

Relationship Among Stress, Rumination, Coping Styles, and Sleep Quality

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Abstract

Previous research suggests coping styles mediate the relationship between stress and sleep. Rumination, perceived stress, coping styles (problem-focused, emotion-focused, avoidant), and sleep quality were measured in a sample of undergraduates ($N = 346$). Participants completed four self-report measures on sleep quality, perceived stress, coping styles (emotion-focused, problem-focused, avoidant), and rumination. Analyses revealed significant positive associations between rumination and the three other measures. Avoidant coping was positively correlated with rumination, stress, and sleep quality. Emotion-focused and problem-focused were both positively correlated with rumination, and were both negatively correlated with stress. Contrary to previous research, coping styles did not mediate the relationship between stress and sleep, but rumination significantly mediated the relationship between stress and sleep. Coping styles moderating the stress-rumination-sleep quality relationship were also considered. Suggested further research is discussed.

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Relationship Among Stress, Rumination, Coping Styles, and Sleep Quality

Sleep is an essential part of every person's life. Although the majority of people do not have difficulty sleeping, at least 15-35% of the adult population complain of difficulty falling asleep and maintaining sleep (Karacan et al., 1976; Bixler et al., 1979). A particular population who is acutely subject to insufficient amounts of sleep is college students (Lund, Whiting, & Prichard, 2010; Buboltz, Brown, & Soper, 2001). College students are at a high-risk of not getting enough sleep due to classes, exams, work, family, relationships, social events, etc. and in the process of all these factors they have to find time to sleep. College students are expected to juggle these different aspect of their lives and the one activity that gives them the energy to complete these activities, sleep, is most often at the bottom of the list as evidenced in a study by Lund et al. (2010). Lund et al. found college student's overall mean sleep is 7.02 hours per night, while only 29.4% reported getting the minimally recommended 8 or more hours of sleep each night. Importantly, a plethora of research has found that sleep deprivation and poor sleep quality negatively affects many aspects of a person's life such as academics, memory, and health.

Trockel et al. (2000) examined the effects of certain health and health-related behaviors on the GPA of 200 college students. The researchers measured exercise, eating, sleep habits, mood states, perceived stress, time management, social support, spiritual habits and number of hours worked per week. Sleep quality accounted for the greatest variability in GPA, with later wake-up time being particularly associated with lower grades. This finding could be accounted for in a study by Dotto (1996), who found impaired memory for class material among students who delay bedtime and wake-up times on the weekend. Studies conducted by Elkin and Murray (1974) and Polzella (1975) further show that sleep deprivation can lead to failure to adequately retain information presented for memorization.

Sleep also affects health and well-being. For example, Pilcher and Ott (1998) measured the sleep quality and health of 75 individuals in an Introductory Psychology course. They found subjective sleep quality, but not sleep quantity, was highly correlated with subjective health and subjective well-being. What this study suggests is that not only is sleep an important aspect of one's life, but it is also an important aspect that affects a multitude of other aspects of an individual's life as shown by the study above. Much research has been done on the relationship between stress and sleep. Many studies have found that stress can often lead to sleep difficulties (Healey et al., 1981; Cartwright & Wood, 1991; Caldwell et. al., 2010; Sadeh, 1996; Lavie, 2001; Van Reeth et al., 2000; Mosley et al., 1994; Hoyt et al., 2009; Mesquita & Reimao, 2008; Utsugi et al., 2005; Topf & Thompson, 2001; Brand et al., 2010; Trockell et al., 2000; Rosalind & Wood, 1991). Sleep difficulties typically include delayed onset of sleep, poor subjective sleep quality, difficulty falling asleep, and a reduced total amount of sleep. Stressors which typically affect a person's sleep quality include diseases (i.e. cancer), work, and academics (Willert et al., 2010; Mosley et al., 1994; Mesquita & Reimao, 2008; Hoyt et al., 2009; Sadeh et al., 2004; Guastella & Moulds, 2006; Zoccola et al., 2009; Utsugi et al., 2005; Hall et al., 2004; Topf & Thompson, 2001; Brand et al., 2010).

What is interesting to note about these studies is that stressors such as health and academics which can cause a reduction in sleep quality also, as discussed in the effects of poor sleep quality in college students, can also be negatively affected by poor sleep quality. Two interesting studies by Gray et. al. (1984) and Lund et. al. (2010) highlight the importance of the relationship between stress and sleep. Lund et. al. (2010) found that 20.1% of college-age participants stated that stress was a major contributing factor to a loss of sleep and in responding to the question "How often have you had trouble sleeping because of other reason(s)", 35% of

the responses were related to stress (Lund et al. 2010). Of course, the relationship is reciprocal in nature as stress may cause a lack of sleep, but a lack of sleep can also cause stress. Gray et al. (1984) administered a questionnaire measuring sleep quality, sleep habits, beliefs about sleep, and daytime mood and functioning to 277 9th and 10th-grade students. After administering the questionnaire and analyzing the results, Gray divided the groups into good sleepers, occasional poor sleepers, and chronic poor sleepers. Gray found that the occasional poor sleepers and chronic poor sleepers reported more signs of daytime stress and observable signs of daytime stress. Another interesting finding was that the poor sleepers were more likely to report worrying and thinking about two things at once. As was to be expected in these studies, and as suggested by Sadeh et. al. (2004), not all participants' sleep was affected by the onset of a stressful event or disease.

Coping strategies are a likely mediating factor that account for the differences in sleep quality people experience after exposure to stressors. There are three types of coping strategies: Emotion-Focused, which typically involves managing the emotional symptoms of stress, Problem-Focused, which involves altering the problem that is causing the stress, and Disengagement which involves emotionally disengaging from the stressor (Folkman & Lazarus, 1986). As Folkman and Lazarus (1986) discuss, the appraisal of an event as either stressful or not stressful is important as to whether or not the method of coping will have any significant effect on the variance seen in perceived stress. Coping strategies in much of the literature is shown to account for much of the variance in the amount of stress or stress-affected behaviors, such as sleep, people report or experience (Mosley et. al., 1994; Nowack, 1998; Morin & Ivers, Sadeh et. al., 2004; Aldwin & Revenson, 1987; Clohessy & Ehlers, 1999; Folkman & Lazarus, 1986; Forsythe & Compas, 1987; Hoyt et. al., 2009; Lazarus & DeLongis, 1983; Meyer, 2004). The

study by Mosley et. al. (1994) assessed sixty-nine third year medical students on stress, coping, depression and somatic distress. Those individuals who reported a greater use of engagement strategies, such as emotion-focused and problem-focused coping, reported fewer depressive symptoms compared to those who reported a greater use of a Disengagement strategy. Of course, these individuals are a unique population under unique circumstances, but the effect of coping on depressive symptoms is interesting to note as it can have a significant effect on the outcome of stress.

Morin and Ivers (2003) compared 40 individuals who were diagnosed with insomnia and 27 individuals who were rated as “good sleepers”. They found that individuals with insomnia were more likely to rate similar events as more stressful compared to the control group and were more likely to employ emotion-focused coping strategies. Furthermore, emotion-focused coping (but not problem-focused) was related to reduced sleep quality. However, studies by Diehl and Hay (2010) and Sadeh and Daon (2004) found problem-focused coping to predict better sleep quality. Both studies also found, similar to Morin and Ivers (2003), that individuals who employed Emotion-Focused coping strategies had a decrease in sleep quality. Also, Sadeh and Daon (2004) measured Disengagement and found no significant effect on sleep. All studies assessed coping strategies with different self-report measures, but all measures were similar in content and defined emotion-focused, problem-focused and disengagement strategies similarly.

Diehl and Hay (2010) examined individuals ranging from ages 18 to 89 while Sadeh and Daon (2004) measured individuals who were applying to grad school. The conflicting results of problem-focused coping could be accounted for by the operationalization of stress and the studied populations where Morin and Ivers (2003) examined insomniacs and used self-report measures while Sadeh (2004) looked at a very specific and possibly intelligent group considering

they were applying for grad school and Diehl (2010) described stress as self-concept incoherence.

Another variable that appears to have a significant relation to sleep quality is rumination. Rumination has been seen as maintaining negative mood and a variety of clinical disorders such as depression and PTSD (Nolen-Hoeksema, 2009; Clohessy & Ehlers, 1999; Spasojevic & Alloy, 2001; Segerstorm et al., 2004; Lyubomirsky & Hoeksema, 1995). Rumination involves repetitive thoughts focusing on a problematic situation which is typically a source of stress for the individual (Guastella, 2006). In particular, student populations seem to be acutely susceptible to the effects of rumination as a study by Nolen-Hoeksema & Morrow (1991) found that rumination predicted depression over a nine-week period in a student population. The study of rumination in a student population is of the utmost importance as some studies suggest that 50% of college students report depressive symptoms shortly after beginning their academic careers (Furr et al., 2001). Not only does rumination maintain depressive symptoms and negative mood but studies have also found that individuals who ruminate upon stressors typically experience reduction in sleep quality (Guastella & Moulds, 2006; Brand et al., 2010; Zoccola et al., 2009; Thomsen et al., 2003). What is interesting to note here is that typically those individuals who are considered to be the poorest sleepers, insomniacs, tend to score higher on scales of depression (Hatzinger et al., 2004; Taylor, 2009). Why this is interesting can be found in a study by Brand et al. (2010) where he found that insomniacs often reported more dysfunctional sleep-related cognitions. In this study, dysfunctional sleep-related cognitions were operationalized in the self-report measure as rumination. Of course, insomnia is an extreme example of poor sleep, but it is significant to note that rumination which can lead to poor sleep as

shown by the previous and following studies can possibly instigate severe psychological distress which college students are much more susceptible to (Furr et. al., 2001).

Thomsen et. al. (2003) assessed the distinction between negative affects, such as anxiety and anger, and rumination in a college student sample. They found that even after controlling for negative mood, rumination was still highly negatively correlated with subjective sleep quality. Using an experimental procedure, Zoccola et. al. (2009) introduced participants to a stressful event and then measured their sleep-onset latency that night with a wrist actigraph. Prior to the event participants were measured for trait rumination and event specific rumination was measured after the event. The researchers found that those participants who rated high in both trait and event-specific rumination had higher sleep onset latency following exposure to the stressful event.

Purpose of the Present Research

The cited research above has revealed that coping strategies appear to have a mediating effect on the relationship between stress and sleep (Mosley et. al., 1994; Nowack, 1998; Morin & Ivers, Sadeh et. al., 2004; Aldwin & Revenson, 1987; Clohessy & Ehlers, 1999; Folkman & Lazarus, 1986; Forsythe & Compas, 1987; Hoyt et. al., 2009; Lazarus & DeLongis, 1983; Meyer, 2004). However, the extent to which coping strategies, and which one specifically, contribute to the relationship between stress and sleep is conflicting and unclear as discussed above. Rumination also appears to have a significant effect on stress and sleep, but its relation to coping strategies has not been assessed, and in a similar vein, the coping strategies literature has not assessed the effects of rumination (Guastella & Moulds, 2006; Brand et al., 2010; Zoccola et al., 2009; Thomsen et. al., 2003; Mosley et. al., 1994; Nowack, 1998; Morin & Ivers, Sadeh et. al., 2004; Aldwin & Revenson, 1987; Clohessy & Ehlers, 1999; Folkman & Lazarus, 1986; Forsythe

& Compas, 1987; Hoyt et. al., 2009; Lazarus & DeLongis, 1983; Meyer, 2004).

In particular, this study is suggesting that those individuals who employ emotion-focused coping strategies will correlate highly with those individuals scoring high on a rumination scale. As was discussed previously, Emotion-focused coping involves occupying oneself with the emotions related to a stressful event and rumination is similar in that it involves contemplating a stressful event as well.

Based on studies by Sadeh et. al. (2004) and Morin et. al. (2003), the present study is designed to test the hypothesis that individuals who experience a significant amount of stress also experience poor sleep quality. Furthermore, individuals who employ emotion-focused coping strategies, will experience a greater reduction in sleep quality than those individuals who employ a problem-focused coping strategy or disengagement coping strategy. Moreover, it is hypothesized that individuals who score high on rumination will report lower sleep quality and more emotion-focused coping. As was mentioned, in the current literature, there is an absence of any research assessing the relationship among stress, sleep quality, and rumination. This researcher suggests that along with coping strategies mediating the relationship between stress and sleep quality, rumination may also mediate the relationship between stress and sleep quality. Also, studies by Morin and Sadeh measured populations such as insomniacs and grad school applicants, which are very specific and lead to difficulties in generalizability into other populations. These studies by Morin et. al. (2003) and Sadeh et. al. (2004) also lack any discussion of the effects rumination may have on sleep quality or how rumination may relate to the coping strategies. This study attempts to address this issue by studying a broader population in hopes of finding similar results in a general college population and by measuring rumination.

Method

Participants

Participants were 346 undergraduate enrolled in an introductory psychology course at Ball State University. Ages of participants ranged from 18-28 with the majority being between 18-20 (91%). The majority of participants were female (64.5%) and White/Anglo American (88.4%). The questionnaires were available to all students enrolled in the Introductory Psychology course via InQsit, an online computer system. Participants completed the questionnaires on a voluntary basis and were allowed to stop the questionnaire at any time without penalty.

Measures

Demographic Questionnaire. The questionnaire asked for age, height, gender, weight, ethnicity, class, major, GPA, employment status, and residence type.

Pittsburg Sleep Quality Index (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The 19-item scale measured sleep quality and sleep disturbance over the previous 1-month interval. The PSQI consists of seven sub-scales (Duration of Sleep, Sleep Disturbance, Sleep Latency, Daytime Dysfunction, Sleep Efficiency, Overall Sleep Quality, Sleep Medication Use) and one total score combining the scores of each subscale. A total score of twenty-one can be obtained, with a score less than or equal to five indicating good sleep quality and a score greater than five indicating poor sleep quality.

Perceived Stress Scale (PSS; Cohen et. al. 1988). The 10-item scale uses a 4-item Likert scale format to measure perceived amount of stress a person has experienced over a previous 1-month time interval. The scale is non-diagnostic in nature and a total score of 40 can be obtained. A higher scores indicates higher perceived stress while a lower score indicates lower perceived stress.

Ways of Coping Inventory (COPE; Carver et. al. 1989). The 60-item scale inventory uses a 4-item Likert scale format to measure specific aspects of each coping strategy (emotion-focused, problem-focused, disengagement). The COPE scale consists of 15 scales with 4 items from the 60-item scale corresponding to one of the 15 scales (Positive Interpretation, Mental Disengagement, Focus on and venting of emotions, Use of instrumental social support, Active coping, Denial, Religious coping, Humor, Behavioral disengagement, Restraint, Use of emotional social support, Substance use, Acceptance, Suppression of competing activities, Planning).

Ruminative Response Scale of the Response Styles Questionnaire (Nolen-Hoeksama & Morrow, 1991). The 22-item self-report measure uses a 4-item Likert scale format to assess rumination in response to depressed mood. The scale is non-diagnostic in nature with a total score of 88 representing maximum rumination.

Procedure

Participants were recruited online through a link to an InQsit page containing the questionnaires. After clicking the link, participants were redirected to an information and credit page explaining the purpose and rationale of the study. Participants were also made aware that there would be no penalty if they decided to quit the study. Also, contact information for any further questions regarding the study was presented on the page. Participants were then directed to click continue at the bottom of the page if they wished to complete the questionnaires. Participants, then, completed the set of questionnaires. Ordering of the questionnaires was randomized for each participant so as to control for order effects. After completing the questionnaire, the participants were thanked for their participation and provided with the same

contact information that was presented on the information and credit page. Participants received 1 research credit for their Introductory Psychology course upon completion of the study.

Results

Using the clinical cutoff validated by Buysse et al. (1989), most participants (52.5%) reported poor overall sleep quality as indicated by total PSQI scores ($M = 6.34, SD = 3.25$). A mean score of 19.49 ($SD = 5.28$) was found on the PSS indicating a moderate stress level. Also, a mean score of 46.55 ($SD = 15.36$) was found on the RSS indicating a moderate level of rumination. As expected, Pearson correlation analyses revealed significant relationships between stress and sleep quality ($r = .29, p < .01$), rumination and sleep quality ($r = .25, p < .01$), and rumination and stress ($r = .50, p < .01$). The COPE scale (Carver et. al. 1989), is comprised of 15 scales, each measuring a particular aspect of coping. Table 1 displays the significant relationships between these coping scales and stress, sleep quality, and rumination.

The correlations give a general idea as to what coping strategies are more effective than others. For instance, those individuals who predominantly employ substance abuse as a coping mechanism tend to score higher on the stress and rumination scales as well as score higher on the sleep quality scale. However, coping strategies that are considered more effective, such as positive reinterpretation are negatively correlated with the PSS and PSQI which indicates that this method of coping is more effective when dealing with stress.

Although these relationships are interesting, the majority of the literature on coping strategies deals with coping in three dimensions: emotion-focused coping, problem-focused coping, and disengagement (avoidant) coping. The COPE scale is comprised of 15 distinct scales, but Litman (2006) tested the dimensionality of the COPE scale and found that the 15 scales could be combined into the three predominant coping strategies often found in the coping

literature. Using the study as a guideline, the 15 scales were combined into the three coping strategies mentioned above, and then Pearson correlation analyses were conducted to test the significance of these composite scales with the stress, rumination, and sleep scales.

Pearson correlation analyses revealed significant relationships between avoidant coping and stress, avoidant coping and rumination, avoidant coping and sleep quality, emotion-focused coping and stress, emotion-focused and rumination, problem-focused and stress, problem-focused and rumination (see Table 2). However, avoidant coping was hypothesized to be a maladaptive coping strategy that would increase stress and rumination while also decreasing the quality of sleep an individual receives. The correlations support this hypothesis. Also, contradictory to this researcher's hypotheses is that emotion-focused was negatively correlated with stress. However, as was hypothesized, individuals who scored high in problem-focused coping reported significantly less stress.

One of the main hypotheses is that there would be significant differences between "good" sleepers and "bad" sleepers in scores of stress, rumination, and coping styles. Total PSQI scores equal to or less than five indicates a "good" sleeper, while a score of six or above indicates a "poor" sleeper. Using this cut score, poor sleepers ($M = 24.40$, $SD = 5.78$) reported significantly more avoidant coping than good sleepers ($M = 22.98$, $SD = 5.47$), $t(335) = -2.32$, $p = .02$, $d = .25$). Poor sleepers ($M = 49.39$, $SD = 15.62$) reported significantly more rumination than good sleepers ($M = 43.38$, $SD = 14.43$), $t(333) = -3.65$, $p = .000$, $d = .40$) and poor sleepers ($M = 20.54$, $SD = 5.04$) reported significantly more perceived stress than good sleepers ($M = 18.31$, $SD = 5.26$), $t(337) = -3.98$, $p = .000$, $d = .43$). Poor sleepers ($M = 31.89$, $SD = 5.73$) did not report significantly more emotion-focused coping than good sleepers ($M = 32.81$, $SD = 6.12$), $t(331) = 1.43$, $p = .154$, $d = .16$). Poor sleepers ($M = 30.24$, $SD = 6.66$) did not report significantly more problem-focused

coping than good sleepers ($M= 31.29$, $SD= 5.72$), $t(333) = 1.532$, $p=.127$, $d= .17$). Problem-focused coping and emotion-focused coping were not significant, but the marginal significance of problem-focused coping does support this researcher's hypothesis that individuals who implement problem-focused coping are more likely to report better sleep. The marginal significance of emotion-focused coping conveys the opposite of this researcher's hypothesis as it shows good sleepers tend to use emotion-focused coping. The following hypotheses were supported. Poor sleepers are more likely to experience higher perceived stress and they are also more likely to report ruminating more than "good" sleepers report ruminating. Also, individuals indicated as "poor" sleepers are more likely to employ an avoidant-coping strategy, than those considered "good" sleepers.

The main hypothesis of this study was to test what mediated the relationship between stress and sleep as stress itself appears to not be the only predictor of poor sleep. The mediators were hypothesized to be rumination and the three coping strategies: emotion-focused, problem-focused, and avoidant coping. As was mentioned prior, stress and rumination research has not appeared to focus on the relationship between the two. In order to test the mediating effect of rumination, a Sobel test was conducted (Preacher et. al, 2004). Per the steps of the Sobel test, regressions were conducted to ensure that the relationships between stress and rumination ($b=1.441$, $t(331)=10.355$, $p < .01$), stress and sleep ($b=.130$, $t(328)=3.51$, $p < .01$), and rumination and sleep ($b=.032$, $t(328)=2.501$, $p < .05$) were all significant. All regressions were significant thus the rule of whether or not the Sobel test could be conducted was satisfied. The Sobel test was conducted (Sobel=2.39, $p < .05$) and partial mediation was found. The path from PSS to PSQI was still significantly different from zero even with the control of RSS, therefore RSS partially mediated the relationship between stress and sleep quality (see Figure 1).

However, since emotion-focused and problem-focused coping did not meet the requirement of significant regression coefficient among stress and sleep, the Sobel test could not be conducted and the hypothesis of mediation was not supported. Also, a Sobel test was conducted with avoidant coping as the mediating variable, and it was found to not be significant. Therefore, the hypothesis of coping strategies mediating the relationship between stress and sleep was not supported.

Although tests of mediation reported that coping strategies did not significantly mediate the stress/sleep relationship, the significant correlations found between the coping strategies and the three scales, and prior research finding significant mediation with coping strategies, lead this researcher to believe that coping strategies possibly moderated particular pathways in the relationship among rumination, stress, and sleep. To investigate, a series of moderated mediation tests were conducted (Preacher et. al., 2007). As shown in Figure 2, five models of moderated mediation are presented. The X variable, for this study, is PSS; the M variable is RSS; the Y variable is PSQI, and the W variable is any one of the three coping strategies. Model 2 was first conducted to test the moderating role of problem-focused coping, emotion-focused coping, and avoidant coping on the relationship between stress and rumination. For problem-focused coping, the interaction was not significant ($t=-.6736$ $p=.5011$). The interaction of emotion-focused coping was also found to not be significant ($t=.4068$ $p=.6844$). The interaction of avoidant coping was found to not be significant as well ($t=1.1245$ $p=.2617$). Utilizing model 2 revealed that coping strategies did not significantly moderate the relationship between stress and rumination.

Model 3 was then conducted to analyze if coping strategies moderated the relationship between rumination and sleep. The moderating effect emotion-focused coping was found to be

significant ($t=-1.6676$ $p<.10$). When conducting a moderated mediation test, the indirect effect of the moderator and its significance is given at specific values of the moderator. Individuals who received a value of 26.6614 ($z=2.9837$ $p<.05$) and 32.4845 ($z=2.9019$ $p<.05$) were found to have a significant moderating affect on the relationship between rumination and sleep. While individuals who scored higher on the emotion-focused scale, emotion-focused coping did not moderate the relationship. The moderation effects of problem-focused coping and avoidant coping were not significant.

Discussion

The first objective of this study was to assess the effects stress has on sleep quality. Consistent with this researcher's hypothesis and the current research, individuals who scored high on the stress scale tended to score high on the sleep quality scale as well, indicating a relationship between high stress and poor sleep quality (Healey et al., 1981; Cartwright & Wood, 1991; Caldwell et. al., 2010; Sadeh, 1996; Lavie, 2001; Van Reeth et al., 2000; Mosley et al., 1994; Hoyt et al., 2009; Mesquita & Reimao, 2008; Utsugi et al., 2005; Topf & Thompson, 2001; Brand et al., 2010; Trockell et al., 2000; Rosalind & Wood, 1991). Also in line with current research by Lund et. al. (2010), this study found that the majority of college students do not receive an adequate amount of sleep. This research adds to existing research indicating college students are an at-risk population for poor sleep quality which is of great significance as prior research has showed a connection between sleep quality and GPA.

Another hypothesis of this study was that high scores of rumination would be correlated with high scores on the PSS and PSQI. Linear regressions supported this hypothesis and individuals who scored high in stress also scored high in rumination and individuals who scored high in rumination also scored high in on the PSQI. This finding adds to and supports the current

research on rumination and its effects on sleep quality and stress (Guastella & Moulds, 2006; Brand et al., 2010; Zoccola et al., 2009; Thomsen et. al., 2003).

This studies main focus was on the role coping strategies play in the relationship among stress, sleep quality, and rumination. Linear regressions were conducted and revealed that disengagement (avoidant) coping was positively correlated with stress, sleep quality, and rumination which supports this researcher's hypothesis. Based on these regressions the hypothesis that individuals who employ an avoidant coping strategy will score high in stress, rumination, and sleep quality was supported. However, contrary to this researcher's hypothesis, neither emotion-focused coping or problem-focused coping were significantly correlated with sleep quality. However, as was predicted, problem-focused coping was negatively correlated with stress. Also, emotion-focused coping was positively correlated with emotion-focused coping. Another unsupported hypothesis and a surprising finding showed emotion-focused coping to be negatively correlated with stress. Current research on emotion-focused coping has found results opposites to this finding and possible explanations for this and the finding that problem-focused coping was not significantly correlated with sleep quality will be discussed further in the study's limitations. While prior researchers' findings of the mediating role of emotion-focused and problem-focused coping is relatively consistent, research into avoidant coping's relationship with sleep quality has varied (Mosley et. al., 1994; Nowack, 1998; Morin & Ivers, Sadeh et. al., 2004; Aldwin & Revenson, 1987; Clohessy & Ehlers, 1999; Folkman & Lazarus, 1986; Forsythe & Compas, 1987; Hoyt et. al., 2009; Lazarus & DeLongis, 1983; Meyer, 2004). Avoidant coping has been found to be negatively correlated with sleep quality and stress, and it has also been found to have no effect. This study supports the latter, but further research should assess this aspect of coping. A finding of particular note is that individuals who employ

an avoidant coping strategy tend to disengage physically and emotionally from the stressor, yet the positive correlation with rumination indicates those individuals who attempt to disengage from a stressor inadvertently increase their focus on the stressor. Once again, future research should examine this relationship, as the effects of avoidant coping are conflicting in the current research.

In order to test for mediation, a Sobel test was conducted which requires the hypothesized mediator to be significantly correlated with the other two variables (Preacher, & Hayes, 2008). The hypothesis that coping strategies would mediate the relationship between stress and sleep was not supported. Only avoidant coping was significantly correlated with stress and sleep, but the Sobel test revealed avoidant coping did not significantly mediate the relationship between stress and sleep quality. As was noted, there is a relative lack of research into the relationship between stress, rumination, and sleep quality. The Sobel test revealed that rumination significantly mediated the relationship between stress and sleep. This is an especially important finding as not all individuals who experience stress experience any change in their respective sleep quality. The finding that rumination mediates this relationship is especially important to a student population as student populations seem to be acutely susceptible to the effects of rumination (Nolen-Hoekseman & Morrow, 1991). The study by Nolen-Hoekseman & Morrow (1991) found that rumination predicted depression over a nine-week period in a student population. Another study of rumination in a student population found that 50% of college students report depressive symptoms shortly after beginning their academic careers (Furr et al., 2001). Although all reports of depression are not related to rumination, it is still important to acknowledge the relationship it has with stress and sleep, as rumination appears to be more than capable of exacerbating the symptoms of depression.

Although coping strategies did not mediate the relationship between stress and sleep, this researcher assessed the possibility of coping strategies moderating one or more pathways of the relationship among stress, sleep, and rumination. To this researcher's knowledge, no prior research has assessed the moderating role of coping strategies using a moderated mediation statistical technique. In line with this researcher's hypotheses, only Model 2 and Model 3 were used to assess the possibility of moderated mediation. Model 2 revealed no significant moderation with the three coping strategies on the pathway between stress and rumination. Model 3 revealed that only emotion-focused coping significantly moderated the relationship between rumination and sleep quality. This finding was somewhat unexpected as the regressions implied that avoidant coping would have a significant role in moderation, but emotion-focused was hypothesized to have a significant effect as well. No prior research has assessed the moderating role of coping strategies via the rumination and sleep quality pathway, so it is difficult to infer the implications of the finding, but it is still important to note that rumination alone is still not sufficient enough to explain why stress affects sleep quality.

The finding that coping strategies did not mediate the relationship between stress and sleep quality was confounding when considering that prior research often found significant mediation, but it is possible this could be attributed to this study's limitations. A major limitation of this study was all measures were self-report. Self-report measures are subjective in nature and thus it is the burden of the participants to be as honest as possible with their answers and, for various reasons, this may not be possible. Also, the PSQI and PSS scales, were retrospective in nature, and asked participants to recall the previous month, and it is possible answers may have been affected due to a lapse in memory. This study is also correlational in nature which makes it impossible to infer any sort of causation. Participants were also allowed to complete the study

via InQsit, in any setting they chose, which leaves the possibility of the answers being tampered with due to extraneous variables in their chosen environment to complete the test. A specific population of interest, college students, was used in this study which leads to difficulties in generalizability.

Further research, should assess individuals' sleep quality through more objective measures, such as the use of actigraphs in order to gain an even better understanding of the effect coping strategies, stress, and rumination have on sleep quality. In the interest of making the research on stress, sleep quality, and coping strategies more experimental in design, it would be beneficial to somehow induce stress in participants in a lab setting in order to ensure all participants are experiencing some level of stress. The current study only examines perceived stress, and while this provides interesting results it would of interest to examine populations actually under stress and how this affects the variables of rumination, coping strategies, and sleep quality.

The results of this study do suggest that college students typically experience poor sleep quality, and according to current research, poor sleep quality can affect academics, health, and health behavior. Students are typically under a considerable amount of stress with an extensive course load, a part-time or full-time job, and extracurricular activities. Although coping strategies, in this study, did not mediate the relationship between stress and sleep quality, the significant regressions found with the coping strategies and other variables did reveal that they still play a significant role. For example, avoidant coping is correlated with high stress, high rumination, and poor sleep quality. Based on these results coping skill training would be beneficial to individuals who may have difficulty effectively dealing with daily stressors. This study has also highlighted the importance of rumination as a variable that has a significant effect

on the relationship between stress and sleep. Rumination is important to understand for any program seeking to improve a college student's career at a university not only because it has implications for sleep quality, but also because it has been found to maintain depressive symptoms. Along with this, a better understanding of the relationship between coping strategies and rumination is necessary as this study found that emotion-focused coping was positively correlated with rumination. If these maladaptive coping skills, such as avoidant coping, are allowed to persist without an intervention then they will only persist and possibly have consequences throughout the individual's life after college.

References

- Aldwin, C. M. & Revenson, T. A. (1987) Does Coping Help? A Reexamination of the Relation Between Coping and Mental Health. *Journal of Personality and Social Psychology*, 53(2), 337-348.
- Bixler, E.O., Kales, A., Soldatos, C.R., Kales, J.D., & Healey, S. (1979) Prevalence of sleep disorders in the Los Angeles Metropolitan area. *American Journal of Psychiatry*, 136, 1257-1262.
- Buboltz, W. C., Brown, F., & Soper, B. (2001). Sleep habits and patterns of college students: A preliminary study. *Journal of American College Health*, 50, 131-135.
- Buysse, D.J., Reynolds, C.F., Monk, T.H., Berman, S.R., & Kupfer, D.J. (1989). The Pittsburgh Sleep Quality Index (PSQI): A new instrument for psychiatric research and practice. *Psychiatry Research*, 28(2), 193-213.
- Brand, S., Puhse, U., Gerber, M., & Trachsler, E. (2010). Depression, Hypomania, and Dysfunctional Sleep-Related Cognitions as Mediators Between Stress and Insomnia: The Best Advice is Not Always Found on the Pillow. *International Journal of Stress Management*, 23(2), 114-134
- Brown, F. C., Buboltz, W. C., & Soper, B. (2002). Relationship of sleep hygiene awareness, sleep hygiene practices, and sleep quality in university students. *Behavioral Medicine*, 28, 33-38.
- Caldwell, K., Harrison, M., Adams, M., Quin, R. H. & Greeson, J. (2010) Developing Mindfulness in College Students Through Movement-Based Courses: Effects on Self-Regulatory Self Efficacy, Mood, Stress, and Sleep Quality. *Journal of American College Health*, 58(5), 433-442.

- Carver, C. S., Scheier, M. F. & Weintraub, J. K. (1989) Assessing Coping Strategies: A Theoretically Based Approach. *Journal of Personality and Social Psychology*, 56(2), 267-283.
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983) A global measure of perceived stress. *Journal of Health and Social Behavior*, 24, 386-396.
- Clohessy, S. & Ehlers A. (1999) PTSD symptoms, response to intrusive memories and coping in ambulance service workers. *British Journal of Clinical Psychology*, 38(3), 251-265.
- Diehl, Manfred and Hay, Elizabeth (2010) Risk and Resilience Factors in Coping with Daily Stress in Adulthood: The Role of Age, Self-Concept Incoherence, and Personal Control. *Developmental Psychology*, 46(5), 1132-1146
- Elkin, A. J. & Murray, D. J. (1974) The Effects of Sleep Loss on Short-Term Recognition Memory. *Canadian Journal of Psychology*, 28(2), 192-198.
- Folkman, S., Lazarus, R. S., Schetter, C. D., DeLongis, A. & Gruen, R. J. (1986) Dynamics of a Stressful Encounter: Cognitive Appraisal, Coping, and Encounter Outcomes. *Journal of Personality and Social Psychology*, 50(5), 992-1003.
- Folkman, S., Lazarus, R. S., Gruen, R. J. & DeLongis, A. (1986) Appraisal, Coping, Health Status, and Psychological Symptoms. *Journal of Personality and Social Psychology*, 50(3), 571-579.
- Forsythe, C. J. & Compas, B. E. (1987) Interaction of Cognitive Appraisals of Stressful Events and Coping: Testing the Goodness of Fit Hypothesis. *Cognitive Therapy and Research*, 11(4), 473-485.

- Furr, S. R., Westfield, J. S., McConnel, G. N., & Jenkins, J.M. (2001) Suicide and depression among college students: A decade later. *Professional Psychology: Research and Practice, 32*, 97-100.
- Guastella, A., & Moulds, M. (2007) The impact of rumination on sleep quality following a stressful life event, *Personality and Individual Difference, 42*, 1151-1162
- Gray, K. K., Eagleston, J. R., Gibson, E., & Thoresen, C. E. (1984). Sleep Disturbance in Adolescents: Sleep Quality, Sleep Habits, Beliefs About Sleep, and Daytime Functioning. *Journal of Youth and Adolescence, 13, 5*, 375-384.
- Gross, R. T. & Borkovec, T.D. (1982). Effects of a cognitive intrusion manipulation on the sleep-onset latency of good sleepers. *Behavior Therapy, 13, 1*, 112-116.
- Hatzinger, M., Hemmeter, U. M., Brand, S., Ising, M., & Holsboer-Trachsler, E. (2004) Electroencephalographic sleep profiles in treatment course and long-term outcome of major depression: Association with DEX/DRH-test response. *Journal of Psychiatric Research, 38*, 453-465.
- Hayes, A.F. & Preacher, K.J. (2004) SPSS and SAS Procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instrument, & Computers, 36 (4)*, 717-731.
- Hayens, S. N., Adams, A. & Franzen, M. (1981) The Effects of Presleep Stress on Sleep-Onset Insomnia. *Journal of Abnormal Psychology, 90(6)*, 601-606.
- Hoeksema, S. N., Wisco, B. E. & Lyubomirsky, S. (2008) Rethinking Rumination. *Perspective on Psychological Science, 3(5)*, 400-424.
- Hoeksema, S. N. & Morrow, J. (1991) Response to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology, 100*, 569-582.

- Hoyt, M., Thomas, K., Epstein, D., & Dirksen, S. (2009) Coping Style and Sleep Quality in Men with Cancer. *Ann. Behav. Med.*, 37, 88-93.
- Karacan, I., Thornby, J.I., Anch, M., Holzler, C.E., Warheit, G.J., Schivab, J.J., & Williams, R.L. (1976) Prevalence of sleep disturbances in a primarily urban Florida county. *Social Science & Medicine*, 10, 239-244.
- Kienan, G. & Sivan, D. (2001). The Effects of Stress and Desire for Control on the Formation of Causal Attributions. *Journal of Research in Personality*, 35, 127-137.
- Lazarus, R. & DeLongis, A. (1983) Psychological Stress and Coping in Aging. *American Psychologist*, 245-254.
- Lund, H., Redier, B., Whiting, A., & Prichard, J. (2010). Sleep Patterns and Predictors of Disturbed Sleep in a Large Population of College Students. *Journal of Adolescent Health*, 46, 124-132.
- Lyubomirsky, S. & Hoeksema, S. N. (1995) Effects of Self-Focused Rumination on Negative Thinking and Interpersonal Problem Solving. *Journal of Personality and Social Psychology*, 69(1), 176-190.
- Martica, H., Vasko, R., Buysse, D., Ombao, H., Chen, Q., Cashmere, D. J., Kupfer, D. & Thayer, J. (2004) Acute Stress Affect Heart Rate Variability During Sleep. *Psychosomatic Medicine*, 66, 56-62.
- Mesquita, Gema and Reimao Rubens (2010) Stress and sleep quality in high school Brazilian Adolescents. *Anais da Academia Brasileira de Ciencias*, 82(2), 545-551
- Meyer, B. (2004) Coping with Sever Mental Illness: Relations of the Brief COPE with Symptoms, Functioning, and Well-Being. *Journal of Psychopathology and Behavioral Assessment*, 23(4), 265-277.

- Morin, C., Rodrigue, S., & Ivers, H. (2003) Role of Stress, Arousal, and Coping Skills in Primary Insomnia. *Psychosomatic Medicine*, 65, 259-267
- Mosley, T., Perrin, S., Neral, S., Dubbert, P., Grouthues, C., & Pinto, B. (1994) Coping and Well-Being among Third-Year Medical Students, *Academic Medicine*, 69(9), 765-767
- Nowack, K. M. (1989) Coping Style, Cognitive Hardiness, and Health Status. *Journal of Behavioral Medicine*, 12(2), 145-158.
- Pilcher, J.J. & Ott, E.S. (1998). The relationships between sleep and measures of health and well being in college students: A repeated measures approach. *Behavioral Medicine*, 23, 170-178.
- Polzella, D. J. (1975) Effects of Sleep Deprivation on Short-Term Recognition Memory. *Journal of Experimental Psychology*, 104(2), 194-200.
- Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Assessing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivariate Behavioral Research*, 42, 185-227.
- Rosalind, C. D. & Wood, E. (1991). Adjustment disorders of sleep: The sleep effects of a major stressful event and its resolution. *Psychiatry Research*, 39, 3, 199-209
- Sadeh, A., Keinan, G., & Daon, K. (2004). Effect of stress on sleep: The moderating role of coping style. *Health Psychology*, 23, 542-545.
- Segerstrom, S. C., Tsao, J. C. I., Alden, L. E. & Craske, M. G. (2004) Worry and Rumination: Repetitive Thoughts as a Concomitant and Predictor of Negative Mood. *Cognitive Therapy and Research*, 24(6), 671-688.
- Spasojevic, J. & Alloy, L. B. (2001) Rumination as a Common Mechanism Relating Depressive Risk Factors to Depression. *Emotion*, 1(1), 25-37.

- Taylor, D. J. (2008) Insomnia and depression. *Sleep, 31*, 447-448.
- Thomsen, D. K., Mehlsen, M. Y., Christensen, S. S., & Zachariae, R. R. (2003) Rumination-relationship with negative mood and sleep quality. *Personality and Individual Differences, 34(7)*, 1293-1301.
- Topf, M. & Thompson, S. (2001) Interactive relationships between hospital patients' noise-induced stress and other stress with sleep. *Issues in Neurological Care, 30(4)*, 237-243.
- Trockel, M.T., Barnes, M.D., & Egget, D.L. (2000). Health-related variable and academic performance among first-year college students: Implication for sleep and other behaviors. *Journal of American College Health, (49)*, 125-131.
- Utsugi, M., Saijo, Y., Yoshioka, E., Horikawa, N., Sato, T., Gong, Y. & Kishi, R. (2005) Relationships of Occupational Stress to Insomina and Short Sleep in Japanese Workers. *SLEEP, 28(6)*, 728-735.
- Vgontzas, A. N., Lin, H. M., Papaliaga, M., Calhoun, S., Bueno, A. V., Chrousos, G. P. & Bixler, E. O. (2008) Short sleep duration and obesity: the role of emotional stress and sleep disturbances. *International Journal of Obesity, 32*, 801-809.
- Willert, M., Thulstrup, A., Hertz, J., & Bonde J. (2010) Sleep and Cognitive Failures Improved by a Three-Month Stress Management Intervention. *International Journal of Stress Management, 17 (3)*, 193-213
- Zoccola, P. M., Dickerson, S. S., & Lam, S (2009). Rumination Predicts Longer Sleep Onset Latency After An Acute Psychosocial Stressor. *Psychosomatic Medicine, 71*, 771-775.

Appendix I

Table 1	PSS (stress)	RSS (rumination)	PSQI (sleep quality)
Substance Abuse	.170**	.233**	.227*
Positive interpretation	-.234**	.025	-.143**
Mental Disengagement	.218**	.373**	.069
Venting of emotions	.305**	.405**	.076
Denial	.220**	.295**	.138*
Behavioral Disengagement	.305**	.407**	.167**
Planning	-.182**	.102	-.125*
Suppress competing activities	-.033	.251**	.070
Restraint	.014	.273**	.005

* $p < .05$, ** $p < .01$, all two-tailed

Table 2	RSS (Rumination)	PSS (Stress)	PSQI (Sleep Quality)
Emotion-Focused	.191*	-.129*	-.065
Problem-Focused	.163**	-.167**	-.055
Avoidant	.460**	.327**	.166**

* $p < .05$, ** $p < .01$, all two-tailed

Figure 1:

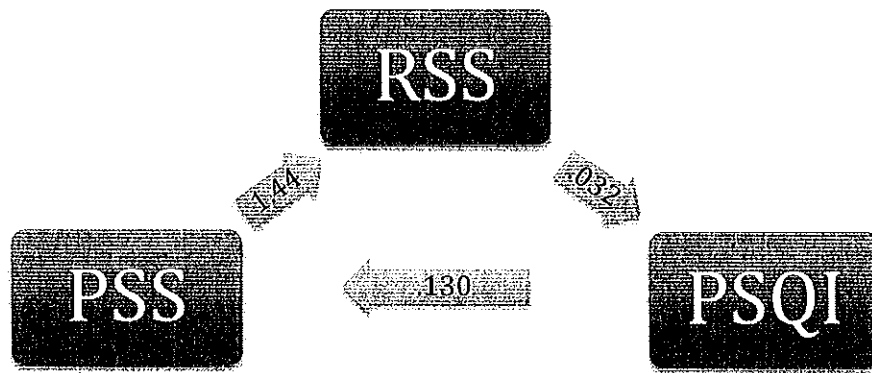


Figure 2:

