problem solving (Brown et al., 2002), deficits in attention (Vanderlind et al., 2014), concentration problems, and issues with critical thinking (Yildirim, Boysan, & Yilmaz, 2018). Sleep issues are also related to attention deficits (e.g., lack of attention while driving) and disruptions in social relationships (Piro et al., 2017). Sleep disturbances have also been associated with various domains of dysfunction including suicidal ideation (Nadorff, Nazem, & Fiske, 2011), irritability (Pilcher, Ginter, & Sadowsky, 1997), academic difficulties (Gaultney, 2010), substance use (Vail-Smith, Felts, & Becker, 2009), and poor mental health (Mellman, 2006; Orzech, Salafsky, & Hamilton, 2011; Taylor et al., 2011;

Nyer et al., 2013). As it relates to health, sleep disturbances may cause weight gain, stress, and neurocognitive dysfunction (Grandner, 2017).

Sleep problems and complaints are common among individuals with psychiatric disorders (Calkins et al., 2013; Koffel & Watson, 2009; Tkachenkoet al., 2014). One study found the lifetime prevalence of sleep disorders was 16.6% in psychiatric patients (Szelenberger & Soldatos, 2005). Results from other studies estimate between 40 to 72% of psychiatric patients have insomnia or hypersomnia (Doghramji, Tanielian, Certa, & Zhan, 2018; Szelenberger & Soldatos, 2005). In addition, psychopathology has been associated with anomalous sleep experiences such as sleep time hallucinations (e.g., hypnagogic and hypnapompic), sleep paralysis (i.e., the inability to move upon awakening; Jiminéz-Genchi, Ávila-Rodríguez, Sánchez-Rojas, Terez, & Nenclares-Portocarrero, & 2009), and nightmares (Speth, 2013; Watson & Stasik, 2015). For example, nightmares are common in people who experience substance use, psychosis, depression, and anxiety disorders, while sleep paralysis is linked to bipolar disorder and post-traumatic stress disorder (Mellman et al., 2008). Research has also found that high levels of anxiety and depressive symptoms are associated with sleep disturbances (Tkachenko et al., 2014). Pre-sleep anxiety has been associated with delayed sleep onset, where sleep onset is the period of moving from wakefulness into sleep (Bertini, Ferrara, Gennaro, 2001), which can potentially increase anxiety and, in turn, increase the chances of sleep onset latency (Babson, Trainor, Bunaciu, & Feldner, 2008). Further, sleep disturbance has also been associated with depression and the development of major depressive disorder (Koffel & Watson, 2009). In fact, sleep disturbances are said to be a core symptom of depression, and subjective sleep quality, with daytime dysfunction being a predictor of depressive symptoms (Norra et al., 2012). In a sample of depressed elderly patients, 90% of them showed signs of sleep

disturbances, and sleep apnea was revealed as an indicative risk factor for depression (Norra et al., 2012).

Depressive disorders are extremely prevalent and are recognized as major public health issues in both developed and developing countries (Mohammadiet al., 2019). The Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5) criteria for depression includes depressed mood most of the day, lack of pleasure or interest in all or almost all daily activities, significant weight loss or weight gain, fatigue, inability to concentrate, and feelings of worthlessness (APA, 2013). In 2009, the lifetime prevalence of major depressive disorder in the USA was estimated at 16.2%; however, there was no association between the recurrence of major depressive disorder and demographic factors such as gender, age, and socioeconomic status (SES; Hardeveld, Spijker, De Graad, Nolen, & Beckman, 2009). On the other hand, 10-15% of depressive patients report having sleep complaints in general while 93% in-patients with depression report having insomnia (Szelenberger & Soldatos, 2005). As noted, sleep disturbance is commonly associated with major depressive disorder; yet, those with depression report a range of sleep issues, including difficulties falling asleep, nighttime and early morning awakenings, oversleeping, feelings of fatigue, and sleepiness during the day (Koffel & Watson, 2009). Research suggests that these sleep difficulties might be interpreted as evidence of irreversible depression, cognitive incapacitation, or personal inadequacy (Cox et al., 1999).

Understanding the associations between sleep and psychological factors allows for a better interpretation and identification of potential methods for reversing the adverse effects of unhealthy sleep habits (Jansson & Linton, 2007). Specifically, the cognitive-behavioral model of sleep dysfunction provides a framework for understanding how sleep issues are maintained and how they may be addressed through psychological interventions (Jansson & Linton, 2007).

Cognitive mechanisms that influence sleep and contribute to insomnia are negative cognitions (e.g., “I’m going to toss and turn all night” or “There’s something wrong with me”), dysfunctional beliefs (e.g., unrealistic sleep expectations, worry/helplessness about insomnia, & perceived consequences of insomnia), and appraisal of sleep and daytime functioning (e.g. staying awake at work or school; Jansson & Linton, 2007). Sleep disturbances often result from dysfunctional beliefs about sleep, pre-sleep worry, and anxiety (Nyer et al., 2013). In addition, studies have found that personality factors have been linked with stress-related sleep dysfunction, and generally, people who have insomnia show neurotic symptoms that affect their ability to stay asleep (Akehurst & Blagrove, 2001; Calkins, Hearon, Capozzoli, & Otto, 2013). In one study, the most important mechanism in explaining insomnia was beliefs about long-term negative consequences of insomnia, which was followed by arousal, depression, and anxiety (Jansson & Linton, 2007). Cumulatively, these findings suggest a bi-directional association between psychological symptoms and sleep.

One specific psychological factor that is of interest is anxiety sensitivity (AS). While anxiety is a feeling of worry, nervousness, or unease about an imminent event, AS is the fear of anxiety-like sensations due to the belief that these sensations are harmful (Reiss & McNally, 1985). AS has been described as a cognitive and affective construct (Berry, Tart, & Powers, 2008). With respect to fears associated with AS, three commonly identified facets of AS include fear of physical symptoms (e.g., increased heart rate), fear of cognitive dyscontrol (e.g., fear of losing control over emotions), and fear of publicly observable symptoms (e.g., sweating and blushing; Taylor et al., 2007). AS is a vulnerability factor for psychopathology more broadly, with studies finding a relationship between AS and borderline personality (Grove, Smith, Crowell, & Ellis, 2017), depressive symptoms (Tull & Gratz, 2008), substance use (Keough,

Hendershot, Wardell, & Bagby, 2018), emotional disorders (Emert et al., 2014), physical health conditions (Rosen, Gimotty, Shea, & Bellini, 2006; Simpson &, 2007; Nillni, 2011), dermatological disorders (Dixon et al., 2018), and sleep disturbances (Calkins et al., 2013).

Research has demonstrated an association between AS and sleep across clinical and nonclinical samples. For instance, one study showed that AS plays a moderating role between anticipatory anxiety about sleep and sleep onset (Calkins et al., 2013). More specifically, past research has found that at increased levels of anxiety sensitivity (AS) and anticipatory anxiety, there is an increase in sleep onset latency (Calkins et al., 2013). In a study that examined 101 anxious youth, increased anxiety sensitivity was a predictor of sleep onset latency (Weiner, Elkins, Pincus, & Comer, 2015). Another study found that AS was associated with racial differences in sleep duration among adults (Alacantara, Cosenzo, Fan, Doyle, & Shaffer, 2016). Comparatively, a previous study was done to examine the relationship between AS and sleep in college students and older adults, indicating strong, positive relationships in both populations (Alacantara et al., 2016). Further, AS has also been found to be elevated in patients with major depression (Schmidt et al., 1998; Taylor et al., 1996). In particular, studies found that severe depressive symptoms are linked to specific dimensions of AS, including the fear of cognitive dyscontrol (Cox et al., 1999), and the fear of publicly observable anxiety (Cox et al., 2001).

Due to the fact that depression has been linked with AS and sleep, it is important to understand the additional effects and causes of depression in college populations. In particular, research has shown that AS, sleep disturbance, and depression are each commonly experienced by college students; however, there are relatively few studies that have concurrently examined these factors.

Sleep complaints are prevalent among college students, with 88% of students reporting some type of sleep difficulties, (Thomas, 2015), such as issues falling or staying asleep, restlessness, or unsatisfying sleep at night, and fatigue during the day (Koffel, 2009); whereas two thirds of the students report regular severe sleep difficulties (Brown et al., 2002). These reported sleep disturbances also include overall poor sleep quality, and other general sleep problems (Nyer et al., 2013). In college students, sleep disturbance has been associated with numerous adverse effects such as suicidal ideation, irritability, poor physical health, academic difficulties, substance use, and poor mental health (Nyer et al., 2013). Previous research shows that less sleep has negative impacts on students' academic performance (e.g., GPA; Koffel & Watson, 2009). More specifically, in college students, sleep latency and use of sleep aid medication were negatively associated with academic performance (Chiang et al., 2014), sleep dysfunctions were associated with lower GPA (Brown et al., 2001), and lack of sleep led to excessive day-time sleepiness (Piro et al., 2017).

Studies have shown the importance of sleep in college students' health, function at work, and daily activities (Vincent & Walker, 2001). In university students, sleep has been associated with anxiety, stress, alcohol consumption, depression, pain, memory and cognition (Manzar et al., 2015). Students with sleep disorders have reported far more physical and mental health complaints than students without sleep disorders (Thomas, 2015). Homeostatic drive for sleep has been found to decrease as individuals get older, thereby indicating that age is a vulnerability factor for sleep problems (Buysse et al., 1993; Espie, 2002). In adults, sleep patterns are more fragmented, and they also report to be lighter sleepers (Espie, 2002). Research also indicates gender differences in undergraduates, specifically females report sleep problems at higher rates than males, and yet report going to bed earlier (Manzar et al., 2015). Subsequently,

understanding relations between sleep and mental health among those who practice healthy sleep habits is important due to the fact that individuals sleep habits tend to worsen over time (Lukowski & Milojevich, 2016).

Along with sleep being a major concern among college students, AS is another significant factor that affects college students in various ways. Similar to the general population, AS is also associated with variables such as depression (Koffel & Watson, 2009), suicide (Lamis et al., 2013), and sleep (Calkins et al., 2013) in college students. College students with depressive symptoms and sleep deprivation may experience a greater burden of comorbid anxiety symptoms and hyper-arousal, and may have impairments in functioning, compared to students with depressive symptoms without sleep deprivation (Nyer et al., 2013). In that same study, results showed that students with depressive symptoms and sleep deprivation reported greater anxiety, and cognitive and physical impairment. In regard to AS, elevated levels of AS are a risk factor for the development of depressive symptoms. Given that AS intervention has been shown to decrease AS and depression, thereby reducing symptoms of anxiety and worry (Lamis & Jahn, 2013), it supports the idea that these interventions could potentially improve sleep quality. Because AS is linked to depression (Koffel & Watson, 2009), which is linked to sleep quality, it is important to consider these associations in the college population to better understand how sleep disturbances affect their quality of life. Accordingly, this study aimed to do just that.

Current Study

The first aim of this study was to examine types and rates of sleep disturbance among a sample of undergraduate college students. The second aim was to examine associations between sleep disturbance, AS, and depressive symptoms. It was hypothesized that sleep disturbance will

be positively correlated with AS and depressive symptoms. The third aim was to examine AS and depression symptoms by comparing college students with high levels sleep disturbance and those with low levels sleep disturbance. It was predicted that students in the high sleep disturbance group would report significantly higher levels of AS and depression while those who report low levels of sleep disturbance would report decreased AS and decreased symptoms of depression.

Method

Participants and Procedure

Undergraduate research participants were recruited through the University of Mississippi's Department of Psychology Sona System's research pool. This study was conducted on University of Mississippi's college campus, and students completed the online prescreening before continuing with further research. Participants had to be at least 18 years of age or older to participate in this study. The initial sample was comprised of 656 participants, where 12 participants were excluded due to incomplete self-report measures resulting in a final sample of 644 participants (70.2 % female & 29.7 % male). The majority of the sample were college freshman (75.5%) living in on-campus dormitories. The sample was 80.7% White, 16.5% Black/African American, 3.1% Hispanic/Latino, 2.6% Asian/Pacific Islander, and 0.9% Native American.

This study was part of a larger study entitled "Responses to Interpersonal and Personal Stressor," which was approved by the University of Mississippi's Institutional Review Board (IRB). Participants were informed that the purpose of the study was to learn about how college students respond to stress. After consenting to study procedures, participants responded to a battery of online questionnaires that asked about mental health, physical health, and reactions to

stress with respect to depression, anxiety symptoms, substance use, emotions, and relationships. The time allotted for the completion of the study was 40-50 minutes, and all participants were required to complete the questionnaires in one sitting. Upon completion of the study, participants received 1.0 hours of Psychology research credit via University of Mississippi's Department's Sona Systems Pool. For the purposes of the current study only responses to measures examining demographics, anxiety sensitivity, depression, and sleep were used.

Measures

The College Student Demographic Form. A researcher-developed demographic form was used to collect relevant sociodemographic information about the participants such as age, race/ethnicity, sex, gender identity, undergraduate classification, and residential status (e.g. off-campus vs. on-campus housing). See Appendix A.

The Anxiety Sensitivity Index – 3 (ASI-3). The ASI-3 (Taylor et al., 2007) is an 18-item self-report scale that measures concerns associated with anxiety-related sensations. The ASI-3 is reportedly the psychometrically strongest measure of AS to date (Taylor et al., 2007). Using a Likert-type scale (*0=Very little, 1=A little, 2=Some, 3=Much, 4=Very much)* participants rated the extent to which they agree with statements such as, "It is important for me to not to appear nervous". This questionnaire assessed physical (e.g., "It scares me when my heart beats rapidly"), cognitive (e.g., "When my thoughts seem to speed up, I worry that I might be going crazy"), and social concerns (e.g., "When I begin to sweat in a social situation, I fear people will think negatively of me") of AS. Taylor and colleagues (2007) demonstrated that ASI-3 provides a stable three-factor structure across gender and seven multi-language nonclinical and clinical samples (Olthuis, Watt, & Stewart, 2014). The ASI-3 has demonstrated strong

convergent, discriminant, and in-group validity in prior research (Taylor et al., 2007). See Appendix B.

The Depression Anxiety and Stress Scale – 21 (DASS-21). The DASS-21 (Lovibond & Lovibond, 1995) is a 21-item self-report scale that measures severity of the emotional states of depression, anxiety, and stress. However, the current study only used the DASS-21 Depression Scale. Using a Likert-type scale (*0=Did not apply to me at all, 1=Applied to me to some degree, or some of the time, 2=Applied to me to a considerable degree, or a good part of the time, 3=Applied to me very much, or most of the time)*, individuals rate the degree at which they believe statements such as, "I couldn't seem to experience any positive feeling at all" apply to them. Each scale contains 7 items that are divided into subscales with similar content that assess dysphoria, hopelessness, lack of interest, situational anxiety, and nervous arousal. The maximum obtainable score on each subscale is 42. However, 16 points or higher is the cut-off score for MDD on the depression subscale. People who meet these criteria have a greater probability of being diagnosed with MDD or an anxiety disorder (Chin, Buchanan, Ebesutani, & Young, 2019). Cut off scores for the depression subscale are labeled as normal (0-9), mild (10-13), moderate (14-20), severe (21 to 27), and extremely severe (28+). More specifically, the depression subscale includes but is not limited to dysphoria, hopelessness, devaluation of life, anhedonia, inertia, self-deprecation, and lack of interest (Campbell, Runions, Shaw, & Zubrick, 2017). Lovibond and Lovibond (1995) demonstrated that DASS-21 has high reliability and strong convergent validity with other measures of anxiety and depression. See Appendix C.

The Pittsburg Sleep Quality Index (PSQI). The PSQI (Buysse et al., 1989) is a 19-item self-report questionnaire that is used to measure sleep quality and sleep patterns by seven domains: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep

disturbances, uses of sleep medication, and daytime dysfunction over the past month. The sleep quality subscale measures sleep quality within the past month. The sleep latency subscale measures the number of minutes it takes to fall asleep each night. However, some individuals measured the time spent in bed until time awake. This scale excludes daytime naps. The sleep duration subscale measures the time participants usually wake up in the morning. The sleep efficiency subscale, which was excluded from the current study's results, measures the number of hours of actual sleep participants get at night. The sleep disturbance subscale measures how often participants had trouble sleeping during the past month due to various interruptions. The sleep medication subscale measures how often participants took prescribed or over the counter meds within the past month. The daytime dysfunction subscale measures how often participants had trouble staying awake while driving, eating, or participating in social activities.

In this study, a modified PSQI total was calculated by summing the items from the subscales described above, with the exception of sleep efficiency. Higher scores on the PSQI scale were an indication of poorer sleep quality, specifically scores above 5. The PSQI questionnaire can identify potential sleep dysfunction, possible causes of sleep disturbances, and it can be used in the diagnosis of sleep disorders. Using a Likert scale (*0=Not during the past month, 1=Less than once a week, 2=Once or twice a week, 3=Three or more times a week),* participants rated the degree to which they believe the statements such as, "Cannot get to sleep within 30 minutes" applied to them. See Appendix D.

Results

Preliminary Analyses

The low sleep disturbance and high sleep disturbance groups were determined by examining the total scores on the PSQI excluding the sleep efficiency. In the full sample, the

mean total score was 5.88 (*SD* = 3.01). Participants who scored 1 standard deviation (*SD*) below the mean (*n* = 78) comprised the "low" sleep disturbance group, and participants who scored 1 *SD* above the mean (*n*= 111) comprised the "high" sleep disturbance group.

Descriptive Statistics

The mean score of the modified sleep quality total was 5.88 (*SD* = 3.01) and ranged from 1.45-10.70. The mean score is above the clinical cutoff score of 5, suggesting that the sample reported generally suboptimal sleep quality. Specifically, responses to sleep quality consisted of 37.1% who reported Very Good Sleep, 37.9% Fairly Good Sleep, 20.1% Fairly Bad Sleep, and 4.9% very bad sleep. There was a mean score of 28.05 minutes (*SD* = 41.18) for sleep onset latency and a mean score of 7.10 hours (*SD* = 2.19) for sleep duration. See Table 1 for a full summary of sleep disturbances reported by this sample. With regard to depression symptoms, on average, this sample reported symptoms in the normal range (0-9).

Examination of Study Hypotheses

To test the hypothesis that high levels of sleep disturbance will be positively correlated with anxiety sensitivity and depressive symptoms, a Pearson's *r* correlation was conducted. Results were consistent with the prediction, and significant correlations were observed at $p < .001$. Specifically, there was a statistically significant correlation between high levels of sleep disturbance and anxiety and depressive symptoms (Table 2).

An independent samples *t*-test was conducted to test the hypothesis that students with low levels of sleep disturbance will report lower levels of anxiety sensitivity and fewer depressive symptoms. Results were consistent with this prediction for anxiety sensitivity, $t(187) = 6.37$, $p < .001$, with an effect size of $d = .43$. The results were also significant for depression symptoms $t(187) = 8.23$, $p < .001$ with an effect size of $d = .53$. The effect size for the subscales, anxiety

sensitivity physical d = .36, social d = .43, and cognitive d = .33. Specifically, participants who reported low levels of sleep disturbance had fewer symptoms of anxiety and depression. Cohen's (1988) convention for a small effect, medium effect, and large effect are d= .20, d = .50, and d = .80, respectively. Therefore, each score indicated a small effect. Results also indicated that students with high sleep disturbance would report significantly higher levels of AS and depression. Results were consistent with this prediction. See Table 3.

Discussion

The first goal of this study was to examine sleep disturbance among college students. In the current study, this sample of students that showed a high level of sleep disturbance, which is similar to prior research conducted in undergraduate populations. Preliminary analyses indicate that 56.4% of college students, men and women, report some type of sleep disturbance (Sivertsen et al., 2019), while results from a meta-analysis revealed that 25.7% university students reported sleep issues with a PSQI range of 21.0-27.5%, which indicates high levels of sleep disturbance (Li, Wang, & Zhang et al., 2018) while the current study showed a mean score of 6.436 (SD = 5.261) for total sleep disturbance.

In support of the studies first hypothesis, which states that sleep disturbance will be positively correlated with anxiety sensitivity and depressive symptoms, the correlation tests revealed a statistically significant positive correlation between all of our variables (i.e., sleep disturbance, anxiety sensitivity, and depressive symptoms). Specifically, these results revealed that greater sleep disturbance is associated with higher levels of AS and increased depressive symptoms. This finding is consistent with previous research that says sleep dysfunction is a core symptom of depression and a predictor of depressive syndromes (Nora et al., 2012). Moreover, previous research also shows that specific dimensions of AS has been associated with depressive

symptoms, and elevated levels have been found in individuals diagnosed with major depression (Cox et al., 1999; Cox et al., 2001; Schmidt et al., 1998; Taylor et al., 1996). Other research suggests that there is a relationship between psychological distress and sleep quality (John-Henderson, Williams, Brindle, & Ginty, 2018). Psychological distress has been found to negatively impact sleep and over half the student population have reported experiencing symptoms of depression shortly after being enrolled (Furr et al., 2001; John-Henderson, Williams, Brindle, & Ginty, 2018).

The final aim of this study was to examine the different effects of high and low sleep disturbance among college students. The results of the independent samples *t*-tests comparing symptoms between those with high and low sleep disturbance supported the second hypothesis. That is, individuals with high sleep disturbance reported significantly higher levels of AS and depressive symptoms than those with low or no sleep disturbance. This finding further supports the indication that sleep disturbance is associated with poor mental health, and students who report signs of sleep deprivation had higher levels of anxiety (Nyer et al., 2013).

Taken together, these findings provide a replication of previous studies for what is known about sleep disturbance among college students, as well as the connections among sleep disturbance, anxiety sensitivity, and depression. Nyer and colleagues (2013) did not actually find an association between depressive symptom severity and sleep disturbance, while the current study yielded significant results showing that high levels of depressive symptoms are related to high levels of sleep disturbance. According to another study, undergraduate students reported significantly high levels of sleep disturbance (Ye et al., 2016).

Future studies could benefit from using the past and current findings to implement effective therapeutic interventions in college population being that depression and poor sleep is a

target of concern (Nyer et al., 2013). According to that same study previously cited studies, there has been no evidence of studies targeting or examining insomnia in depressed college students, which suggests another possible examination for future studies. Nyer and colleagues (2013) also added an idea that brings attention to the side effects of certain medications, such as antidepressants, which are sometimes insomnia and cognitive symptoms. This information suggests that future studies could focus on examining students who take antidepressants for depression and compare the findings with depressed students who take sleep medication for sleep disturbances in addition to studying the relationships with anxiety sensitivity.

Limitations

There are a number of limitations that should be considered. First, it is important to note that the data from this study was retrieved from a larger study that was not intended to answer the specific questions of the current study. Participants answered a series of questions related to stress, sleep, anxiety sensitivity, depression, and demographics; however, this study was based upon self-report measures to determine the levels of anxiety sensitivity, depressive symptoms, and sleep disturbance. Self-report measures limit the amount of accurate and honest data that participants report (Gamache, Savard, Leclerc, & Cote, 2019). Additionally, the research study was limited to one, southern university's undergraduate students. It is possible that future research could benefit from data collected in western and eastern cultures of the United States. Additionally, it was limited to a southern, white, and mainly female population, thus limiting the generalizability of these results. Another possible limitation is sample size. The sample size was affected by participants who failed to complete certain questionnaires. This study is also cross-sectional in nature and thus causation cannot be determined. Future studies could benefit by

conducting a longitudinal study to examine depressive symptoms, anxiety sensitivity, and sleep disturbances over a longer period of time to see how the symptoms progress.

This study suggests a need for further investigation in various directions. We can use the data from this study to further understand the connection between sleep disturbances, AS, and depressive symptoms. This data could also be useful for creating and improving existing treatment plans related to anxiety sensitivity, depression, and sleep. The correlations suggest a greater need for treatment plans to be implemented and accessible on university campuses as the symptoms of each variable have an effect on quality of life and academic performance (Nyer et al., 2013). This study could enhance our knowledge of various sleep components that aid in sleep disturbances as well as the relationship between depressed individuals who experience sleep disturbances and those who do not.

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Table 1. *Sleep Disturbance in College Students*

Pittsburgh Sleep Quality Inventory (PSQI)	**Full Sample** ***N*** **= 638**	**High Sleep Disturbance** ***n*** **= 111**	**Low Sleep Disturbance** ***n*** **= 78**
	M**(*****SD*****)**	***M*****(*****SD*****)**	***M*****(*****SD*****)**
Sleep Latency Onset in Past Month (Minutes)	28.05(41.18)	46.46(34.02)	16.05(26.72)
Sleep Duration in Past Month (Hours)	7.0(2.19)	5.87(1.85)	8.31(2.702)
Subjective Sleep Quality	.93(.87)	1.88(.81)	.039(.19)
Sleep Latency Score	1.17(.93)	2.24(.75)	.24(.46)
Sleep Duration	1.10(.65)	1.74(.63)	.41(.50)
Sleep Disturbance	6.44(5.26)	11.90(5.69)	1.63(2.55)
Use of Sleep Medication	1.09(.68)	1.81(.67)	.35(.53)
Daytime Dysfunction Over Past Month	.76(.78)	1.51(.77)	.06(.25)
Modified Sleep Quality Total	5.88(3.01)	10.70(1.92)	1.45(.75)

Table 2. *Correlations and Descriptive Statistics for Primary Study Variables*

Measures	1.	2.	3.	4.	5.	6.	*M*	*SD*
1. Sleep Score	--	.463**	.329**	.270**	.263**	.340**	5.88	3.01
2. DASS-21 Depression		--	.488**	.481**	.426**	.405**	8.64	9.55
3. ASI-3 Total		__		.910**	.904**	.867**	32.51	13.28
4. ASI-3 Cognitive				--	.804**	.655**	9.47	4.71
5. ASI-3 Physical					--	.636**	10.21	4.79
6. ASI-3 Social						--	12.83	5.38

Note. Sleep Score = Modified Pittsburgh Sleep Quality Index; DASS-21 = Depression Anxiety Stress Scales – 21; ASI-3 = Anxiety Sensitivity Index – 3.

** indicates significance at the 0.01 level (2-tailed)

* indicates significance at the 0.05 level (2-tailed)

Table 3. *Independent Samples t-tests among College Students with High and Low Disturbance*

	High Sleep Disturbance	Low Sleep Disturbance	*t-test results*	*p-value*	*d*
	M(*SD*)	*M*(*SD*)			
DASS-21 Depression	15.62(11.66)	3.49(6.91)	8.23	$p < .001$	.53
ASI-3 Cog	11.85(5.57)	8.44(4.25)	4.54	$p < .001$	.33
ASI-3 Phys	12.34(5.60)	8.51(4.25)	5.10	$p < .001$	.36
ASI-3 Soc	15.91(5.77)	10.01(4.76)	7.42	$p < .001$	.43
ASI-3 Total	40.10(14.95)	26.96(12.44)	6.37	$p < .001$	.43

Note. DASS-21 = Depression Anxiety Stress Scales – 21; ASI-3 = Anxiety Sensitivity Index – 3.

Appendix A

College Student Sociodemographic Information

1. With which gender do you identify?

____ Male

____ Female

____ Non-binary

____ Other

2. What was your sex at birth?

____ Male

____ Female

3. Age: ____

4. With which ethnicity/race do you identify?

____ Native American

____ Asian/Pacific Islander

____ Black/African American

____ Hispanic/Latino(a)

____ White/Caucasian

____ Other

____ Prefer not to answer

5. To what extent do you consider yourself a religious person?

____ Not religious at all

____ Slightly religious

____ Moderately religious

____ Very religious

6. To what extent do you consider yourself a spiritual person?

____ Not spiritual at all

____ Slightly spiritual

____ Moderately spiritual

____ Very spiritual

7. Identify which best represents your housing situation:

____ Dormitory

____ Greek Housing

____ With friends or roommates - Apartment/Condominium/House

____ With family - Apartment/Condominium/House

____ Live alone

____ Other

8. How many individuals share your living quarters with you?

____ Live alone

____ 1 person/roommate

____ 2 persons/roommates

____ 3 or more persons/roommates

9. Are you employed? (yes/no)

How many hours per week? ____

How stressful is this job for you?

____ Not stressful at all

____ Slightly stressful

____ Moderately stressful

____ Very stressful

How important is this job to you?

____ Not important at all

____ Slightly important

____ Moderately important

____ Very important

10. What's the highest level of education your parent(s)/guardian(s) have achieved?

____ No high school

____ Some high school

____ Graduated high school

____ Some college, but did not graduate

____ Graduated with 2-year degree or technical school

____ Graduated with 4-year degree

____ Some graduate school but no graduate degree

____ Attained Master's degree (i.e., M.A., M.S., M.B.A., etc.)

____ Attained Professional or Doctoral degree (i.e., Ph.D., J.D., M.D., etc.)

11. How do you self-identify?

___ Gay

___ Lesbian

___ Bisexual

___ Queer

___ Questioning

___ Heterosexual/Straight

___ Asexual

___ Other (Please specify): _____

12. Year in college:

___Freshman (1st year)

___Sophomore (2nd year)

___Junior (3rd year)

___Senior (4th year)

___Other: _____

Number of credit hours enrolled in this semester: _____

What forms of social media do you use? Check all that apply.

- □ Facebook
- □ Instagram
- □ Snapchat
- □ Twitter
- □ Pinterest
- □ YouTube
- □ Linkedin
- □ Other _____

Thinking of an average day, how much time do you spend engaged in these forms of social media?

- □ 0 – 1 hour
- □ 1 – 4 hours
- □ 5-9 hours
- □ 10-14 hours
- □ 15 – 20 hours

What forms of communication do you use? Check all that apply.

- □ E-mail
- □ Text messaging
- □ Twitter
- □ Facebook messenger
- □ G-chat messager/Hangouts
- □ Facetime

- □ Skype
- □ In-person
- □ Telephone calls
- □ Other chat or messenger apps
- □ Other _____

Thinking of an average day, how much time do you spend communicating with others using these forms of communication?

- □ 0 – 1 hour
- □ 1 – 4 hours
- □ 5-9 hours
- □ 10-14 hours
- □ 15 – 20 hours

What is your preferred method of communicating with close friends? _____

What is your preferred method of communicating with your social network _____

What is your preferred method of communicating with your family? _____

Appendix B

Anxiety Sensitivity Index-3

Please circle the number that best corresponds to how much you agree with each item. If any items concern something that you have never experienced (e.g., fainting in public) answer on the basis of how you think you might feel *if you had* such an experience. Otherwise, answer all items on the basis of your own experience. Be careful to circle only one number for each item and please answer all items.

	Very Little	**A little**	**Some**	**Much**	**Very much**
1. It is important for me not to appear nervous.	0	1	2	3	4
2. When I cannot keep my mind on a task, I worry that I might be going crazy.	0	1	2	3	4
3. It scares me when my heart beats rapidly.	0	1	2	3	4
4. When my stomach is upset, I worry that I might be seriously ill.	0	1	2	3	4
5. It scares me when I am unable to keep my mind on a task.	0	1	2	3	4
6. When I tremble in the presence of others, I fear what people might think of me.	0	1	2	3	4
7. When my chest feels tight, I get scared that I won't be able to breathe properly.	0	1	2	3	4
8. When I feel pain in my chest, I worry that I am going to have a heart attack.	0	1	2	3	4
9. I worry that other people will notice my anxiety.	0	1	2	3	4
10. When I feel "spacey" or spaced out I worry that I may be mentally ill.	0	1	2	3	4
11. It scares me when I blush in front of people.	0	1	2	3	4

12. When I notice my heart skipping a beat, I worry that there is something seriously wrong with me.	0	1	2	3.	4
13. When I begin to sweat in a social situation, I fear people will think negatively of me.	0	1	2	3	4
14. When my thoughts seem to speed up, I worry that I might be going crazy.	0	1	2	3	4
15. When my throat feels tight, I worry that I could choke to death.	0	1	2	3	4
16. When I have trouble thinking clearly, I worry that there is something wrong with me.	0	1	2	3	4
17. I think it would be horrible for me to faint in public.	0	1	2	3	4
18. When my mind goes blank, I worry there is something terribly wrong with me.	0	1	2	3	4

Appendix C

DASS - 21

INSTRUCTIONS: Please read each statement and choose the number which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement. The rating scale is as follows:

0 = Did not apply to me at all
1 = Applied to me to some degree, or some of the time
2 = Applied to me to a considerable degree, or a good part of the time
3 = Applied to me very much, or most of the time

_____ 1. I found it hard to wind down.

_____ 2. I was aware of dryness in my mouth.

_____ 3. I couldn't seem to experience any positive feeling at all.

_____ 4. I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion).

_____ 5. I found it difficult to work up the initiative to do things.

_____ 6. I tended to over-react to situations.

_____ 7. I experienced trembling (e.g., in the hands).

_____ 8. I felt that I was using a lot of nervous energy.

_____ 9. I was worried about situations in which I might panic and make a fool of myself.

_____ 10. I felt that I had nothing to look forward to.

_____ 11. I found myself getting agitated.

_____ 12. I found it difficult to relax.

_____ 13. I felt down-hearted and blue.

_____ 14. I was intolerant of anything that kept me from getting on with what I was doing.

_____ 15. I felt I was close to panic.

_____ 16. I was unable to become enthusiastic about anything.

_____ 17. I felt I wasn't worth much as a person.

_____ 18. I felt that I was rather touchy.

_____ 19. I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat).

_____ 20. I felt scared without any good reason.

_____ 21. I felt that life was meaningless.

Appendix D

PITTSBURGHSLEEPQUALITYINDEX

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.

1. During the past month, what time have you usually gone to bed at night?

BED TIME __

2. During the past month, how long (in minutes) has it usually takes you to fall asleep each night?

NUMBER OF MINUTES __

3. During the past month, what time have you usually gotten up in the morning?

GETTING UP TIME _

4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.)

HOURS OF SLEEP PER NIGHT __

For each of the remaining questions, check the one best response. Please answer all questions.

5. During the past month, how often have you had trouble sleeping because you . . .

	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
Cannot get to sleep within 30 minutes				
Wake up in the middle of the night or early morning				
Have to get up to use the bathroom				
Cannot breathe comfortably				
Cough or snore loudly				
Feel too cold				
Feel too hot				
Have bad dreams				
Have pain				
Other reasons, please describe				

6. During the past month, how would you rate your sleep quality overall?

_____Very Good

_____Fairly Good

_____Fairly bad

_____Very Bad

7. During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?

_____Not during the past month	_____Less than once a week	_____Once or twice a week	_____Three or more times a week

8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

_____Not during the past month	_____Less than once a week	_____Once or twice a week	_____Three or more times a week

9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

_____No problem at all

_____Only a very slight problem

_____Somewhat of a problem

_____A very big problem

10. Do you have a bed partner or roommate?

_____No bed partner or room mate

_____Partner/roommate in other room

_____Partner in same room, but not same bed

_____Partner in same bed