THE EFFECTS OF CHANGES IN SLEEP SCHEDULE VARIABILITY ON FIRST-YEAR COLLEGE STUDENTS

by

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A Dissertation Submitted to the Faculty of the

DEPARTMENT OF PSYCHOLOGY

In Partial Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

In the Graduate College

THE UNIVERSITY OF ARIZONA

2015

THE UNIVERSITY OF ARIZONA

GRADUATE COLLEGE

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ACKNOWLEDGEMENTS

Thanks go to my advisor first and foremost. Many thanks also to my committee, the small army of RAs who debriefed my participants, my lab mates and fellow grad students who provided support and encouragement, and my husband, who did not realize what he was getting into when he married a graduate student.

DEDICATION

To my advisor, Richard R. Bootzin, without whom, none of this would have been possible. Your contributions to the field were immense and your dedication to your students was incomparable. I couldn't have asked for a better mentor. Your legacy lives on.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES FOUND IN APPENDIX B

ABSTRACT

College students are known for having poor sleep and irregular sleep schedules, especially during the first year of college. These sleep habits may contribute to poor academic outcomes down the line, as well as increased risk of developing depression and other disorders. The current study aims to look at the degree of change in sleep variability between high school and college and examine its relationship with mood, emotion regulation, and academic performance. The study also aims to explore the relationship between morningness-eveningness tendencies and academic performance, emotion regulation, and sleep variability, reported both at baseline (as perceived by the students) and over 7 days of daily sleep diaries. Additionally, the study is designed to look at day-to-day effects of sleep on mood. Data were obtained from 311 college freshmen (237 females). Participants were 17-19 years old (M=18.4) and freshmen in college. The study took place over one baseline internet-based session and a week of internet-based daily questionnaires. While students had significantly more variable schedules in college than in high school, this change did not correlate with or predict any measures of interest, including sleep quality, grades, and mood. However, overall variability, as well as eveningness, was associated with a number of negative outcomes, including lower GPA, less adaptive emotion regulation strategies, worse mood, and more depression symptoms.

INTRODUCTION

The current study aims to look at the degree of change in sleep variability between high school and college and examine its relationship with mood, emotion regulation, and academic performance. The transition between high school and college can be a stressful time for students (Kerr, Johnson, Gans, & Krumrine, 2004; Larose & Boivin, 1998) and can result in a number of changes in functioning, including higher alcohol use (Phinney & Haas, 2003), psychosocial difficulties (Tavernier & Willoughby, 2014), and sleep problems (Galambos, Vargas-Lascano, Howard, & Maggs, 2013). If not dealt with, these difficulties can incur high costs. Freshmen who have more trouble adjusting to college have worse grades (Lau et al, 2013), a greater likelihood of developing depression and anxiety (Furr, Westefeld, McConnel, & Jenkins, 2001; Pryor, Hurtday, DeAngelo, Blake, & Tran, 2010), and a higher likelihood of dropping out (Hartley, 2012).

Effects of Sleep Loss and Fragmentation

Sleep, specifically, is an important component of well-being. It is an essential biological need and has been shown to play a role in a diverse array of functions, including mood, learning, memory consolidation, critical thinking, and decision-making (Harrison & Horne, 2000; Jean-Louis, von Gizycki, Zizi, & Nunes, 1998; Mednick, Nakayama, & Stickgold, 2003; Pilcher & Walters, 1997; Smith & Lapp, 1991). Sleep deprivation has been shown to have negative effects ranging from increased accidents (Fourquer, Camden, Gabriau, & Johnson, 2008) to poor daytime function (Tsai & Li, 2004) to decreased school performance (Gilbert & Weaver, 2010; Swanum & Zody, 2001). Additionally, sleepiness has been shown to have an effect on emotion regulation, with people having less adaptive emotion regulation strategies when they are sleepy or sleep-deprived (See Walker, 2009, for a review).

Studies have shown that sleep loss and fragmentation can impair executive function, including cognitive flexibility and ability to focus on relevant cues (Jones & Harrison, 2001). In a meta-analysis of studies focusing on short term sleep deprivation, Lim and Dinges (2010) found that less than 48 hours of sleep deprivation can have significant negative effects on many areas of cognitive functioning, including working memory, processing speed, and simple and complex attention. Additionally, studies have found negative effects of sleep deprivation on inhibitory control such as performance on a Stroop task (Bratzke, Steinborn, Rolke, & Ulrich, 2012), on other forms of self-control (such as impulse control and hostility in the workplace; Christian & Ellis, 2011), and sleepiness and working memory specifically in adolescents and young adults (Jiang et al., 2011).

Along with sleep deprivation effects discussed above, sleep loss and deprivation have been associated with emotion dysregulation. For example, Dinges et al. (1997) used a sleep restriction paradigm in which participants were allowed 4-5 hours of sleep per night over the course of a week. Questionnaire mood scales and descriptions in participants' daily journal showed increasing emotional disturbances as the study went on. A study by Zohar, Tzischinsky, Epstein, and Lavie (2005) examined the relationship between sleep loss and emotional reactivity in medical residents. Residents who experienced greater sleep loss exhibited more negative emotions in response to disruptive daytime events. Additionally, greater sleep loss was associated with less positive reactions to potentially rewarding or beneficial activities.

Another study on sustained sleep restriction (Haack & Mullington, 2005) examined the effects of long-term partial sleep deprivation on mood and physical well-being. Participants were randomly assigned to 12 consecutive days of normal sleep (8 hours per night) or 50% sleep restriction (4 hours per night). Participants in the sleep restriction condition showed decreases in

mood over the course of the study, with significant differences from the non-restricted group becoming apparent on the second night of the experiment. Interestingly, mood and physical symptoms showed complete recovery to baseline after only one night of recovery sleep. The study's findings suggest that chronic insufficient sleep has negative consequences for both physical and emotional health, but may be easily treatable.

Franzen et al. (2006, 2007) looked at sleepiness and emotional reactivity to negative images in healthy, sleep-deprived adults. Participants were randomly assigned to one night of total sleep deprivation or a night of normal sleep (8 hours). Mood and sleepiness were assessed the following morning using questionnaires as well as more objective measures, such as pupil dilation. Additionally, the study looked at physiological reactivity to emotional stimuli. As predicted, one night of total sleep deprivation led to an increase in sleepiness and negative mood, a reduction in positive mood, and higher physiological reactivity in response to emotional stimuli.

A rare study looked at the effect of sleep loss on human brain reactivity. Yoo. Gujar, Hu, Jolesz, and Walker (2007) randomly assigned participants to normal sleep or one night of sleep deprivation prior to an fMRI scanning session. While in the scanner, participants viewed pictures ranging from neutral to negative. Participants in the sleep deprivation conditions showed a large increase in amygdala activation in response to the increasingly negative pictures, indicating that sleep loss may inappropriately modulate reactivity. Additionally, this increase in amygdala activation was associated with a decrease in functional connectivity between the amygdala and the medial prefrontal cortex, which is another indicator of inappropriate modulation. Taken together, these findings suggest that sleep has an important role in regulating emotional responses.

Sleep in College Students

College students are known for having shorter sleep and later bedtimes than the general population (Brown & Buboltz (2002; Brown, Buboltz, & Soper, 2001; Machado, Varella, & Andrade, 1998). A significant proportion of them report daytime sleepiness and other functional impairments stemming from lack of sleep (Lund, Reider, Whiting, & Prichard, 2010).

A number of studies have looked at college students' sleep patterns in an attempt to predict sleep disturbances, school performance, and general well-being. One large study (Lund et al., 2010) administered an online survey to a group of college students, asking them about sleep quality, daytime sleepiness, and mood, among other items. Students reported chronically restricted sleep (mean sleep time was 7.02 hours and 25% of students reported sleeping less than 6.5 hours per night), significant daytime sleepiness, and daytime impairments (such as falling asleep in class). Additionally, the study showed that college students went to bed and woke up significantly later than high school students, and that first year college students had later bed and rise times than 3rd and 4th year college students, but only on weekends. Although the study did not look at whether this degree of change was associated with any other variables, it is possible that this was a contributing factor in some of the sleep disturbances observed.

Another study by Tsai and Li (2004) looked at sleep in college students over a 7-day period. Participants filled out daily morning diaries recording sleep variables such as bed time and rise time, nighttime awakenings, and estimates of sleep quality. They also noted major stressors of the prior day. The study found earlier rise time, but not bed time, on weekdays as compared to weekends, leading to a shorter sleep duration on weekdays. The authors also found that women had greater sleep difficulties than men, and that freshmen had shorter sleep than

older students. Although the study collected daily data, day-to-day variability and its correlates were not reported.

Orzech, Salafsky, and Hamilton (2011) surveyed a large sample of University of Arizona students living in university housing and used the data to develop an educational campaign to improve sleep. They collected data about sleep quality using the Pittsburgh Sleep Quality Inventory (PSQI; Buysse et al., 1989) as well as grades and daytime impairment. A PSQI score of >5 indicates clinically significant impairment. Male respondents had an average PSQI score of 6.38 and female respondents had an average PSQI score of 6.69. The study also found that students with higher PSQI scores had slightly lower GPAs. A small number of students (9% of the sample) showed improvements following the sleep education campaign.

Although depression and sleep disturbances have been shown to go hand-in-hand both in college students and the general population (See Staner, 2010, for a review), most studies looking at the effects of poor sleep in college students do not screen out depressed individuals, making the findings somewhat murky. However, one recent study (Gilbert & Weaver, 2010) specifically looked at non-depressed college students and their grades. Students were asked to complete the PSQI as well as answer questions about their GPA and the number of courses they had dropped or withdrawn from. Students in the sample slept an average of 7.2 hours per night and approximately 70% reported clinically significant sleep difficulties. Those with worse sleep had significantly lower GPA than those with fewer sleep difficulties. Taken together, these and other studies provide evidence that college students' sleep is short and disturbed, and that they suffer from daytime impairments and lower GPA as a result.

One study has been found that looked specifically at sleep during the transition from high school to college. Doane, Gress-Smith, and Breitenstein (2014) assessed student sleep using actigraphy and the PSQI at 3 time points: spring of their senior year of high school (T1), fall of their first year of college (T2), and spring of their first year of college (T3). They also assessed symptoms of anxiety and depression using self-report questionnaires. They found that several sleep measures actually improved from T1 to T2, including sleep efficiency, minutes of sleep, and subjective sleep complaints. Despite this, anxiety symptoms increased. Additionally, wake time variability (there were no other variability measures in the study) increased across all three time points. Interestingly, the study found that sleep problems, including wake time variability, at T1 predicted anxiety at T2, which in turn predicted sleep problems both at T2 and T3. Conversely, depression at T1 predicted future sleep difficulties but was not predicted by them.

Sleep Schedule Regularity and Variability

It is also known that sleep schedule is one of the first things to change when a student transitions from high school to college, with college students shortening their sleep time and adopting a more irregular schedule (Pilcher, Ginter, & Sadowsky, 1997). Despite evidence suggesting that regular sleep schedules are better for sleep and well-being (Manber, Botozin, Acebo, & Carskadon, 1996; Yang, Spielman, & Glovinsky, 2006), and despite the fact that it is known that the transition from high school to college is associated with various disruptions, to date, few studies have looked at sleep schedule variability during that transition. Although the Doane et al (2014) study described above collected data from students in high school and followed them over the first year of college, they reported limited analyses of variability (see above).

A consistent sleep schedule is dependent on a number of endogenous and environmental factors (Czeisler, Buxton, & Khalsa, 2005). A number of studies have examined the effect of irregular vs. regular sleep on daytime functioning and conversely, the effects of regular daily routines on sleep quality. One study (Soehner, Kennedy, & Monk, 2011) assessed sleep quality, duration, and timing in working adults age 23-48. The authors found that more stable weekday rise times were correlated with better sleep quality and shorter sleep-onset latency. Additionally, more stable overall rise times were associated with better sleep quality as well as higher sleep efficiency. Unfortunately, the study did not measure daytime variables, so the effect of schedules on mood and functioning could not be assessed. Sleep variability has also been associated with increased stress (Mezick et al, 2009).

Sleep quality has been shown to be negatively associated with irregular daily routines, while strategies that regularize daily events have been shown to be beneficial to patients with insomnia and other sleep disturbances (Bootzin & Nicassio, 1978; Edinger et al., 1992, 1998, 2001; Edinger & Sampson, 2003; Espie et al., 2001; Hauri, 1982; Monk et al., 1994, 2003; Morin et al., 1993, 1999). The timing of social rhythms and social engagement during the day has also been found to be related to sleep quality in adults (Edinger et al., 1998; Monk et al., 1994; Ohayon et al., 2001). Carney et al. (2006) examined effects of daily activities on sleep in college students. The authors assessed sleep quality using the PSQI and daily social rhythms using the Social Rhythm Metric (SRM; Monk et al., 1990). They also assessed, but did not exclude for, depression. Participants completed the SRM daily over a 14 day period. Poor sleepers were found to engage in fewer activities overall and in fewer social activities than good sleepers. Additionally, poor sleepers had lower regularity of activities than did good sleepers.

However, when depression was controlled for, most of these effects did not reach significance, suggesting that at least in this study, the effects were mediated by mood.

The present study also aims to explore the relationship between morningness-eveningness tendencies and academic performance, emotion regulation, and sleep variability, reported both at baseline (as perceived by the students) and over 7 days of daily sleep diaries. Additionally, the study is designed to look at day-to-day effects of sleep on mood. The relevant literatures are described below.

Morningness-eveningness Tendencies and Their Daytime Effects

The idea of morningness and eveningness reflects the circadian preference of a given individual. One's chronotype, or where one falls on the morningness-eveningness continuum, is determined by one's preferred bed times and wake times (Natale & Cicogna, 2002), as well as the time of day when one feels best and most alert. There are also biological indicators of chronotype, including body temperature and melatonin (Baile and Heitkemper, 2001; Mongrain, Lavoie, Selamoui, Paquet, & Dumont, 2004). Individuals can be generally classified as having a neutral chronotype (the majority of the population) or as being a morning or evening type (Adan, 1994; Horne and Ostberg, 1976).

In addition to inter-individual differences, chronotypes typically vary within an individual over the lifespan (Taylor, Jenni, Acebo, and Carskadon, 2005). Young children, once they develop a circadian rhythm, show morning tendencies and shift towards eveningness at the beginning of adolescence. During the transition to young adulthood, in the mid to late 20s, circadian preference moves back toward morningness and continues to do so over the rest of the lifespan (Crowley, Acebo, and Carskadon, 2007).

A number of studies have examined the correlates of morningness and eveningness tendencies and their relationship with overall sleep quality, mood, and daytime functioning in various populations, including college students. Consistently, evening types experience worse intrapersonal adjustment (Lazar et al, 2012), less positive attitudes towards life (Randler, 2011), and lower life satisfaction (Randler, 2008). One study (Tavernier & Willoughby, 2014) found subtypes of evening-type individuals who did not suffer from these deficits, but they also identified two other evening-type subtypes to be susceptible to intrapersonal difficulties and increased alcohol consumption. Another study (Hsu, Gau, Shang, Chiu, & Lee, 2012) found evening type to be associated with psychopathology, including symptoms of anxiety and depression, as well as negative personality characteristics such as neuroticism. A recent study (Jonason, Jones, & Lyons, 2013) found that evening-type individuals are more likely to exhibit "dark triad" personality traits of narcissism, Machiavellianism (tendency toward manipulation of others), and psychopathy. Taken together, data support the idea that in general, it is more adaptive to be a morning type rather than an evening type.

Within college and other young-adult populations specifically, eveningness has been associated with lower grades (Giannotti, Cortesi, Sebastiani, & Ottaviano, 2002; Taylor, Clay, Bramoweth, Sethi, & Roane, 2011), difficulties with emotion regulation (Drennan, Klauber, Kripke, & Goyette, 1991), and higher alcohol consumption (Fernandez-Mendoza, Ilioudi, Montes, & Olavarrieta-Bernardion, 2010; Taylor et al, 2011). One study (Preckel et al, 2013), for example, assessed high school students with a self-report questionnaire and a standardized cognitive test. Eveningness significantly predicted lower GPAs, even when other factors such as academic motivation, cognitive abilities, conscientiousness, and gender were controlled for.

Interestingly, morningness tendencies were not significantly associated with higher GPAs, suggesting that chronotypes may be multi-, rather than uni-dimensional.

Effects of Morningness and Eveningness on Sleep

Generally, evening tendencies have been shown to be related to worse sleep and greater sleep disturbance. Gau et al (2007) looked at sleep in a sample of Chinese adolescents who were 12-13 years old. The participants completed self-report measures of sleep schedule and sleep complaints, as well as a Chinese-language morningness-eveningness questionnaire (the CMES, translated from the MES, Carskadon, Vieira, & Acebo, 1993). The students' mothers also completed a behavior checklist and a health questionnaire. Adolescents who were classified as evening-types had more sleep variability (shorter weekday sleep time and longer weekend sleep time) than the intermediate and morning types, more sleep complaints, as well as more daytime napping. Additionally, evening types were more likely to have behavioral and emotional difficulties. An earlier study (Gau, Soong, & Merikangas, 2004) from the same group found similar results, with evening-type children and adolescents experiencing increased fear of sleeping in the dark, insomnia, and more instances of going to bed after 3 am.

Another study (Merikanto et al, 2012) looked at chronotypes and sleep complaints in a general Finnish population, aged 25 and older. In this large study (n = 6848), a random sample of the population was asked to fill out surveys that included six questions from the MEQ and a brief self-report measure of average sleep amount and sleep complaints. The study found that evening types reported more insomnia symptoms, higher sleep medication use, and more nightmares than evening types. Interestingly, while evening types also reported more instances of insufficient sleep, there were more long sleepers in the evening group than the neutral or

morning groups. This suggests that evening-types may have greater variability in their sleep, along with more sleep disturbance overall.

Other studies, too, have found eveningness tendencies to be associated with greater variability, such as shorter weekday sleep (Gau et al, 2007) and longer weekend sleep delay (Garcia et al, 1999; Randler, 2008). Randler and Jankowski (2014), found that adolescents and young adults who were considered evening types were more likely not only to have later bed times, rise times, and meal times (as would be expected from their preferred chronotype), but to have more variability in their sleep timing. Yang et al (2001) found similar associations, with sleep delay on weekends being associated with delayed dim-light melatonin onset (DLMO, a measure of circadian rhythm) on Monday evenings. It appears that this relationship is bi-directional – irregular schedules increase evening tendencies, and eveningness in turn contributes to greater schedule irregularity.

Daytime sleepiness and lower learning motivation have also been found to be related to being an evening type. For example, Roeser, Schlarb, and Kubler (2013) looked at high-school age adolescents (ages 14-16) and administered questionnaires to assess daytime sleepiness, academic achievement, and learning motivation. They classified participants into chronotypes using the MEQ. The study found that adolescents who were morning-types experienced less daytime sleepiness than both neutral and evening types. Morning-types also had higher learning motivation. Additionally, sleepiness was correlated with lower learning motivation. Although chronotype was not directly related to academic achievement, evening-types had lower learning motivation on the whole, and students with lower learning motivation were found to do more poorly academically, suggesting that sleepiness contributed to lower motivation, which in turn contributed to poor performance.

Emotion Regulation

According to Gross and colleagues (1989, 2002, 2003), individuals regulate emotions via cognitive reappraisal or expressive suppression. Cognitive reappraisal involves reconstructing a situation in a way that alters its emotional impact. This is done before the emotion is experienced. Expressive suppression involves preventing the outward expression of emotion and takes place after the emotional experience has already begun. Both of these strategies may be used for positive, negative or neutral emotions. Cognitive reappraisal appears to be an adaptive strategy, while suppression may be a less adaptive one (See John & Gross, 2004, for a review). While early emotion regulation studies simply assessed emotion regulation strategies, more recent studies have begun manipulating them, as well.

In one study, Gross (1998) showed participants film clips designed to elicit negative emotions and randomly assigned participants to one of three emotion regulation (ER) strategies: reappraisal, suppression, or control. The reappraisal group was asked to think about the film in such a way that would lead them to not have an emotional response. The suppression group was told to hide their emotional response to the film so that an observer would be unable to tell what they were feeling. The control group was told simply to watch the clip. Participants in the suppression group did not differ from controls on subjective measures of negative affect. They also showed greater physiological arousal, measured through skin conductance and heart rate, then did the control participants. Individuals in the reappraisal group, on the other hand, had no increase in physiological arousal and experienced less negative emotions than both the control and suppression groups.

Another study by Richards and Gross (1999, 2000) looked at cognitive consequences of different ER strategies. Participants were asked to either suppress or reappraise emotions while learning social information (in this case, names and facts about individuals presented on slides). Participants who regulated their emotions through reappraisal did not differ from controls on their recall of this information. Participants in the suppression group, however, were less able to recall social facts which were presented while they were regulating emotions.

Richards, Butler, and Gross (2003) conducted a study looking at emotion regulation in dating couples. Participants were asked to discuss a conflict in their relationship and randomly assigned to either respond naturally during the conversation, reappraise, or suppress their emotions. The group that suppressed their emotions had a more difficult time recalling details of the conversation than did either of the two other groups. Interestingly, the suppression group had a better recall for emotional reactions during the conversation than did the reappraisal or control groups. Taken together, these and other studies provide evidence for the idea that cognitive reappraisal is a more adaptive emotion regulation strategy than expressive suppression both with respect to mood and cognition.

While a number of studies have looked at the relationship between sleep quality and various indicators of emotion regulation, such as disordered emotional expression, to date, only one study examined the correlation between poor sleep and effective use of cognitive reappraisal. Mauss, Troy, and LeBourgeois (2013) looked at the relationship between a self-report measure of sleep quality and participants' ability to utilize cognitive reappraisal in a laboratory setting. Adults from the general population participated in a standard sadness induction task (Troy, Wilhelm, Shallcross, & Mauss, 2010) and were asked to use reappraisal techniques during part of the task. Lower sleep quality over the past week, as well as lower sleep quality the night

before, was significantly correlated with less successful use of reappraisal. Sleep duration, however, was not related to use of reappraisal. However, since the study asked participants about the entire past week during the lab visit, it is possible that sleep duration was not remembered accurately. Additionally, it did not assess participants' general use of reappraisal or suppression via the ERQ.

Methods of Assessing Variability

A number of studies have looked at methodology for assessing variability in daily measures. Jahng, Wood, and Trull (2008) compared four different methods of measuring variability in mood and came to the conclusion that using mean square successive difference (MSSD) best captured both variability and temporal dependency in measures taken over successive days or other time periods. Similar methods were used specifically for sleep measures by Sanchez-Ortuno, Carney, Edinger, Wyatt, and Harris (2012), who found it useful for capturing night-to-night fluctuations in sleep times and difficulties in falling asleep. Suh et al (2012) used MSSD to compute a composite variability score for several sleep measures in order to better capture overall variability. Their computation of z-scores of the variability scores allowed for better comparisons, and is the methodology used in the current study.

The Present Study

As described above, the current study is designed to look at the relationship between sleep variability, morningness-eveningness tendencies, academic performance, sleep, mood, and emotion regulation. It is also designed to allow for examination of day-to-day effects of sleep on mood. In addition to the hypotheses described below, analyses will be carried out to look at additional correlates of emotion regulation strategies, morningness-eveningness scores, and depression severity.

Hypothesis 1: A greater degree of change in sleep regularity between high school and college will be negatively associated with adaptive emotion regulation, academic performance, morningness-eveningness status, and daily mood.

Hypothesis 2: Over the course of a 1-week period, shorter sleep will be negatively associated with mood, with the relationship being moderated by use of adaptive emotion regulation strategies and morningness-eveningness status.

Hypothesis 3: Over the course of a 1-week period, greater sleep schedule variability will be negatively associated with average mood and average sleep time, with the relationship being moderated by use of adaptive emotion regulation strategies and morningness-eveningness status.

Hypothesis 4: Perceived sleep schedule variability (assessed at baseline) will be negatively associated with adaptive emotion regulation strategies, GPA, morningness-eveningness status, and average daily mood measured over the following week.

RESEARCH DESIGN AND METHODS

Three hundred and twelve participants (237 females) were recruited through the University of Arizona Psychology Department's experiment website. Participants were 17-19 years old (M=18.4) and freshmen in college. Participants were excluded if they are not freshmen in college, if they had a break of longer than 4 months between finishing high school and beginning college, if they were taking medications that interfered with sleep, and if they have been previously diagnosed with any sleep disorder other than insomnia. Participants were screened, but not excluded, for depression. Upon attendance at a mandatory debriefing session, subjects were awarded four experimental credits if they participated in the entire study and 1 credit if they completed the baseline but were not eligible for the rest of the study.

Study Design

The study took place over one baseline internet-based session and a week of internet-based daily questionnaires. During the first session, informed consent was obtained. Subjects then filled out a screening questionnaire packet, including demographic information and the Beck Depression Inventory (BDI; Beck, Steer, & Brown, 1996). If eligible, they filled out the baseline questionnaires, which are described below. At the end of the packet, subjects were given instructions for accessing the daily internet-based questionnaires. They were asked to complete the questionnaires for the next 7 days and were sent daily reminder emails with links to the questionnaires. Additionally, participants were asked to attend an in-person debriefing session to receive their credits.

Measures

Screening measures. The screening questionnaire is a sixteen-item questionnaire which assesses medical and psychiatric history and sleep quality, as well as demographic information. Students were also asked their current GPA.

Baseline measures. The Beck Depression Inventory is a 21-item self-administered questionnaire with demonstrated validity and reliability (Beck, Steer, & Brown, 1996). Participants were not excluded from the study if they met criteria for an MDD diagnosis (BDI>14), but level of depression was controlled for in the analyses.

The Morningness Eveningness Questionnaire (MEQ; Horne & Ostberg, 1976), consists of nineteen items. This questionnaire assesses morning and evening tendencies through questions about the time of day at which individuals prefer to wake up, go to sleep, and engage in other activities. Horne and Ostberg (1976) demonstrated that the MEQ has high reliability as well as high external validity. Higher scores on the MEQ indicate more morning tendencies.

The Stanford Sleepiness Scale, (SSS; Hoddes, Dement, & Zarcone, 1971), is a seven-item scale that assesses subjective sleepiness. It consists of statements which correspond to increasing levels of sleepiness and asks participants to select the one that is closest to their current state. Hoddes et al. (1971) showed that the SSS is highly sensitive to changes in sleepiness. Additionally, the SSS has good external validity, correlating highly with performance on mental tasks (Hoddes, Zarcone, Smythe, Phillips, & Dement, 1973).

The Emotion Regulation Questionnaire (ERQ; Gross & Munoz, 1995) is a self-report questionnaire which assesses emotion regulation strategies. It includes questions that specifically measure suppression and reappraisal of emotions (Gross & John, 2003). The ERQ has been shown to vary with state and to be responsive to low mood (Gross & Munoz, 1995). The ERQ has questions that can be used to calculate several subscales, including one on emotion suppression and another on cognitive reappraisal. High scores on the suppression subscale indicate less adaptive emotion regulation strategies, whereas high scores on the cognitive reappraisal subscale represent more adaptive ones (John & Gross, 2004).

The Pittsburgh Sleep Quality Index (PSQI; Buysse et al, 1989), is a 19-item self-administered questionnaire designed to measure sleep quality and sleep disturbance over a 1-month period. It includes questions to assess subjective sleep quality, sleep latency and duration, sleep disturbance, and daytime functioning. PSQI scores of 5 and above indicate some sleep disturbance (Buysse et al., 1989).

The Sleep Schedule Regularity Questionnaire (SSRQ), designed for this study, is a face-valid measure designed for this study. It is designed to assess student perception of current schedule variability, as well as variability during the previous semester (if applicable), summer and while in high school. It also contains questions about the subjects' average amount of sleep on weekdays and weekends. The SSRQ given in the first semester consists of 18 Likert-type items. The version given in the second semester contains an additional 6 items to ask about the previous semester. The SSRQ can be subdivided into 4 subscales to assess variability during the time periods described above. Higher scores on the subscales indicate a more regular sleep schedule. The SSRQ had good reliability, $\alpha = .84$, for the 12 relevant items. Inter-item correlations ranged between .01 and .89. No items significantly increased reliability through

their removal. However, the SSRQ subscale scores for the current semester, as well as the average variability scores measured by the SSRQ, were not correlated with the composite variability score.

Daily Measures. Participants filled out internet-based daily sleep diaries. The sleep diary is based on the consensus sleep diary (Carney et al., 2012).

Copies of all measures are included in Appendix A.

Statistical Analyses

Participants' data were excluded for the following reasons: beginning but not completing baseline, completing baseline more than once with different data, average sleep (in minutes) was more than 3 standard deviations above or below the mean, daily sleep times and wake times were identical (but participant reported sleeping more than 0 minutes on those days), GPA was reported as 0.0

Reliability was calculated for the SSRQ, using the variability subscales for the 4 different time periods. These were the same subscales used in the rest of the analyses. Intra-class correlations were also obtained for the 12 relevant items.

A composite variability score was calculated according to the guidelines suggested by Jahng et al (2008) and also used by Suh et al (2012). The index consisted of total sleep time, bed time, and wake time. The differences between consecutive time points were squared and averaged over the week for each variable and were then converted to z-scores. The composite variability score, then, was the average of the z-scores of the above 3 variables. Analyses were

also ran using within-person standard deviation instead of the composite variability score, but as there were no significant differences on any analyzes, the composite score is reported here.

To evaluate hypothesis 1, correlations were run between SSRQ change scores (calculated as the difference between average variability in high school and average variability in the present semester) and GPA, morningness-eveningness scores, and use of suppression and reappraisal on the ERQ. To evaluate hypothesis 2, a mixed level model examined the effects of sleep at night on mood the following day, using use of reappraisal and MEQ score as moderators. All predictor variables were centered on their own means. Hypothesis 3 was evaluated by looking at correlations between the composite variability score and MEQ and use of suppression and reappraisal. Hypothesis 4 was evaluated by looking at correlations between average SSRQ variability (calculated as the average of the four variability subscales) and MEQ scores, GPA, average daily mood, and use of suppression and reappraisal.

RESULTS

Students got an average of over 7.5 hours of sleep per night (m = 459.5 minutes, sd = 61.3 minutes), with 6.4% getting 6 hours or less per night and about 25% getting 7 hours of sleep or less. The average bed time (assessed by diaries) was about 1am, and the average wake time was about 9am. This was consistent with average current bed and wake times reported on the SSRQ (bed times of about 12:30am on weekdays and 1:40 on weekends and wake times of 8:35am on weekdays and 10:55am on weekends). Despite being a healthy sample, not selected for sleep disturbance, students had mild levels of sleep disturbance on the PSQI (m = 6.21, sd = 2.94). High school sleep was only assessed via the SSRQ. Students reported going to sleep at 10:30pm on weekdays and 12:30am on weekends, and waking up at 6:40am on weekdays and 10:30am on weekends.

Students were, on average, not depressed (BDI mean = 8.11, sd = 8.06). Notably, 19% of students had BDI scores above 14, which is the cutoff for mild depression. Additionally, 9.6% had scores above 20 (moderate depression) and 2.3% had scores above 29 (severe depression). As expected, most students had neutral chronotypes on the MEQ (m = 45.08, sd = 7.84). However, unlike the general population, 33.4% of students were classified as evening types (with MEQ<41) and only 4.5% were classified as morning types (MEQ scores>59). Students reported to have generally neutral to positive mood (m = 6.64, sd = 1.32) on a 10-point mood scale.

Hypothesis 1 was not confirmed. There were no significant correlations between the SSRQ change score and any other measures of interest. The change itself, however, was significant. Students showed less regular sleep schedules in college than high school ($t = 14.72$, $p<.001$) and during the summer than in high school ($t = 12.52$, $p<.001$).

Hypothesis 2 was partially confirmed. Using a mixed level model, the best fit for the data (that is, the one with the lowest -2 Log Likelihood and the best predictive power) was with sleep predicting mood over time. Neither MEQ scores nor the use of either reappraisal or suppression contributed significantly to the model. Sleep significantly predicted mood, $F(1, 314.5) = 16.03$, $p < .001$. Additionally, the intercept (that is, mood on the first day) significantly predicted future mood, $F(1, 323.62 = 66.34$, $p < .001)$. The interaction term was not significant. Additionally, intercepts varied significantly across participants, Var (u) = 1.33, $p < .001$, as did slopes, Var (u) = .02, $p < .001$. The two did not significantly covary.

Hypothesis 3 was partially confirmed. The composite variability score was significantly correlated with lower average daily mood ($r= -0.13$, $p<.05$). The use of reappraisal was significantly correlated with better average daily mood ($r = 0.33$, $p<.001$). However, the interaction of the two was not significant, suggesting that moderation was not occurring. Additionally, morningness significantly predicted better daily mood ($R^2 = 0.04$, $p<.01$), but the effect of the interaction between MEQ score and the composite variability score was not significant (R^2change=.05, p=.07). Surprisingly, the composite variability score was correlated with more average daily sleep ($r = 0.12$, $p < .05$).

Hypothesis 4 was confirmed. Greater schedule regularity (that is, less schedule variability) was significantly correlated with greater use of reappraisal ($r = 0.18$, $p<.01$), morningness ($r = 0.28$, $p<.001$), better grades ($r = 0.25$, p,.001), less sleep disturbance ($r = -.22$, $p<.001$), and better daily mood ($r = 0.21$, $p<.001$). SSRQ scores were not correlated with use of suppression as an emotion regulation strategy or with sleep amounts. A hierarchical multiple regression was performed to explore combined effects of these correlations. The first block included relevant sleep variables (morningness-eveningness and level of sleep disturbance), the

second contained variables related to mood (daily mood and use of reappraisal), and the last contained grades. Greater regularity was significantly predicted by the entire model (R^2=.15, p<.001).

Additionally, exploratory analyses were performed to look at the relationship of depression and mood, sleep, emotion regulation strategies, GPA, and MEQ scores. Depression is correlated with more variability on the SSRQ (r = -0.17, p<.01), poorer grades (r = -0.15, p<.01), less use of reappraisal (r = -0.34, p<.001), eveningness (r = -0.12, p<.05), poorer mood (r = -0.35, p<.001), greater sleep disturbance (r = .4, p<.001), and greater use of suppression (r = 0.18, p<.01).

The use of adaptive emotion regulation strategies, in addition to the results reported above, was correlated with less variability (r = .20, p < .001), better grades (r = .13, p < .05), morningness (r = .12, p < .05), less sleep disturbance (r = -.19, p<.001), and better mood (r = .33, p <.001).

Greater sleep disturbance (as measured by the PSQI) was correlated with worse mood (r = .25, p<.001), greater use of suppression (r = .14, p<.01), less daily sleep (r = -.15, p<.01), and worse grades (r = -.21, p<.001).

A hierarchical multiple regression was performed to examine the relationship between GPA and other variables. The first block contained sleep variables (schedule variability, sleep disturbance, and morningness-eveningness) and the second included mood variables (depression, daily mood, and use of reappraisal). GPA was significantly predicted by the entire model (R^2=.11, p<.001).

Finally, in addition to the above results, morningness was correlated with less schedule variability ($r = .28$, $p < .001$), better grades ($r = .22$, $p < .001$), less sleep disturbance ($r = -.21$, $p<.001$), and better mood ($r = .19$, $p < .001$). A hierarchical multiple regression was performed to examine the effects of these correlations. The first block contained sleep variables (schedule variability and sleep disturbance), the second included mood variables (depression, daily mood, and use of reappraisal), and the third contained GPA. Morningness was significantly predicted by the entire model (R^2=.13, $p<.001$).

Relevant tables and figures are included in appendix B.

DISCUSSION

The goal of the study was to examine the effects of changes in sleep schedule regularity and variability in the transition from high school to college. Additional goals were to look at possible contributions of morningness-eveningness, depression, and emotion regulation strategies to those effects. Daily effects of sleep on mood were also examined. While students had significantly more variable schedules in college than in high school, this change did not correlate with or predict any measures of interest, including sleep quality, grades, and mood. Higher variability over the week was correlated with lower daily mood. Surprisingly, it was correlated with more daily sleep, and unrelated to morningness and eveningness. It was not related to adaptive emotion regulation (reappraisal) or to maladaptive emotion regulation (suppression). Greater schedule regularity (that is, lower variability) reported at baseline was correlated with morningness, average daily mood, GPA, and use of reappraisal, and was uncorrelated with suppression or average daily sleep time. Amount of sleep each night predicted mood the next day, but no baseline factors contributed significantly to the model.

Students in the study got, on average, over 7.5 hours of sleep per night, a number higher than that reported in the literature. Despite that, a sizeable percentage (about 54%) had PSQI scores over 5, which is the cutoff for some clinically significant disturbance. The latter number is consistent with previous findings (Lund et al, 2010, for example), but it surprising that students experienced such a high level of sleep disturbance despite getting a seemingly-adequate amount of sleep. It is possible, consistent with study hypotheses, that the high variability in their schedule contributed to their sleep disturbance. However, it is important to note that clinical samples (that is, individuals presenting to sleep clinics for treatment) tend to have PSQI scores above 10. Additionally, a surprisingly large number of students (about 33%) were classified as

evening types, with scores less than 41 on the MEQ. This is a much larger percentage than what is usually found in the literature, even in other college samples (for reference, Merikanto et al (2012) report 4.9% of their sample to be evening types). This may be due to the fact that students have a more variable schedule than the general population, and as others have reported (Gau et al, 2007; Garcia et al, 1999; Randler, 2008), variability and eveningness are correlated. The amount of evening types may explain the high levels of sleep disturbance. It's possible that students who feel that they "should" go to bed at a particular time have a harder time falling asleep, thus contributing to higher PSQI scores. Finally, despite the surprising proportions of morning and evening types, the current study replicated previous findings of the correlates of those chronotypes. Eveningness, on the whole, was associated with more negative outcomes such as greater current and overall variability, lower GPAs, and lower daily mood (though not, surprisingly, with less sleep).

Although it was hypothesized that a greater degree of change would be associated with worse functioning in college, this was not confirmed by the study. However, greater overall variability was associated with lower GPA and less use of reappraisal, an adaptive emotion regulation strategy. Taken together, these findings suggest that one does not get used to a variable sleep schedule – students who were highly variable in high school and remained variable in college did not do better in college than those who were more regular in high school and became more variable in college. As expected, variability scores were highly correlated with each other over time, perhaps suggesting that a tendency towards regularity or variability is, to some degree, specific to the individual. Additionally, variability measures (past and current) were all correlated with eveningness. Given what is known about the effects of eveningness on variability and vice-versa, this is not surprising. However, it is unclear if eveningness as a trait

caused greater variability, or if schedule irregularity shifted students toward a more evening preference. Finally, current variability measured over the week was correlated with a lower average daily mood. This is consistent with the literature. Unfortunately, the causal direction cannot be determined with the current study, and may be a promising line of future research.

Surprisingly, current variability was correlated with increased sleep times, which is not typically found in the literature. While the effect size was small, it was statistically significant. It is possible that students with greater variability got more sleep on weekends, which may have brought up their average sleep times. It would be helpful in future studies to specifically assess weekend and weekday sleep times. While the current study collected data for a week, we did not keep track of which day each data point fell on.

As expected, sleep during one night predicted mood the next day. Although mood predicted sleep the next night, the model did not fit the data as well, suggesting that the effects were driven by sleep. Additionally, mood on one day predicted mood the next, even when taking sleep into account. Neither emotion regulation strategies nor morning or evening tendencies significantly contributed to the model. Finally, mood and the slope with which it changed varied significantly across individuals, suggesting that intra-individual variability is an important component of the model. However, mood stayed relatively stable in the study and slope changes were small. Although they were significant, interpretations should be made cautiously.

Although the SSRQ, a questionnaire created for this study, had good reliability, it appeared to be measuring something different than the variability measured by the daily sleep diaries. The composite variability score, calculated from daily variables (total sleep time, bed

time, and wake time) was not correlated with either the average variability over time or the current self-perceived variability measured by the SSRQ. Daily data were collected over 7 days with the assumption that a week would accurately capture typical variability, but perhaps the responders were thinking of different time scales when responding to the SSRQ. It is also possible that daily data were inaccurate or not representative of typical sleep patterns, but since students answered at different times in the semester, it seems an unlikely explanation.

As expected, adaptive emotion regulation was related to a more regular sleep schedule, current GPA, morningness, and daily mood, though it was not related to average daily sleep. The current study did not look at causal relationships between these variables, hence it is not possible to make interpretations about the direction of the relationship. However, given the research looking at sleepiness and emotion regulation, as well as schedule variability and sleepiness, it would be interesting in a future study to examine possible changes in emotion regulation strategies following a change in sleep patterns.

Finally, the current study confirmed previous findings from the literature related to depression and sleep, mood, and academic function. Greater regularity (that is, lower variability) on the SSRQ was negatively correlated with depression severity, though the day-to-day variability reported in sleep diaries was unrelated to depression. Depression was also negatively correlated with GPA, mood, MEQ scores (indicating that evening types were more likely to have higher depression scores), and use of reappraisal. Interestingly, depression was not related to average daily sleep, unlike other findings in the literature. However, the students in the study were, by and large, not depressed, which limits the interpretations that are able to be made.

Limitations of the Current Study

The current study had a number of limitations, with the primary one being that all measures were self-report. Although less burdensome on participants, self-report measures are subject to memory difficulties as well as biased reporting of past events. While most diaries were filled out within an hour of awakening, some had significant delays, potentially resulting in less accurate reporting. There is also a well-documented disconnect between objective measures of sleep such as actigraphy or polysomnography and subjective measures, such as sleep diaries. It is not always obvious which measures are more useful, since people with subjective sleep disturbance may suffer despite the lack of an objectively-documented sleep problem. However, having both objective and subjective measures would provide additional information. Additionally, it is unclear how well scores on measures of emotion regulation correlate with actual use of emotion regulation strategies. Hence, although it is useful to inquire about general emotion regulation approaches, the data do not allow us to make conclusions about student functioning in this arena.

An additional limitation of the study was that sleep measures were not collected in high school, but instead were asked in a retrospective questionnaire given in college. As above, this may lead to biased reporting. In addition to general difficulty remembering one's sleep schedule several months prior to the study, students may be influenced by current functioning and be more likely to view past functioning as similar, whether it was or not. One mitigating factor is that data were collected during both the first and second semester of college. Students' ratings of their sleep in high school and during the summer before college did not differ by semester of data collection, indicating that time, at least, was not a factor in reporting.

The main analyses performed in the study were correlations. Due to the exploratory nature of the study, Bonferroni corrections were not applied so as not to mistakenly eliminate potentially interesting significant effects. However, this increases the likelihood of illusory correlations. Hence, future studies in the area should apply more stringent criteria and perform more targeted analyses.

Finally, the current study was administered online. Although this is beneficial in terms of participant burden, it is can be problematic with regards to data quality. It was not possible to ask participants to clarify answers on particular questions, and it was easy for participants to answer in an automatic manner. Data that appeared to be entered in a non-genuine manner (such as putting 5pm for all questions about bed and wake times) were not included in the analyses, leading to some data loss.

Future Directions

There are a number of promising options for future research. First, it would be helpful to follow students from high school to college in order to assess their sleep in real-time during the transition. This would allow for more precise assessment of high-school sleep, unbiased by college perception. Additionally, such research would allow for assessment of beliefs and attitudes about sleep and whether these change as students become more independent. To date, only one study (Doane et al, 2014) has measured adolescent sleep both in high school and in college, and unfortunately, they did not look at variability. Additionally, future studies should assess sleep with both objective and subjective measures to allow for direct comparison as was done in the Doane et al (2014) study. Polysomnography may not be feasible for lengthy data collection, but actigraphy would provide a good additional measure. This would allow for less

biased sleep measures, as well as an additional comparison between the objective and subjective measures of sleep quality and variability.

The current study was not designed to answer questions about causal relationships. The combination of correlational analyses and a single point of measurement do not allow us to draw those conclusions. It would be useful, then, to look at causal pathways. An intervention targeting sleep variability (perhaps during the summer before college, as well as during the first semester) could help clarify matters. Specifically, it would be helpful to see if adopting a more regular schedule would increase mood, as well as promote the use of more adaptive emotion regulation strategies. Similarly, it would help to find out the effects of a more regular schedule on GPA, as well as test grades during the semester. Additionally, it would be useful to explore different types of interventions. College students do not find it easy to change their schedules, thus it would be helpful to investigate which interventions would be most acceptable and have lowest drop-out rates.

Finally, continuing on the work of Tavernier and Willoughby (2014), it would be useful to examine different subtypes of morning and evening types and how they are affected by schedule variability. The limited evidence available suggests that some evening types don't suffer the same negative consequences as the rest, but there is nothing about schedule variability specifically. Having this knowledge could help with the development of more targeted interventions, allowing customization in approaching individual difficulties.

APPENDIX A: MEASURES

Pre-screening questionnaire

Pre-Screening Survey

1. How old are you today? ___

2. Are you a freshman in college?

No ___

Yes ___

a) If Yes, did you take time off between high school and college, besides summer break? No ___ Yes ___

b) If Yes, where do you currently live?

With parents_____ In dorms_____ Off-campus but not with parents_____

3. Have you been diagnosed with a sleep problem?

No ___

Yes ___

a) If Yes, what is the sleep problem you have?

_____

b) Are you being treated for the sleep problem? No ___ Yes ___

4. What time do you normally go to bed? ____

5. What time do you normally wake up? ____

6. Do you currently have physical health problems (e.g., heart problems, arthritis, anemia)?

No ___

Yes ___

a) If Yes, what physical health problems do you currently have?

b) Are you being treated for the disorder? No ___ Yes ___

c) What is the kind of treatment you are currently receiving (e.g., medication, physiotherapy)?

7. Have you ever had a seizure?

No ___

Yes ___

8. Have you ever been diagnosed with epilepsy?

No ___

Yes ___

9. Have you ever had a traumatic brain injury or other brain damage?

No ___

Yes ___

10. Have you ever been diagnosed with a psychological or psychiatric disorder (like depression, anxiety, schizophrenia)?

No ___

Yes ___

a) If Yes, what was the disorder? _____

b) When were you diagnosed with it?

c) Have you ever been treated for the disorder? No ___ Yes ___

d) What was the kind of treatment you received (e.g., medication, therapy session)?

_____

11. What medications do you take regularly?

Name of medication	Is it prescribed (P) or Over the Counter (OTC)?	Dosage (how may mg or tablet?)	Frequency (how many times per day?)	Purpose (what are you taking it for)

12. Do you smoke?

No ___

Yes ___

a) If Yes, on average, how many cigarettes or packs of cigarettes do you smoke per day?

___ _____ (cigarettes) OR _____ (packs of cigarettes)

13. Do you drink caffeinated beverages (e.g., coffee, tea, coke)?

No ___

Yes ___

a) If Yes, on average, how many cups of caffeinated beverages do you drink per day?_____

b) On an average day, when do you have your last caffeinated beverage?

_____am/pm

14. Do you use recreational drugs (e.g. cocaine, marijuana)?

No ___

Yes ___

15. Are you currently pregnant?

No _____

Yes _____

16. What is your current GPA? (if you don't have an official one, please estimate based on exams you've had)

Name _____

Email address _____

Phone Number_____

BDI-II

Date:

Name: _____ Marital Status: _____ Age: _____ Sex: _____

Occupation: _____ Education: _____

Instructions: This questionnaire consists of 21 groups of statements. Please read each group of statements carefully, and then pick out the **one statement** in each group that best describes the way you have been feeling during the **past two weeks, including today**. Circle the number beside the statement you have picked. If several statements in the group seem to apply equally well, circle the highest number for that group. Be sure that you do not choose more than one statement for any group, including Item 16 (Changes in Sleeping Pattern) or Item 18 (Changes in Appetite).

1. Sadness
0 I do not feel sad.
1 I feel sad much of the time.
2 I am sad all the time.
3 I am so sad or unhappy that I can't stand it.

2. Pessimism
0 I am not discouraged about my future.
1 I feel more discouraged about my future than I used to be.
2 I do not expect things to work out for me.
3 I feel my future is hopeless and will only get worse.

3. Past Failure
0 I do not feel like a failure.
1 I have failed more than I should have.
2 As I look back, I see a lot of failures.
3 I feel I am a total failure as a person.

4. Loss of Pleasure
0 I get as much pleasure as I ever did from the things I enjoy.
1 I don't enjoy things as much as I used to.
2 I get very little pleasure from the things I used to enjoy.
3 I can't get any pleasure from the things I used to enjoy.

5. Guilty Feelings
0 I don't feel particularly guilty.
1 I feel guilty over many things I have done or should have done.
2 I feel quite guilty most of the time.
3 I feel guilty all of the time.

6. Punishment Feelings
0 I don't feel I am being punished.
1 I feel I may be punished.
2 I expect to be punished.
3 I feel I am being punished.

7. Self-Dislike
0 I feel the same about myself as ever.
1 I have lost confidence in myself.
2 I am disappointed in myself.
3 I dislike myself.

8. Self-Criticalness
0 I don't criticize or blame myself more than usual.
1 I am more critical of myself than I used to be.
2 I criticize myself for all of my faults.
3 I blame myself for everything bad that happens.

9. Suicidal Thoughts or Wishes
0 I don't have any thoughts of killing myself.
1 I have thoughts of killing myself, but I would not carry them out.
2 I would like to kill myself.
3 I would kill myself if I had the chance.

10. Crying
0 I don't cry anymore than I used to.
1 I cry more than I used to.
2 I cry over every little thing.
3 I feel like crying, but I can't.

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_____ Subtotal Page 1

Continued on Back

11. Agitation

0 I am no more restless or wound up than usual.

1 I feel more restless or wound up than usual.

2 I am so restless or agitated that it's hard to stay still.

3 I am so restless or agitated that I have to keep moving or doing something.

12. Loss of Interest

0 I have not lost interest in other people or activities.

1 I am less interested in other people or things than before.

2 I have lost most of my interest in other people or things.

3 It's hard to get interested in anything.

13. Indecisiveness

0 I make decisions about as well as ever.

1 I find it more difficult to make decisions than usual.

2 I have much greater difficulty in making decisions than I used to.

3 I have trouble making any decisions.

14. Worthlessness

0 I do not feel I am worthless.

1 I don't consider myself as worthwhile and useful as I used to.

2 I feel more worthless as compared to other people.

3 I feel utterly worthless.

15. Loss of Energy

0 I have as much energy as ever.

1 I have less energy than I used to have.

2 I don't have enough energy to do very much.

3 I don't have enough energy to do anything.

16. Changes in Sleeping Pattern

0 I have not experienced any change in my sleeping pattern.

1a I sleep somewhat more than usual.

1b I sleep somewhat less than usual.

2a I sleep a lot more than usual.

2b I sleep a lot less than usual.

3a I sleep most of the day.

3b I wake up 1–2 hours early and can't get back to sleep.

17. Irritability

0 I am no more irritable than usual.

1 I am more irritable than usual.

2 I am much more irritable than usual.

3 I am irritable all the time.

18. Changes in Appetite

0 I have not experienced any change in my appetite.

1a My appetite is somewhat less than usual.

1b My appetite is somewhat greater than usual.

2a My appetite is much less than before.

2b My appetite is much greater than usual.

3a I have no appetite at all.

3b I crave food all the time.

19. Concentration Difficulty

0 I can concentrate as well as ever.

1 I can't concentrate as well as usual.

2 It's hard to keep my mind on anything for very long.

3 I find I can't concentrate on anything.

20. Tiredness or Fatigue

0 I am no more tired or fatigued than usual.

1 I get more tired or fatigued more easily than usual.

2 I am too tired or fatigued to do a lot of the things I used to do.

3 I am too tired or fatigued to do most of the things I used to do.

21. Loss of Interest in Sex

0 I have not noticed any recent change in my interest in sex.

1 I am less interested in sex than I used to be.

2 I am much less interested in sex now.

3 I have lost interest in sex completely.

3 4 5 6 7 8 9 10 11 12 A B C D E

_____ Subtotal Page 2

_____ Subtotal Page 1

_____ Total Score

MORNINGNESS-EVENINGNESS QUESTIONNAIRE
(MEQ)

For each question, please select the answer that best describes you by circling the point value that best indicates how you have felt in recent weeks.

1. *Approximately* what time would you get up if you were entirely free to plan your day?
[5] 5:00 AM–6:30 AM *(05:00–06:30 h)*
[4] 6:30 AM–7:45 AM *(06:30–07:45 h)*
[3] 7:45 AM–9:45 AM *(07:45–09:45 h)*
[2] 9:45 AM–11:00 AM *(09:45–11:00 h)*
[1] 11:00 AM–12 noon *(11:00–12:00 h)*

2. *Approximately* what time would you go to bed if you were entirely free to plan your evening?
[5] 8:00 PM–9:00 PM *(20:00–21:00 h)*
[4] 9:00 PM–10:15 PM *(21:00–22:15 h)*
[3] 10:15 PM–12:30 AM *(22:15–00:30 h)*
[2] 12:30 AM–1:45 AM *(00:30–01:45 h)*
[1] 1:45 AM–3:00 AM *(01:45–03:00 h)*

3. If you usually have to get up at a specific time in the morning, how much do you depend on an alarm clock?
[4] Not at all
[3] Slightly
[2] Somewhat
[1] Very much

4. How easy do you find it to get up in the morning (when you are not awakened unexpectedly)?
[1] Very difficult
[2] Somewhat difficult
[3] Fairly easy
[4] Very easy

5. How alert do you feel during the first half hour after you wake up in the morning?
[1] Not at all alert
[2] Slightly alert
[3] Fairly alert
[4] Very alert

6. How hungry do you feel during the first half hour after you wake up?
[1] Not at all hungry
[2] Slightly hungry
[3] Fairly hungry
[4] Very hungry

7. During the first half hour after you wake up in the morning, how do you feel?
[1] Very tired
[2] Fairly tired
[3] Fairly refreshed
[4] Very refreshed

8. If you had no commitments the next day, what time would you go to bed compared to your usual bedtime?
[4] Seldom or never later
[3] Less that 1 hour later
[2] 1-2 hours later
[1] More than 2 hours later

9. You have decided to do physical exercise. A friend suggests that you do this for one hour twice a week, and the best time for him is between 7-8 AM *(07-08 h).* Bearing in mind nothing but your own internal "clock," how do you think you would perform?
[4] Would be in good form
[3] Would be in reasonable form
[2] Would find it difficult
[1] Would find it very difficult

10. At *approximately* what time in the evening do you feel tired, and, as a result, in need of sleep?
[5] 8:00 PM–9:00 PM *(20:00–21:00 h)*
[4] 9:00 PM–10:15 PM *(21:00–22:15 h)*
[3] 10:15 PM–12:45 AM *(22:15–00:45 h)*
[2] 12:45 AM–2:00 AM *(00:45–02:00 h)*
[1] 2:00 AM–3:00 AM *(02:00–03:00 h)*

11. You want to be at your peak performance for a test that you know is going to be mentally exhausting and will last two hours. You are entirely free to plan your day. Considering only your "internal clock," which one of the four testing times would you choose?
[6] 8 AM–10 AM *(08–10 h)*
[4] 11 AM–1 PM *(11–13 h)*
[2] 3 PM–5 PM *(15–17 h)*
[0] 7 PM–9 PM *(19–21 h)*

12. If you got into bed at 11 PM *(23 h),* how tired would you be?
[0] Not at all tired
[2] A little tired
[3] Fairly tired
[5] Very tired

13. For some reason you have gone to bed several hours later than usual, but there is no need to get up at any particular time the next morning. Which one of the following are you most likely to do?
[4] Will wake up at usual time, but will not fall back asleep
[3] Will wake up at usual time and will doze thereafter
[2] Will wake up at usual time, but will fall asleep again
[1] Will not wake up until later than usual

14. One night you have to remain awake between 4-6 AM *(04-06 h)* in order to carry out a night watch. You have no time commitments the next day. Which one of the alternatives would suit you best?
[1] Would not go to bed until the watch is over
[2] Would take a nap before and sleep after
[3] Would take a good sleep before and nap after
[4] Would sleep only before the watch

15. You have two hours of hard physical work. You are entirely free to plan your day. Considering only your internal "clock," which of the following times would you choose?
[4] 8 AM–10 AM *(08–10 h)*
[3] 11 AM–1 PM *(11–13 h)*
[2] 3 PM–5 PM *(15–17 h)*
[1] 7 PM–9 PM *(19–21 h)*

16. You have decided to do physical exercise. A friend suggests that you do this for one hour twice a week. The best time for her is between 10-11 PM *(22-23 h)*. Bearing in mind only your internal "clock," how well do you think you would perform?
[1] Would be in good form
[2] Would be in reasonable form
[3] Would find it difficult
[4] Would find it very difficult

17. Suppose you can choose your own work hours. Assume that you work a five-hour day (including breaks), your job is interesting, and you are paid based on your performance. At *approximately* what time would you choose to begin?
[5] 5 hours starting between 4–8 AM *(05–08 h)*
[4] 5 hours starting between 8–9 AM *(08–09 h)*
[3] 5 hours starting between 9 AM–2 PM *(09–14 h)*
[2] 5 hours starting between 2–5 PM *(14–17 h)*
[1] 5 hours starting between 5 PM–4 AM *(17–04 h)*

18. At *approximately* what time of day do you usually feel your best?
[5] 5–8 AM *(05–08 h)*
[4] 8–10 AM *(08–10 h)*
[3] 10 AM–5 PM *(10–17 h)*
[2] 5–10 PM *(17–22 h)*
[1] 10 PM–5 AM *(22–05 h)*

19. One hears about “morning types” and “evening types.” Which one of these types do you consider yourself to be?
[6] Definitely a morning type
[4] Rather more a morning type than an evening type
[2] Rather more an evening type than a morning type
[1] Definitely an evening type

_____ Total points for all 19 questions

Stanford Sleepiness Scale

This is a quick way to assess how alert you are feeling. If it is during the day when you go about your business, ideally you would want a rating of a one. Take into account that most people have two peak times of alertness daily, at about 9 a.m. and 9 p.m. Alertness wanes to its lowest point at around 3 p.m.; after that it begins to build again. Rate your alertness right now.

An Introspective Measure of Sleepiness
The Stanford Sleepiness Scale (SSS)

Degree of Sleepiness	**Scale Rating**
Feeling active, vital, alert, or wide awake	1
Functioning at high levels, but not at peak; able to concentrate	2
Awake, but relaxed; responsive but not fully alert	3
Somewhat foggy, let down	4
Foggy; losing interest in remaining awake; slowed down	5
Sleepy, woozy, fighting sleep; prefer to lie down	6
No longer fighting sleep, sleep onset soon; having dream-like thoughts	7
Asleep	X

What time is it right now? _____

Emotion Regulation Questionnaire (ERQ)

Instructions and Items

We would like to ask you some questions about your emotional life, in particular, how you control (that is, regulate and manage) your emotions. The questions below involve two distinct aspects of your emotional life. One is your emotional experience, or what you feel like inside. The other is your emotional expression, or how you show your emotions in the way you talk, gesture, or behave. Although some of the following questions may seem similar to one another, they differ in important ways. For each item, please answer using the following scale:

1----------2----------3----------4----------5----------6----------7

strongly disagree **neutral** **strongly agree**

1. ____ When I want to feel more *positive* emotion (such as joy or amusement), I *change what I'm thinking about*.
2. ____ I keep my emotions to myself.
3. ____ When I want to feel less *negative* emotion (such as sadness or anger), I *change what I'm thinking about*.
4. ____ When I am feeling *positive* emotions, I am careful not to express them.
5. ____ When I'm faced with a stressful situation, I make myself *think about it* in a way that helps me stay calm.
6. ____ I control my emotions by *not expressing them*.
7. ____ When I want to feel more *positive* emotion, I *change the way I'm thinking* about the situation.
8. ____ I control my emotions by *changing the way I think* about the situation I'm in.
9. ____ When I am feeling *negative* emotions, I make sure not to express them.
10. ____ When I want to feel less *negative* emotion, I *change the way I'm thinking* about the situation.

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 Less than Once or twice Three or more
past month_____ once a week_____ a week_____ 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_____

Sleep schedule regularity questionnaire

1. **On weekdays**, I go to bed and wake up at approximately the same time every day 1 2 3 4 5
2. **On weekends**, I go to bed and wake up at approximately the same time every day 1 2 3 4 5
3. Overall, my sleep schedule is regular (I wake up and go to bed at approximately the same time every day on both weekends and weekdays)

   1 2 3 4 5
4. I'm usually woken up by my parents or another person True False
5. I get approximately _____ hours of sleep per night on **weekdays**
6. I get approximately _____ hours of sleep per night on **weekends**
7. **Last semester**, I went to bed and woke up at approximately the same time every **weekday** 1 2 3 4 5
8. **Last semester**, I went to bed and woke up at approximately the same time every **weekend day** 1 2 3 4 5
9. **Last semester**, my sleep schedule was regular (I woke up and went to bed at approximately the same time every day on both weekends and weekdays)

   1 2 3 4 5
10. **Last semester**, I was usually woken up by my parents or another person True False
11. **Last semester**, I got approximately _____ hours of sleep per night on **weekdays**
12. **Last semester**, I got approximately _____ hours of sleep per night on **weekends**
13. When I was in high school, I went to bed and woke up at approximately the same time every **weekday** 1 2 3 4 5

14. **When** I was in high school, I went to bed and woke up at approximately the same time every **weekend day** 1 2 3 4 5

15. **When** I was in high school, my sleep schedule was regular (I woke up and went to bed at approximately the same time every day on both weekends and weekdays)

1 2 3 4 5

16. **When** I was in high school, I was usually woken up by my parents or another person

True False

17. **When** I was in high school, I got approximately _____ hours of sleep per night on **weekdays**

18. **When** I was in high school, I got approximately _____ hours of sleep per night on **weekends**

19. **During the summer**, I went to bed and woke up at approximately the same time every **weekday** 1 2 3 4 5

20. **During the summer**, I went to bed and woke up at approximately the same time every **weekend day** 1 2 3 4 5

21. **During the summer**, my sleep schedule was regular (I woke up and went to bed at approximately the same time every day on both weekends and weekdays) 1 2 3 4 5

22. **During the summer**, I was usually woken up by my parents or another person

True False

23. **During the summer**, I got approximately _____ hours of sleep per night on **weekdays**

24. **During the summer**, I got approximately _____ hours of sleep per night on **weekends**

Daily Sleep Diary

Please complete each morning when you wake up:

Provide month and date under each day of the week:	**Mon**	**Tues**	**Wed**	**Thurs**	**Fri**	**Sat**	**Sun**
1. What time did your turn off the light intending to go to sleep?							
2. How long did it take you to fall asleep? in minutes)							
3. What time did you wake up in the morning?							
4. What time did you get out of bed?							
5. How many times did you wake up during the night?							
6. Estimate the total amount of time you spent awake during the night (minutes)							
7. Overall, how much sleep did you get? (hours)							
8. Rate how refreshed you feel now: 1= very sleepy….10= not sleepy							
9. How long did you nap yesterday?							
10. Rate the quality of your sleep last night? 1= poor…10 = excellent							
11. What is your mood like right now? 1= poor…10 = excellent							
12. What was your mood like yesterday? 1= poor…10 = excellent							
13. How many caffeinated beverages did you consume yesterday?							
14. How many alcoholic beverages did you consume yesterday?							

APPENDIX B: TABLES AND FIGURES

	Descriptive Statistics -- College				
	Minimum	Maximum	Mean	Median	Std. Deviation
Age	17	23	18.41	18.00	.67
Sleep (minutes)	309.57	713.29	459.51	460.00	61.34
Bed time	21:50	04:30	12:50	12:47	73min
Wake time	5:45	13:10	8:58	8:57	80min
SSRQ	3.00	15.00	9.06	9.00	2.24
Variability z score	-.49	5.35	-.003	-.20	.62
Variability change score	-6.00	12.00	2.5659	3.00	3.18990
MEQ	25	64	45.08	45.00	7.84
PSQI	1.00	17.00	6.22	6.00	2.94
BDI	0	42	8.11	6.00	8.06
Mood	3.00	10.00	6.64	6.57	1.32
Reappraisal	8.00	42.00	28.12	28.00	6.57
Suppression	4.00	27.00	14.85	15.00	4.76
GPA	.65	4.00	3.12	3.20	.59

Table 1: Descriptive statistics for baseline variables (in college), N=312 for all measures

	Descriptive Statistics – High School				
	Minimum	Maximum	Mean	Median	Std. Deviation
High school weekday wake time	5:00	8:00	6:41	6:30	1:22
High school weekday bed time	21:00	3:00	22:44	22:00	2:40
High school weekend wake time	6:00	11:00	10:28	10:00	2:32
High school weekend bed time	21:22	13:00	00:32	1:00	2:33
High school regularity score	1	5	3.44	3	1.31

Table 2: Descriptive statistics for sleep in high school, reported on the SSRQ

Multi-Level Model, Sleep Predicting Mood

Type III Tests of Fixed Effects

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	323.583	66.487	.000
time	1	1765.643	3.053	.081
sleep_mean	1	314.484	15.977	.000
sleep_cent	1	232.553	148.381	.000

Estimates of Fixed Effects

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	4.564149	.559748	323.583	8.154	.000	3.462944	5.665353
time	-.029521	.016895	1765.643	-1.747	.081	-.062658	.003615
sleep_mean	.004791	.001199	314.484	3.997	.000	.002433	.007150
sleep_cent	.005939	.000488	232.553	12.181	.000	.004979	.006900

Estimates of Covariance Parameters

Parameter		Estimate	Std. Error	Wald Z	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Residual		2.26	.08	27.896	.000	2.11	2.43
Intercept + sleep_cent	UN (1,1)	1.32	.13	9.924	.000	1.09	1.61
[subject = STUDY_ID]	UN (2,1)	--.0004	.0006	-.079	.937	-.001270	.001172
	UN (2,2)	-.02	.0005	4.498	.000	.001	.03

Tables 3, 4, and 5: Multi-level model, with sleep predicting mood

Multi-Level Model, Sleep Predicting Mood with Moderators

Type III Tests of Fixed Effects

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	959.572	4322.628	.000
time	1	1811.611	2.208	.137
sleep_cent	1	1800.988	155.992	.000
reapp_cent	0	.	.	.
supp_cent	0	.	.	.
MEQ_cent	0	.	.	.
SSRQ_cent	0	.	.	.

Estimates of Fixed Effects

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	6.753200	.102715	959.572	65.747	.000	6.551627	6.954772
time	-.026078	.017550	1811.611	-1.486	.137	-.060499	.008343
sleep_cent	.004104	.000329	1800.988	12.490	.000	.003460	.004749
reapp_cent	0	0	.	.	.	.	.
supp_cent	0	0	.	.	.	.	.
MEQ_cent	0	0	.	.	.	.	.
SSRQ_cent	0	0	.	.	.	.	.

Estimates of Covariance Parameters

Parameter		Estimate	Std. Error	Wald Z	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Residual		2.585031	.086144	30.008	.000	2.421587	2.759507
Intercept [subject = STUDY_ID]	Variance	1.363963	.140522	9.706	.000	1.114571	1.669159

Tables 6, 7, and 8: Multi-level model, with sleep predicting mood and including possible moderators

Regression Outcomes for the SSRQ

Variables Entered/Removed

Model	Variables Entered	Variables Removed	Method
1	MEQ, PSQI		Enter
2	Reappraisal, average daily mood		Enter
3	GPA		Enter

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	0.322	.104	.098	2.12738	.104	17.865	2	308	.000
2	0.358	.128	.117	2.10525	.024	4.254	2	306	.015
3	0.391	.153	.139	2.07884	.025	8.824	1	305	.003

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	6.771	.812		8.334	.000
	PSQI	-.130	.042	-.170	-3.086	.002
	MEQ	.069	.016	.241	4.375	.000
2	(Constant)	4.774	1.056		4.519	.000
	PSQI	-.099	.043	-.130	-2.312	.021
	MEQ	.062	.016	.218	3.948	.000
	Average daily mood	.185	.099	.109	1.876	.062
	Reappraisal	.031	.019	.091	1.606	.109
3	(Constant)	3.279	1.158		2.831	.005
	PSQI	-.079	.043	-.104	-1.840	.067
	MEQ	.054	.016	.189	3.412	.001
	Average daily mood	.185	.097	.109	1.902	.058
	Reappraisal	.027	.019	.079	1.397	.163
	GPA	.598	.201	.164	2.971	.003

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	161.701	2	80.851	17.865	.000[b]
	Residual	1393.926	308	4.526		
	Total	1555.628	310			
2	Regression	199.411	4	49.853	11.248	.000[c]
	Residual	1356.216	306	4.432		
	Total	1555.628	310			
3	Regression	237.544	5	47.509	10.993	.000[d]
	Residual	1318.083	305	4.322		
	Total	1555.628	310			

Tables 9, 10, 11, and 12: Regression outcomes for the SSRQ (schedule regularity)

Regression Outcomes for GPA

Variables Entered/Removed

Model	Variables Entered	Variables Removed	Method
1	SSRQ, PSQI, MEQ		Enter
2	Reappraisal, Average daily mood, BDI		Enter

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	0.325	.106	.097	.582	.106	12.099	3	307	.000
2	0.334	.112	.094	.583	.006	.698	3	304	.554

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.370	.246		9.625	.000
	PSQI	-.030	.012	-.145	-2.593	.010
	SSRQ	.049	.016	.177	3.110	.002
	MEQ	.011	.004	.141	2.472	.014
2	(Constant)	2.357	.313		7.524	.000
	PSQI	-.025	.013	-.120	-1.969	.050
	SSRQ	.048	.016	.175	3.017	.003
	MEQ	.011	.004	.140	2.435	.015
	Average daily mood	-.015	.028	-.032	-.530	.597
	Reappraisal	.005	.006	.048	.814	.416
	BDI	-.005	.005	-.062	-.975	.330

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.311	3	4.104	12.099	.000[b]
	Residual	104.122	307	.339		
	Total	116.433	310			
2	Regression	13.023	6	2.171	6.381	.000[c]
	Residual	103.410	304	.340		
	Total	116.433	310			

Tables 13, 14, 15, and 16: Regression outcomes for GPA

Regression Outcomes for the MEQ

Variables Entered/Removed

Model	Variables Entered	Variables Removed	Method
1	SSRQ, PSQI		Enter
2	Reappraisal, Average daily mood, BDI		Enter
3	GPA		Enter

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	0.314	.098	.093	7.491	.098	16.803	2	308	.000
2	0.332	.110	.095	7.479	.012	1.329	3	305	.265
3	0.356	.127	.110	7.419	.017	5.928	1	304	.015

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	39.902	2.205		18.098	.000
	PSQI	-.409	.149	-.152	-2.749	.006
	SSRQ	.852	.195	.243	4.375	.000
2	(Constant)	35.372	3.469		10.196	.000
	PSQI	-.336	.162	-.125	-2.072	.039
	SSRQ	.781	.198	.223	3.939	.000
	Average daily mood	.631	.359	.106	1.757	.080
	Reappraisal	.020	.071	.016	.276	.783
	BDI	-.004	.062	-.004	-.064	.949
3	(Constant)	30.548	3.971		7.693	.000
	PSQI	-.285	.162	-.106	-1.760	.079
	SSRQ	.682	.201	.194	3.395	.001
	Average daily mood	.646	.357	.108	1.811	.071
	Reappraisal	.011	.071	.009	.160	.873
	BDI	.004	.061	.004	.071	.943
	GPA	1.759	.723	.137	2.435	.015

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1885.801	2	942.900	16.803	.000[b]
	Residual	17283.190	308	56.114		
	Total	19168.990	310			
2	Regression	2108.779	5	421.756	7.540	.000[c]
	Residual	17060.211	305	55.935		
	Total	19168.990	310			
3	Regression	2435.116	6	405.853	7.373	.000[d]
	Residual	16733.875	304	55.046		
	Total	19168.990	310			

Tables 17, 18, 19, and 20: Regression outcomes for MEQ (morningness-eveningness)

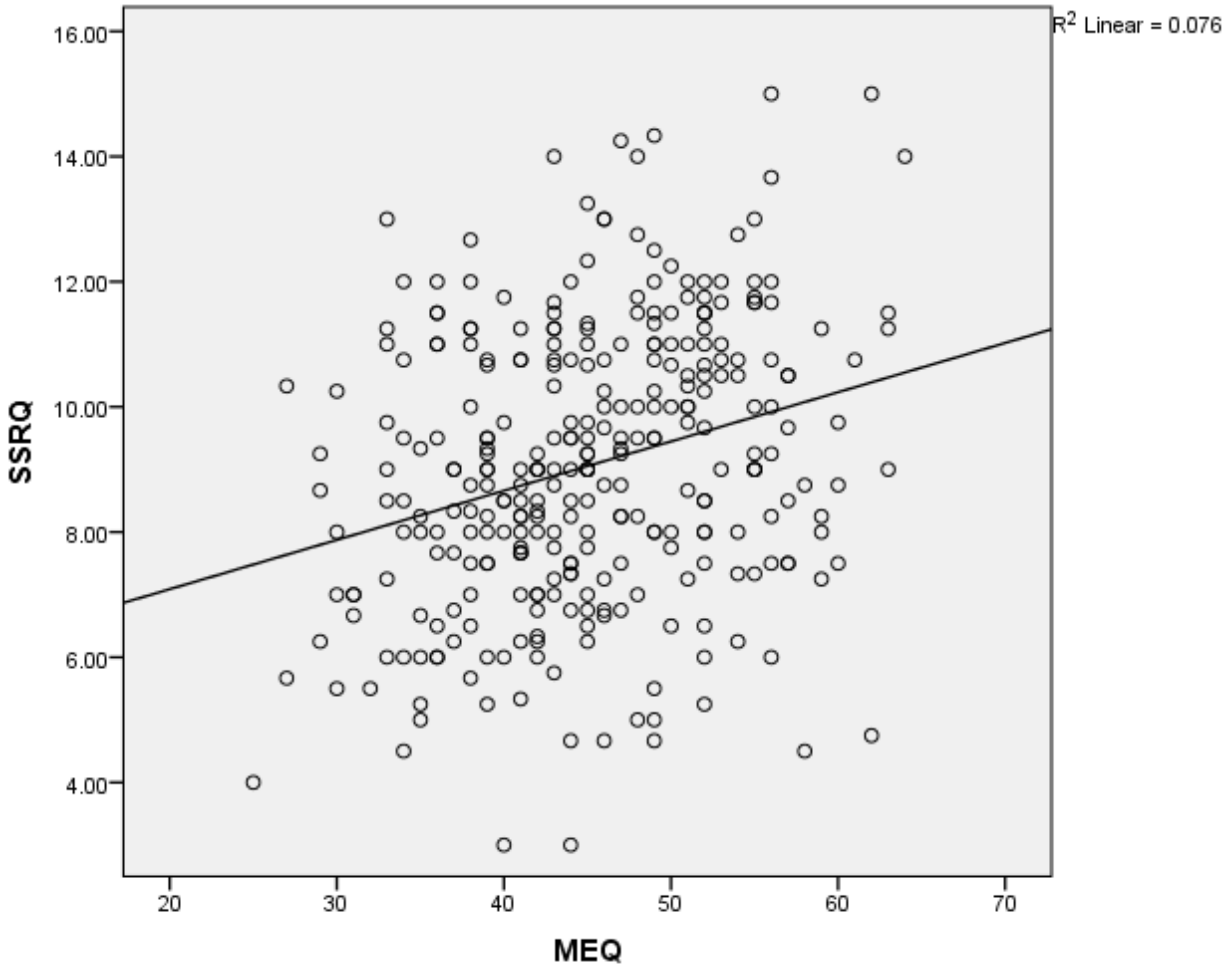

Figure 1: Relationship between Morningness-Eveningness and Variability on SSRQ

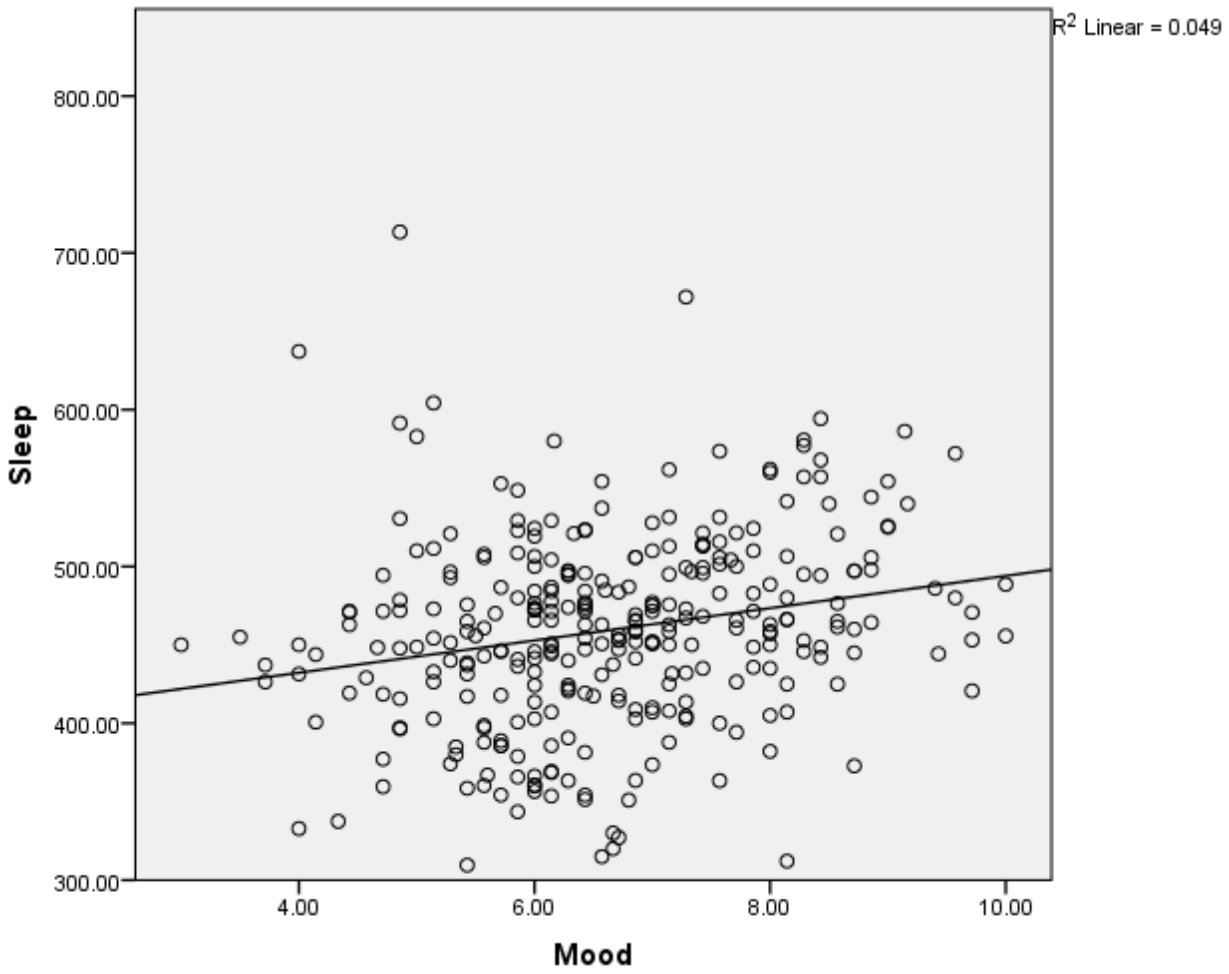

Figure 2: Relationship Between Daily Sleep (in minutes) and Mood

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