2015

The Relationship Between Sexual Functioning and Sleep Quality in A Female Undergraduate Student Sample

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THE RELATIONSHIP BETWEEN SEXUAL FUNCTIONING AND SLEEP QUALITY IN A FEMALE UNDERGRADUATE STUDENT SAMPLE

BY

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A THESIS SUBMITTED

IN PARTIAL FULFILLMENT

OF THE REQUIREMENTS FOR THE DEGREE

MASTER OF ARTS

IN

CLINICAL PSYCHOLOGY

MINNESOTA STATE UNIVERSITY, MANKATO

MANKATO, MN

SPRING 2015

Date_____

This Master's Thesis has been examined and approved.

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Abstract

A relative lack of literature exists regarding the relationship between sexual functioning and sleep quality in women. The current study assessed these constructs in a sample of 260 undergraduate female students via online administration of relevant measures for sleep quality, sexual functioning, stress, and medical conditions and prescription medications. The relationship between sleep quality and sexual functioning was positive but not significant, even when controlling for relevant variables such as stress. As such, future research might seek to clarify this relationship and to identify variables that mediate or moderate this relationship.

Keywords: sleep quality, sexual functioning, stress, medical conditions

Acknowledgements

I want to acknowledge and extend endless thanks to my advisor, Dr. Eric Sprankle, without whom this project would not have been completed. Thank you, Eric, for your support and wisdom. Additionally I want to thank the other members of my thesis committee, Drs. Jeff Buchanan and Don Ebel, for their input and help throughout the completion of my project. I would also be remiss if I did not thank my family and friends in Indiana for their moral support while I worked on my thesis, and for always maintaining an interest in my process and results (or at least putting on Oscar-worthy performances). Last but not least, I would like to thank all of the clinical students and professors for commiserating with me and for always having their doors open, respectively. I will always cherish my time in Mankato; thank you all and go Mavericks.

The Relationship Between Sexual Functioning and Sleep Quality in a Female Undergraduate Student Sample

Introduction

Though both sexual activity and sleep are nearly ubiquitous biological processes, little research has been conducted examining the relationship between the two. This is especially the case for women. A majority of research involving sleep quality and sexual functioning centers on sexual correlates of specific sleep disorders in men, making such research about women conspicuous by its absence. The most prominent sleep disorder addressing sleep and sex in the scientific literature is obstructive sleep apnea (OSA), a disorder characterized by repeated periods of irregular or halted breathing during sleep due to upper airway obstruction (Arruda-Olson, Olson, Nehra, & Somers, 2003). This preponderance of research about men might be less a result of androcentrism than of patient demographics; the prevalence of OSA is approximately 3 to 7% for adult men but 2 to 5% for adult women (Punjabi, 2008). However, the American Academy of Sleep Medicine (2014) estimated that at least 25 million Americans currently suffer from OSA, and that 26% of American adults between the ages of 30 and 70 might suffer from OSA. Though OSA is the most often-researched sleep disorder for which sexual functioning is assessed by a wide margin, it not the only sleep disorder with sexual symptomatology; sexual dysfunction is a common symptom of many disorders of the sleep cycle. For instance, individuals with narcolepsy, a sleep disorder that causes excessive daytime sleepiness, REM sleep disturbances, and sleep paralysis, frequently suffer from sexual dysfunction (Penn State Hershey Medical Center, 2013). The classic narcolepsy symptoms of daytime sleepiness and an overwhelming need for sleep may reduce libido

and sexual functioning, as biological resources are prioritized toward sleep. Additionally, the fact that nocturnal erections occur in REM sleep and REM sleep is disrupted in narcolepsy cannot be ignored, though few studies have assessed sexual functioning in narcolepsy even prospectively.

OSA and Sexual Functioning in Men

A boon to research about OSA in men is its established relationship with an objective biological indicator of male sexual functioning: Erectile dysfunction (ED). Erection is a phenomenon acted upon by many biological mechanisms, such as neural processes of brain regions associated with responsive sexual arousal, autonomic nervous system activation, neurochemical release, and vasodilation (Awad, Alsaid, Bessede, Droupy, & Benoît, 2011). In terms of ED treatment in OSA, Perimenis et al. (2004) found that ED symptoms improved more in men taking sildenafil (i.e., Viagra) than in men using nightly continuous positive airway pressure (CPAP) over 12 weeks, and thus suggested that ED might be better managed through ED-specific pharmaceuticals such as sildenafil than through treatment of the underlying condition itself. Though sildenafil appears to relieve symptomatic concerns of ED more than CPAP because of its direct mechanism of action (acting on one culpable enzyme versus increasing oxygenation of blood through continuous breathing), this pharmacology does not attempt to correct nightly hypoxic episodes that might lead to the enzymatic dysregulation upon which sildenafil acts.

Though sildenafil appears effective at treating the OSA symptom of ED, CPAP is designed to treat OSA itself. Treatment with CPAP has been found to be more effective than antidepressant medications alone in the treatment of ED in men with severe OSA

(Taskin et al., 2010). These findings support the improvement of ED in patients under CPAP treatment observed by Perimenis et al. (2004) and suggest that CPAP might be a particularly effective treatment for ED in individuals with a more severe OSA presentation, especially with long-term treatment adherence. Long-term CPAP use has in fact been associated with an improvement in overall sexual life satisfaction (Petersen, Kristensen, Berg, & Midgren, 2013). Potential barriers to CPAP treatment adherence include discomfort with the CPAP mask and device, difficulty maintaining a routine or generalizing treatment, and concern over negative reactions to the device from bed partners.

Sleep Quality and Sexual Functioning in Women

Though sexual dysfunction in OSA is well described in men, it is not defined as well for women (Subramanian et al., 2010). Research about sexual functioning in men centers on the more objective symptom of ED, but research using objective measures of sexual arousal in women is lacking. Women with OSA have lower levels of progesterone, estradiol, and 17-OH-progesterone than healthy controls when matched for age and menstrual cycle phase (Netzer, Eliasson, & Strohl, 2003), suggesting that some combination of mechanisms with OSA contribute to sex hormone dysregulation in women. Despite this finding, physical measures of sexual dysfunction in women are not widely utilized. One possible method of examining the relationship between sleep disorders and sexual functioning that would use objective measures is measuring vaginal vasocongestion with a vaginal photoplethysmograph, though objective results of this device do not always correspond to women's subjective reports of sexual arousal (Laan,

Everaerd, & Evers, 1995). Thus, this method might be limited to only comparing vasocongestion between women with and without OSA.

Köseoğlu et al. (2007) were the first to examine the specific relationship between sexual functioning and disordered sleep symptoms, including sleepiness, in women with OSA. Twenty-five patients were trichotomized into mild, moderate, or severe OSA groups based on their respiratory disturbance index from polysomnography. Demographic information, medical history, polysomnography results, and frequency of intercourse per month for patients were assessed, and patients completed the Sexual Function Questionnaire Version 2 and the Epworth Sleepiness Scale. Köseoğlu et al. found significantly decreasing scores on the Sexual Function Questionnaire domains of *Desire* ($p = .007$), *Sensation* ($p = .006$), *Lubrication* ($p = .045$), *Orgasm* ($p = .026$), and *Partner Relationship* ($p = .023$) as severity of OSA increased. However, the domain scores of *Pain* and *Enjoyment* did not significantly change across OSA severity groups. Thus, Köseoğlu et al. posited that OSA negatively affects sexual functioning in women independent of age or comorbid conditions.

Subramanian et al. (2010) extended the examination of sexual functioning among women with OSA. Twenty-one premenopausal women with OSA and eleven healthy premenopausal women were administered the Female Sexual Function Index (FSFI) and the Profile of Mood States scale. Total scores on the FSFI below 23, indicating less satisfactory sexual functioning, were labeled *poor*. Though the group means for the mood scale of women with OSA and controls were not significantly different, eleven of the 21 OSA patients had poor FSFI scores but none of the control participants had poor scores. Further analysis of FSFI domain scores found that the domains of *Arousal, Lubrication,*

Orgasm, Satisfaction, and *Pain*, as well as total FSFI score, were significantly lower in women with OSA than in healthy controls. Only the domain of *Desire* was not significantly lower in OSA patients. Subramanian et al. noted agreement between their findings and those of Köseoğlu et al. (2007), in that both demonstrated a high prevalence of decreased sexual functioning in women with OSA.

Biological Factors of Sleep Quality and Sexual Functioning

Both sleep and sexual activity are biologically endogenous and maintained processes. Thus, sleep or sexual dysfunction indicates the presence of biological dysregulation, regardless of whether the etiology of the sleep or sexual dysfunction was organic or psychogenic. Other factors affecting both sleep quality and sexual functioning include chronic pain conditions and pharmaceutical treatments.

Sleep quality. Sleep is typically entrained to occur on an approximately 24-hour *circadian rhythm*, with an optimal sleep duration of seven to nine hours for adults. However, this cycle is maintained or influenced by exogenous environmental cues called *Zeitgebers* (Kooij & Bijlenga, 2013). Examples of Zeitgebers are ambient light or sunlight, temperature, exercise, diet, and pharmaceutical treatments. Alterations to any Zeitgebers affect the human body's natural circadian rhythm and can entrain a new rhythm based on ambient cues (Kooij & Bijlenga, 2013). Sleep is neurologically generated and maintained, with circadian rhythm control arising from a small region of the hypothalamus called the *suprachiasmatic nucleus* (Moore, Speh, & Leak, 2002). This region is situated in close proximity to the optic nerves and receives cues from ambient light, then transmits information about daily light patterns to the *pineal gland*. The pineal gland in turn secretes the chemical *melatonin* in a circadian fashion with higher secretion

levels at night (Kooij & Bijlenga, 2013). Melatonin promotes sleep in anticipation of darkness. Thus, light as a Zeitgeber appears to be integral to sleep rhythm maintenance.

The American Academy of Sleep Medicine divides sleep into four separate stages (Silber et al., 2007). These four stages are neurologically induced during typical sleep, and they follow a relatively consistent cycle each night given a stable circadian rhythm. These stages are further subdivided based on the type of sleep that occurs during that stage: Rapid eye movement (REM) sleep or non-REM (NREM) sleep, and the stages are largely defined by the frequency of electrical activity in the brain. Stage 1 is the first NREM stage and is defined by the transition between wakefulness and sleep. Stage 2 is the second NREM stage, in which the sleeper is more difficult to awaken. Stage 3 is the third NREM stage often colloquially referred to as "deep sleep." In Stage 3 sleep, the sleeper exhibits sharply decreased responsiveness to environmental cues. The final stage is REM sleep, in which the sleeper's muscles are almost totally paralyzed and the eyes quickly move. This stage has a relatively high volume of dreams compared to NREM sleep stages, and neural activity resembles that of an individual who is awake. Humans typically descend from wakefulness into Stages 1 through 3, then experience REM sleep as they ascend into a period of brief wakefulness; this cycle repeats a few times each night with REM periods increasing in duration and Stage 3 decreasing as the night continues, with each cycle lasting approximately 90 to 110 minutes (National Institute of Neurological Disorders and Stroke, 2014). Though the basic structure of sleep cycles is the same across humans, sleep is by no means monolithic. Gender differences related to sleep maintenance have been documented in several examinations of sleep in men and women. For instance, women report longer sleep durations than men, especially in

adulthood (Basner et al., 2007; Burgard & Ailshire, 2012). In the case of college undergraduate women, sleep duration has also been found to increase as the semester progresses (Liguori, Schuna, & Mozumdar, 2011); however, subjective feelings of restfulness upon wakening were reported by less than half of all participants of both genders despite a sufficient mean sleep duration. Research regarding gender differences in sleep processes, especially in terms of sleep duration and sleep quality, has heretofore been conducted through psychosocial and interpersonal lenses.

As it is a biological imperative, sleep is a requisite for the maintenance of both physical and mental health. Sleep debt can have a cumulative, deleterious effect on human psychological and physiological processes, including emotion, cognitive function, and physical health. A consistent sleep cycle is thus vital to better overall health and is essential if better sleep quality is to be obtained. Though not all individuals who experience sufficient sleep duration or stages will feel well rested, proper physiological maintenance is dependent on the sufficient occurrence of sleep stages. In OSA, sufferers briefly stop breathing during sleep, decreasing blood oxygenation and waking the sufferer perhaps dozens of times during a typical night's sleep. This disrupts the sleep stages, affecting the physiological regulatory mechanisms that occur in a proper sleep cycle. Insomnia sufferers cannot fall asleep, interrupting their naturally entrained circadian rhythms, and often turn to Zeitgebers such as pharmaceuticals to induce sleep. Narcolepsy sufferers often drop into REM sleep within a few minutes of sleep onset instead of progressing through the NREM stages first, which disrupts the typical sleep cycle. This shortens the amount of time spent in Stage 2 and 3 during a given night, and the daytime sleepiness and REM disturbances are compensatory for altered nighttime

sleep. Sleep disorders are thus a reflection of dysregulation of the natural sleep cycle produced endogenously, though methods of compensation such as caffeine and psychological states such as anxiety or depression might catalyze, propagate, or exacerbate this dysregulation.

However, it must be said that a sleep disorder diagnosis is not a prerequisite for unsatisfactory sleep quality. Sleep quality as its own construct involves elements of sleep duration, sleep hygiene, and subjective feelings of restfulness; because of the multifaceted nature of sleep, with environmental, psychological, and biological mechanisms at work, sleep quality should be a continuum-based construct. Instead of an individual having either typical or disordered sleep, this continuum would allow each individual to place her sleep quality on a line between complete dissatisfaction and complete satisfaction with sleep.

Sexual functioning. Sexual arousal is a cascade of physiological and psychological responses that prepare the body for sexual activity in response to external or internal cues such as sexual stimulation or fantasizing. In women, the biological mechanisms of sexual arousal include vaginal lubrication and engorgement of the genitals, which are mediated by vasodilation and reflexive nervous system responses and feedback (Kim, Christianson, & Traish, 2004). Dysfunctions in these physiological processes are criteria for the diagnosis of Female Sexual Interest/Arousal Disorder in the *DSM-5* (American Psychiatric Association, 2013), which combines symptoms of decreased biological response with decreased subjective sexual interest. Because of the complexity of both the biological and psychological mechanisms of arousal, sexual functioning is also best conceptualized as a continuum, with complete inability to become

aroused on one end and appropriate and sufficient arousal on the other. This contrasts with the historically categorical, binary diagnostic model of sexual functioning, in which a woman either had sexual dysfunction or did not.

Chronic pain conditions. Chronic pain is an incredibly prevalent health concern affecting many aspects of quality of life, including sexual functioning and sleep. The American Academy of Pain Medicine (2006) estimates that 100 million Americans suffer from some form of chronic pain, equating to over 30% of Americans. Headache is among the most prevalent chronic pain disorders, with migraine headache being of particular concern. Migraines affect 12% of Americans annually; an estimated 17% of women and 5.5% of men experience migraines, reflecting a three-to-one female-to-male prevalence ratio (Smitherman, Penzien, & Rains, 2013). Other common chronic pain conditions affect the low back, neck, and facial nerves.

Because of both the severity and duration of chronic pain, global quality of life is often affected. A common sequela of chronic pain is insomnia, in which the pain sensations are so severe or irritating that sleep cannot be adequately achieved. Additionally, chronic pain sufferers tend to fear an increase in their pain and consequently avoid exercise, further exacerbating both sleep dysfunction and pain levels. This is problematic, as two of the frontline behavioral treatments of chronic pain are improved sleep hygiene and increased exercise levels. Decreased sleep quality, lack of appropriate exercise, and pain state exacerbation thus contribute to a cyclical model of pain maintenance.

Depending on the level of impairment from either a primary medical condition with secondary pain or primary pain itself, sexual functioning may also be affected.

Individuals with neuropathic pain may have hypersensitivity to touch, in which typically neutral or erotic touch may be painful or irritating, or they may experience decreased sensitivity in erogenous areas. As reflexive nervous system response and feedback are critical in the initiation and maintenance of sexual arousal, pain conditions caused by nerve dysfunction may interrupt the arousal input-output loop, causing decreases in subjective or physiological arousal levels. In this case, neurological deficits are directly interfering with sexual functioning, and the primary subjective result of these deficits is pain. Mechanical pain conditions caused by injury or illness may limit sexual activity based on affected areas as well; for instance, an individual with degenerative disc disease may be too distressed by his low back pain to mechanically achieve an erection or maintain it during sexual activity. If it is the case that there is little to no neurological dysfunction present, chronic pain may influence sexual function through psychological factors, e.g., pain as distraction or anxiety about performance.

Pharmaceutical factors. In an effort to alleviate symptoms of sexual dysfunction or poor sleep quality, the first-line treatment is often medication. Sexual dysfunction in women is notoriously difficult to treat with pharmaceuticals, though the effectiveness of medications such as sildenafil is being evaluated (e.g., Alexander et al., 2011). This is in stark contrast to ED in men, which is typically alleviated rapidly by medications such as sildenafil, tadalafil (Cialis), or vardenafil (Levitra). Though these medications do not treat underlying causes of sexual dysfunction, they can improve ED symptoms in the short-term, and may provide some benefit to women in the future.

Medications that promote or alter sleep are often prescribed to treat a variety of sleep symptoms and disorders, including insomnia and excessive daytime sleepiness.

Benzodiazepine medications such as clonazepam, alprazolam, and diazepam are often prescribed as hypnotics to induce sleep, but over longer administrations, these medications have an increasing risk of dependency. These medications are thus intended to break the cycle of sleeplessness in the short term as the sufferer makes lifestyle changes for symptom improvement and weans off the medicine. Nonbenzodiazepine hypnotic medications such as zolpidem and eszopiclone are similarly prescribed to induce sleep, and while these medications are less addictive than benzodiazepines, they still carry abuse potential if consumed above recommended dosage (Lajiness, 2008; Victorri-Vigneau et al., 2013). Conversely, individuals with circadian rhythm disruptions or excessive daytime sleepiness are often prescribed modafinil, a wakefulness-promoting medication, which is functionally opposite the hypnotics listed above. Medications such as modafinil are not inherently habit-forming, allowing reprieve from intrusive sleep in the long term.

Medications prescribed to treat chronic pain can affect both sleep quality and sexual functioning. Opioid narcotic medications can be highly effective treatments for acute or chronic pain, but opioids have also been linked to sexual dysfunction (Christo, 2003). Additionally, narcotic medications and other medications for chronic pain such as tricyclic antidepressants have sedative or hypnotic properties. While this may benefit those with comorbid chronic pain and insomnia, these medications act as Zeitgebers and influence the circadian rhythm.

Antidepressant medications such as selective serotonin reuptake inhibitors are often prescribed for chronic pain management, but are infamously linked with sexual side effects. Montejo, Llorca, Izquierdo, and Rico-Villademoros (2001) investigated the

incidence of sexual dysfunction among outpatients with previously typical sexual functioning who were treated with any of ten antidepressant medications, and found that the overall incidence of reported sexual dysfunction among these outpatients was 59.1%. Men (62.4%) reported sexual side effects more frequently than women (56.9%), but women reported more severe dysfunction. This indicates that the mechanism of action in these medications has a deleterious physiological effect on sexual functioning.

Purpose of Study

By far, the most common sleep disorder researched with regard to sexual functioning in women is OSA. Though research on OSA has yielded findings that support a relationship between sleep and sexual functioning, it is only through the lens of a specific sleep disorder; thus, sexual functioning is only being assessed with respect to OSA's specific sleep symptomatology. There is a substantial lack of literature examining sleep quality and sexual functioning in nonclinical women without prediagnosed sleep or sexual disorders as a requirement for participation.

Accordingly, the researchers aim to investigate whether a relationship exists between sleep quality and sexual functioning in a nonclinical sample of female undergraduate students. The current study will be an analysis of the participants' self-reported sleep quality and sexual functioning ratings. If a relationship between these variables is supported, future research can extend this finding to more diverse samples of women for generalizability. Additionally, future research might attempt to construct a more complex model of sleep quality and sexual functioning in women, which could support either a direction of biological causality or a reciprocal relationship of sleep and sex. If this relationship exists and can be better understood, quality of life might be

improved for women with poor sleep quality, less satisfactory sexual functioning, or both.

Methods

Participants

Participants in the present study were female undergraduate students at Minnesota State University, Mankato (N = 260). Institutional approval for the present study was obtained from Minnesota State University, Mankato on January 28, 2015. To be included in the present study, participants were required to be enrolled at Minnesota State University, Mankato, and be biological female.

Procedures

Participants accessed the present study through SONA systems hosted on the Minnesota State University, Mankato psychology department website. Completion of the current study made participants eligible for course extra credit. The present study consisted of informed consent (see Appendix A); eight demographics items (see Appendix B); the nineteen-item FSFI (2000, see Appendix C); a novel checklist for general medical conditions and medications (see Appendix D); the 26-item Pittsburgh Sleep Quality Index (PSQI; University of Pittsburgh, 1989, see Appendix E); and the College Student's Stressful Events Checklist (CSSEC; Holmes & Rahe, 1967, see Appendix F). Total time of administration of these items was approximately 20 minutes.

Psychometric Properties of Included Measures

FSFI. The FSFI is a widely used measure of female sexual functioning variables, assessing domains of desire, arousal, lubrication, orgasm, satisfaction, and pain. The domains of the FSFI have been found to have high test-retest reliability (r = .79 to .86)

and internal consistencies of 0.82 or higher (Rosen et al., 2000). Wiegel, Meston, and Rosen (2005) similarly found high internal consistency for the total FSFI and domain scores among a combined dysfunctional and nondysfunctional sample (αs < .9). Mean differences between female sexual arousal disorder sufferers and controls have also been found to be highly significant for all domains, suggesting high construct validity ($p \leq$ .001; Rosen et al., 2000).

PSQI. The PSQI is commonly administered to assess individuals on seven components: Subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The PSQI demonstrates acceptable internal homogeneity and validity, and high diagnostic specificity and sensitivity (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). Cronbach's alpha for the global PSQI score has been indexed at .87 for individuals with primary insomnia (Backhaus, Junghanns, Broocks, Riemann, & Hohagen, 2002) and at .77 to .81 for cancer patients (Beck, Schwartz, Towsley, Dudley, & Barsevick, 2004), indicating that the PSQI demonstrates high internal consistency.

CSSEC. Holmes and Rahe (1967) developed the CSSEC as a measure of cumulative stress with higher specificity for young adults, specifically for college students, as some of the stressors included in their prominent Social Readjustment Rating Scale (1967) did not apply to typical events in a college student's life. The goal of the CSSEC is to determine relative risk of illness due to cumulative life stress. Holmes and Rahe applied weights to each item on the CSSEC to adjust for disparities in level of distress caused by each item; however, it must be stated that subjective levels of distress differs between individuals. For instance, having to drop more than one class in a

semester might be very distressing to some students, but might have little effect on others. Scores are then trichotomized into three stress levels based on their scores, with scores below 150 indicating mild stress and scores above 300 indicating severe stress.

Results

The sample consisted of 260 female undergraduate students. Descriptive frequency data for participants' race/ethnicity and sexual orientation are provided in Table 1. It must be noted that demographic variables such as race/ethnicity, sexual orientation, and year in school were presented as open-ended responses for participants; as such, the categories presented in these tables reflect coded groups based on common responses (e.g., *straight* and *heterosexual* coded as *heterosexual*). Five participants were excluded from analysis due to identifying their gender as male; one participant was excluded because of identifying as a graduate student; two participants were excluded for being below age 18; and seven participants were excluded on the basis of responses to less than ten items.

The relationship between sleep quality and sexual functioning as quantified by the PSQI global score and the FSFI total score was analyzed with a Pearson *r* correlation. The relationship between these two measures was not significant, $r = -.100$, $p = .120$. A partial correlation controlling for weighted responses to the CSSEC and participant age increased the magnitude of this relationship, though it remained nonsignificant, $r = -.125$, $p = .054$. A regression model additionally controlling for sleep disorder diagnoses, anxiety medications, and antidepressant medications indicated no significant relationship between FSFI and PSQI scores, $p = .075$.

Though the hypothesized relationship of PSQI and FSFI scores was not significant, other significant relationships between relevant variables were found. Scores on the PSQI and CSSEC were positively correlated, $r = .325$, $p < .001$, indicating that higher cumulative weighted stress levels were significantly related to higher levels of sleep dysfunction. Age was significantly correlated with FSFI total scores, $r = .159$, $p = .013$, indicating a positive relationship between age and sexual functioning such that increasing age was indicative of more satisfactory sexual functioning. Similarly, a one-way, between-groups ANOVA indicated that school class was significantly associated with FSFI total scores, $F(4, 237) = 3.836$, $p = .005$; LSD post-hoc analysis found that most significant difference between classes in terms of FSFI total scores was between freshmen ($M = 19.22$) and seniors ($M = 24.80$), $p = .001$.

Discussion

The primary research hypothesis of the current study was not supported. Though the correlation between scores trended in the hypothesized negative direction with more satisfactory sexual functioning indicating better sleep quality, the relationship between FSFI and PSQI global scores was not significant. This relationship remained nonsignificant even when relevant variables were controlled for, hinting at the existence of at least one other variable that mediates the relationship between sleep quality and sexual functioning but was not examined in the current study. It is also possible that the variables that were controlled for were not adequately addressed by the measures administered in the current study. For instance, only the *presence* of illnesses like neurological or sleep disorders was assessed instead of assessing presence *and severity.* If it is the case that no set of mediating variables exists, the nonsignificant relationship from

the current study suggests that in a nonclinical sample of undergraduate women, sleep quality and sexual functioning might not be interconnected constructs. These constructs might be more closely related in older women, in a clinical sample such as in women with OSA, or in a sample of both genders if appropriate sexual functioning measures were to be administered. However, it cannot be disregarded that a trend appears to exist between these variables; while not statistically significant, there is the possibility that this relationship may feel significant for some individuals such that intervention strategies for the improvement of sleep quality or sexual functioning might be warranted.

Additional Analyses

Another consideration for the current study is that the FSFI might pathologize a participant's lack of sexual activity in the past four weeks by scoring it as a 0 on any relevant item, thereby decreasing her global score drastically and implying a lower level of sexual functioning. This might yield FSFI global scores that are not indicative of true functioning; a woman who has not engaged in sexual activity in the past four weeks might have very satisfactory sexual functioning, but her FSFI global score does not reflect this. Very low scores on the FSFI yielded by this response pattern might also greatly affect analyses and group means. This is evident in the one-way ANOVA for school class by FSFI global score, in which group means for all classes are below the suggested cutoff score of 26, indicating that all classes exhibit clinical levels of sexual dysfunction, which is unexpected in a nonclinical sample of undergraduate female students. Using a nested model to control for participants who are abstinent might give a better picture of functioning in those who have engaged in sexual activity in the past four weeks and thus have substantial FSFI scores.

Religiosity was only accessed with one item in the survey package, but examining responses on this item and the relationship with zero-responses on the FSFI could be a potentially illuminating analysis. This would indicate whether women who agree that religion is important in their lives are more likely to respond that they have not engaged in sexual activity in the past four weeks. Interaction effects with medications and sexual functioning could also be tested to determine whether the presence of medications, or the use of multiple medications, influence global FSFI scores.

Limitations

The current study does not address all possible covariates of sleep quality and sexual functioning. Generalizability to all women is limited by the undergraduate convenience sample, so results may not apply to women in other regions of the United States or to women of ages different than typical undergraduate age. However, generalizability would be acceptable for colleges with similar demographics. Though the goal of the current study is to assess the relationship between sleep quality and sexual functioning *in a nonclinical population*, endorsing a sleep or sexual disorder diagnosis did not preclude participation.

Future Directions

As the current study does not indicate a significant relationship between sleep quality and sexual functioning, future research could aim to establish covariates and to further seek mediating or moderating variables. These findings could elucidate any variables that modify the relationship between sleep quality and sexual functioning. Moreover, individual findings that were supported by the current study might also be targets of future research because they could have practical use as intervention strategies

for undergraduate students. For instance, the negative relationship between stress and sleep quality indicated in the current study could be elaborated upon for the purpose of decreasing cumulative stress levels and increasing sleep quality for undergraduate students.

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Table 1

Descriptive frequency and percent statistics for reported race/ethnicity and sexual orientation.

Variable		Frequency	Percent
Race / Ethnicity			
	White/Caucasian	218	83.8
	Asian	12	4.6
	Hispanic/Latina	6	2.3
	African-American	6	2.3
	Multiracial	10	3.8
	Native American	1	0.4
	Other	3	1.2
	Missing	4	1.5
	Total	260	100
Orientation			
	Heterosexual	234	90.0
	Homosexual	4	1.5
	Bisexual	8	3.1
	Asexual/Other	2	0.8
	Missing	12	4.6
	Total	260	100

APPENDIX A

Informed Consent Document

You are invited to participate in a research study that will examine the relationship between sexual functioning and sleep quality. Dr. Eric Sprankle, clinical psychologist and Assistant Professor at Minnesota State University - Mankato, is conducting this study.

Procedures

If you consent to participate, you will be asked to complete a survey including questions about your recent sexual feelings, sleep quality, and stress. You have the right to withdraw from the study at any time without penalty. The survey takes approximately 15-25 minutes to complete.

Risks and Benefits of Being in the Study

Please be advised that this survey asks questions about your personal history of sexual functioning. Such questions may lead to negative emotions such as anxiety, distress, or embarrassment. Should you experience any discomfort, you have the right to stop and withdraw from the study at any time.

There are no personal benefits of participation.

Compensation

Since this study is using SONA Systems, you will earn three (3) participation credits. Some university professors/instructors offer extra credit in their classes for participation in research involving SONA Systems. However, the amount (if any) of extra credit is solely at the discretion of the professor/instructor.

Confidentiality

Responses will be anonymous. However, whenever one works with online technology there is always the risk of compromising privacy, confidentiality, and/or anonymity. If you would like more information about the specific privacy and anonymity risks posed by online surveys, please contact the Minnesota State University, Mankato Information and Technology Services Help Desk (507-389-6654) and ask to speak to the Information Security Manager. The principal investigator (Dr. Eric Sprankle) and his research assistants are the only people who will have access to the secured data.

Voluntary Nature of the Study

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relationships with Minnesota State University. If you decide to participate, you are free to withdraw at any time without penalty.

Contacts and Questions

If you have any questions, you are encouraged to contact Dr. Eric Sprankle (the principal investigator) at Minnesota State University, Armstrong Hall 23, 507-389-5825 or by email at eric.sprankle@mnsu.edu.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, or if you have questions/concerns about the treatment of human subjects, you are encouraged to contact the Dean of Graduate Studies and Research at Minnesota State University, Mankato, Dr. Barry Ries at 507-389-1242 via phone or at barry.ries@mnsu.edu via email.

Consent

By continuing on to the survey, you affirm that you have read and understood the above information and consent to participate. Please print this page for you records.

IRBNet Approval Number: 710471

APPENDIX B

Demographics Form

Directions: *Please provide answers to the following demographic questions.*

1. Age_____

2. Race/Ethnicity_____

3. Gender_____

4. Sexual Orientation_____

5. Year in School_____

6. Relationship Status:
    a) single
    b) casually dating (no committed partner)
    c) partnered (boyfriend, girlfriend, significant other, fiancé, etc)
    d) legal partnership (married, civil union)
    e) other

7. Religion is very important in my life.
    a) strongly agree
    b) agree
    c) neutral
    d) disagree
    e) strongly disagree

8. What is your current living situation?
    a) live alone
    b) live alone with pet(s)
    c) live with others (roommates, parents, significant others)

APPENDIX C

Female Sexual Function Index

INSTRUCTIONS: These questions ask about your sexual feelings and responses during the past 4 weeks. Please answer the following questions as honestly and clearly as possible. Your responses will be kept completely confidential. In answering these questions the following definitions apply:

Sexual activity can include caressing, foreplay, masturbation and vaginal intercourse.

Sexual intercourse is defined as penile penetration (entry) of the vagina.

Sexual stimulation includes situations like foreplay with a partner, self-stimulation (masturbation), or sexual fantasy.

CHECK ONLY ONE BOX PER QUESTION.

Sexual desire or interest is a feeling that includes wanting to have a sexual experience, feeling receptive to a partner's sexual initiation, and thinking or fantasizing about having sex.

1. Over the past 4 weeks, how **often** did you feel sexual desire or interest?
[ ] Almost always or always
[ ] Most times (more than half the time)
[ ] Sometimes (about half the time)
[ ] A few times (less than half the time)
[ ] Almost never or never

2. Over the past 4 weeks, how would you rate your **level** (degree) of sexual desire or interest?
[ ] Very high

[ ] High
[ ] Moderate
[ ] Low
[ ] Very low or none at all

Sexual arousal is a feeling that includes both physical and mental aspects of sexual excitement. It may include feelings of warmth or tingling in the genitals, lubrication (wetness), or muscle contractions.

3. Over the past 4 weeks, how **often** did you feel sexually aroused ("turned on") during sexual activity or intercourse?
[ ] No sexual activity
[ ] Almost always or always
[ ] Most times (more than half the time)
[ ] Sometimes (about half the time)
[ ] A few times (less than half the time)
[ ] Almost never or never

4. Over the past 4 weeks, how would you rate your **level** of sexual arousal ("turn on") during sexual activity or intercourse?
[ ] No sexual activity
[ ] Very high
[ ] High
[ ] Moderate
[ ] Low
[ ] Very low or none at all

5. Over the past 4 weeks, how **confident** were you about becoming sexually aroused during sexual activity or intercourse?
[ ] No sexual activity
[ ] Very high confidence
[ ] High confidence
[ ] Moderate confidence
[ ] Low confidence
[ ] Very low or no confidence

6. Over the past 4 weeks, how **often** have you been satisfied with your arousal (excitement) during sexual activity or intercourse?
[ ] No sexual activity
[ ] Almost always or always
[ ] Most times (more than half the time)
[ ] Sometimes (about half the time)
[ ] A few times (less than half the time)
[ ] Almost never or never
7. Over the past 4 weeks, how **often** did you become lubricated ("wet") during sexual activity or intercourse?
[ ] No sexual activity
[ ] Almost always or always
[ ] Most times (more than half the time)
[ ] Sometimes (about half the time)
[ ] A few times (less than half the time)
[ ] Almost never or never

8. Over the past 4 weeks, how **difficult** was it to become lubricated ("wet") during sexual activity or intercourse?
[ ] No sexual activity
[ ] Extremely difficult or impossible
[ ] Very difficult
[ ] Difficult
[ ] Slightly difficult
[ ] Not difficult

9. Over the past 4 weeks, how often did you **maintain** your lubrication ("wetness") until completion of sexual activity or intercourse?
[ ] No sexual activity
[ ] Almost always or always
[ ] Most times (more than half the time)
[ ] Sometimes (about half the time)
[ ] A few times (less than half the time)
[ ] Almost never or never
10. Over the past 4 weeks, how **difficult** was it to maintain your lubrication ("wetness") until completion of sexual activity or intercourse?
[ ] No sexual activity
[ ] Extremely difficult or impossible
[ ] Very difficult
[ ] Difficult

[ ] Slightly difficult
[ ] Not difficult

11. Over the past 4 weeks, when you had sexual stimulation or intercourse, how **often** did you reach orgasm (climax)?
[ ] No sexual activity
[ ] Almost always or always
[ ] Most times (more than half the time)
[ ] Sometimes (about half the time)
[ ] A few times (less than half the time)
[ ] Almost never or never

12. Over the past 4 weeks, when you had sexual stimulation or intercourse, how **difficult** was it for you to reach orgasm (climax)?
[ ] No sexual activity
[ ] Extremely difficult or impossible
[ ] Very difficult
[ ] Difficult
[ ] Slightly difficult
[ ] Not difficult

13. Over the past 4 weeks, how **satisfied** were you with your ability to reach orgasm (climax) during sexual activity or intercourse?
[ ] No sexual activity
[ ] Very satisfied
[ ] Moderately satisfied
[ ] About equally satisfied and dissatisfied
[ ] Moderately dissatisfied
[ ] Very dissatisfied

14. Over the past 4 weeks, how **satisfied** have you been with the amount of emotional closeness during sexual activity between you and your partner?
[ ] No sexual activity
[ ] Very satisfied
[ ] Moderately satisfied
[ ] About equally satisfied and dissatisfied
[ ] Moderately dissatisfied
[ ] Very dissatisfied

15. Over the past 4 weeks, how **satisfied** have you been with your sexual relationship with your partner?

[ ] Very satisfied
[ ] Moderately satisfied
[ ] About equally satisfied and dissatisfied
[ ] Moderately dissatisfied
[ ] Very dissatisfied

16. Over the past 4 weeks, how **satisfied** have you been with your overall sexual life?
[ ] Very satisfied
[ ] Moderately satisfied
[ ] About equally satisfied and dissatisfied
[ ] Moderately dissatisfied
[ ] Very dissatisfied

17. Over the past 4 weeks, how **often** did you experience discomfort or pain during vaginal penetration?
[ ] Did not attempt intercourse
[ ] Almost always or always
[ ] Most times (more than half the time)
[ ] Sometimes (about half the time)
[ ] A few times (less than half the time)
[ ] Almost never or never

18. Over the past 4 weeks, how **often** did you experience discomfort or pain following vaginal penetration?
[ ] Did not attempt intercourse
[ ] Almost always or always
[ ] Most times (more than half the time)
[ ] Sometimes (about half the time)
[ ] A few times (less than half the time)
[ ] Almost never or never

19. Over the past 4 weeks, how would you rate your **level** (degree) of discomfort or pain during or following vaginal penetration?
[ ] Did not attempt intercourse
[ ] Very high
[ ] High
[ ] Moderate
[ ] Low
[ ] Very low or none at all

APPENDIX D

Medical Checklist

Medical Conditions

Cancer (if so, what kind)
Thyroid disorder (hypo, hyper, para)
Bleeding problems (anemia, hemophilia, etc.)
Blood Pressure Problems (high, low)
GI disorders
Heart Problems (murmur, pacemaker, etc.)
Chronic Pain (if so, describe)
Diabetes
Breathing Problems (asthma, etc.)
Neurological Problems (stroke, migraine, etc.)
Autoimmune Disorders
STIs
Sleep Disorders

Prescription Checklist

Antidepressants
Anxiety Medications
Heart Medications
Stimulant Medications (Adderall, Ritalin, etc.)
Insulin
Pain Medications

Substances (please indicate amount per week beside check)

Stimulants

- Cocaine
- Adderall/Ritalin
- Methamphetamine

Depressants

- Alcohol
- Heroin
- Codeine

- Hydrocodone/Oxycodone

Hallucinogens

- MDMA/ecstasy
- LSD
- Psilocybin Mushrooms

Cannabis

APPENDIX E

Pittsburgh Sleep Quality Index

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 taken 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 . . .

a) Cannot get to sleep within 30 minutes

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

b) Wake up in the middle of the night or early morning

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

c) Have to get up to use the bathroom

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

d) Cannot breathe comfortably

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

e) Cough or snore loudly

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

f) Feel too cold

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

g) Feel too hot

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

h) Had bad dreams

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

i) Have pain

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

j) Other reason(s), please describe

_____

How often during the past month have you had trouble sleeping because of this?

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

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 room mate?

No bed partner or room mate _____

Partner/room mate in other room _____

Partner in same room, but not same bed _____

Partner in same bed _____

If you have a room mate or bed partner, ask him/her how often in the past month you have had…

a) Loud snoring

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

b) Long pauses between breaths while asleep

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

c) Legs twitching or jerking while you sleep

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

d) Episodes of disorientation or confusion during sleep

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

e) Other restlessness while you sleep; please describe_____

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

APPENDIX F

College Student's Stressful Events Checklist (from Holmes & Rahe, 1967)

___ Death of a close family member (100)
___ Death of a close friend (73)
___ Divorce between parents (65)
___ Serious legal problems (63)
___ Major personal injury or illness (63)
___ Responsibilities for others, such as children/spouse (58)
___ Threat to major source of income (50)
___ Difficulty with roommate(s) (47)
___ Change in health of a family member (45)
___ Pregnancy (45)
___ Sexual problems (44)
___ Serious disagreements with parents (40)
___ Change in lifestyle for financial reasons (39)
___ Difficulty in identifying a major (39)
___ Serious argument with close family member (39)
___ Problems with a girlfriend or boyfriend (39)
___ Having to repeat a course (37)
___ Increased workload at school (37)
___ Outstanding personal achievement (36)
___ First semester in college (35)
___ Change in living conditions (31)
___ Serious disagreements with an instructor (30)
___ Lower grades than expected (29)
___ Change in sleeping habits (29)
___ Change in social habits (29)
___ Change in eating habits (28)
___ Chronic car problems (26)
___ Change in number of family get-togethers (26)
___ Too many missed classes (25)
___ Change in plans for a major (24)
___ Dropped more than one class (23)
___ Minor traffic violations (20)