

How Did You Sleep?: Effects of an Individualized Sleep Hygiene  
Intervention Program on College Students' Sleep

By

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## Abstract

The purpose of the current study was to test an individualized sleep hygiene intervention designed by the investigator for college students experiencing poor quality sleep. The intervention was intended to assess for problem areas, teach components of sleep hygiene, and, through incorporation of components of motivational interviewing, motivate participants to change their sleep related behaviors in an effort to increase subjective sleep quality. The study's design included two treatment groups, one who received the individualized intervention and another that received only an education component, and a control group. Individuals in the individualized intervention group met once a week for four weeks with the investigator individually to discuss sleep habits and progress towards change, and completed sleep diaries each week that served as personalized feedback. Participants receiving the education component heard a 50-minute lecture on the importance of sleep and sleep hygiene. All participants completed the Pittsburgh Sleep Quality Index, Epworth Sleepiness Scale, Adolescent Sleep Hygiene Scale, and Clinical Outcomes in Routine Evaluation Outcome Measure at least twice throughout the study. The results showed few significant differences between the three groups at the end of the study, contrary to one hypothesis. However, the individual intervention group did achieve positive changes on their sleep outcomes over the course of the intervention. Additionally, when considered on a participant by participant basis, these individuals were largely successful in making progress towards their specific sleep related goals, supporting some of the hypotheses. This study marks an important first step in designing an individualized

intervention for college students to motivate behavior change and produce significant changes in their sleep habits and overall sleep quality.

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## **I. Introduction**

An extensive literature base has documented the ill effects of obtaining poor sleep, a common occurrence in today's society. Whether it be poor sleep quality, disrupted sleep, or chronic sleep deprivation, these conditions can all have negative effects on multiple important life domains, including physical health, emotional well-being, mental health, physical performance, and academic performance (Curcio, Ferrara, & De Gennaro, 2006; Dewald, Meijer, Oort, Kerkhof, & Bögels, 2010; Matricciani, Olds, & Petkoy, 2012; Wells & Vaughn, 2012; Zee & Turek, 2008). Adults are thought to need on average at least 7 to 8 hours of sleep a night, while adolescents should sleep for 8.5 to 9.5 hours, and children should sleep even longer (Carskadon, Harvey, Duke, Anders, Litt, & Dement, 1980; Ferrara & De Gennaro, 2001; Wolfson & Carskadon, 1998). Unfortunately, a cultural trend has developed in which less-than-recommended sleep is regarded as an acceptable, and in some instances even a valued, practice (Ferrara & De Gennaro, 2001; Zee & Turek, 2008). It has been estimated that Americans have decreased their average sleep time over the past century by as much as 20%, and that a state of chronic, partial sleep loss is common (Ferrara & De Gennaro, 2001; Knowlden, Sharma, & Bernard, 2012; Matricciani et al., 2012).

In their most recent national survey, the National Sleep Foundation (2014b) found that shorter sleep is more common as people age from childhood up through adolescence. Less than half of all of the children surveyed slept for 9 or more hours a night, only 29% of children 12 to 14 slept for 9 or more hours a night, and a full 90% of teenagers aged 15 to 17 slept for less than 8 hours a night (National Sleep Foundation, 2014b). Past adolescence, sleep duration appears to continue to be problematic. An astonishing 70% of college students have been found to obtain less than 8 hours of sleep a night, with a quarter indicating that they obtain less than 6.5 hours a

night (Hershner & Chervin, 2014; Knowlden et al., 2012). A large scale 2009 study of adults revealed that almost 30% of adults slept for 6 or fewer hours per night (Knowlden et al., 2012). Taken together, it is clear that Americans are not getting enough sleep.

The trend towards declining amounts of sleep has several social, biological, and environmental causes; however, in our society, sleep restriction can be viewed as primarily a voluntary process (Caldwell, Caldwell, & Schmidt, 2008; Knowlden et al., 2012; Zee & Turek, 2008). Lifestyle choices influence sleep, such as shift work, prolonging working hours, and voluntarily maintaining irregular sleep schedules (Caldwell et al., 2008; Knowlden et al., 2012; Zee & Turek, 2008). Jet lag can take a particular toll for travelers as the body's natural circadian rhythms work to become re-established in new time zones (Reilly, 2009). Some students are even thought to experience jet lag type symptoms from Sundays to Mondays after they have spent many more hours sleeping on the weekend than they do during the week, and then are forced back onto their weekday schedules early on Monday mornings (Crowley & Carskadon, 2010; Gruber, 2013; Schulke & Zimmermann, 2014). The constant use of screen media (i.e., televisions, smart phones, tablets, game systems, computers), especially close to bedtime, has been shown to impede sleep due to the light exposure that suppresses natural melatonin release (Chang, Aeschbach, Duffy, & Czeisler, 2015; Ferrara & De Gennaro, 2001; Hershner & Chervin, 2014; National Sleep Foundation, 2014b). Substance use, including alcohol, caffeine, and other stimulants, has been shown to have varied negative effects on sleep, such as fragmenting sleep, decreasing REM sleep, and decreasing subjective sleep quality (Brown, Buboltz, & Soper, 2002; Halson, 2008; Hershner & Chervin, 2014; Stepanski & Wyatt, 2003). Additionally, adolescents and young adults face a special challenge to obtaining adequate sleep, that of the post-pubertal phase delay (Gruber, 2013). This delay in normal circadian rhythms

invokes a later-in-the-evening melatonin release in adolescents, causing them to feel awake longer into the evening than children and adults and to experience a shift in their natural sleepiness time (e.g., 2 am to 12 pm rather than 10 pm to 8 am; Gruber, 2013; Marhefka, 2012). All of these factors combine to create a culture that allows for and perpetuates declines in sleep duration to an unhealthy level.

Some experts believe that the trend towards sleep restriction is not a problem, and that in fact, people only need 5 to 6 hours of sleep a night (Horne, 1991). If this were the case, then current levels of sleep would not present a problem. However, a large amount of research has accumulated to suggest otherwise, with findings pointing to problems in many areas of life as a result of inadequate sleep (Zee & Turek, 2008). For example, learning processes are closely tied to sleep (Curcio et al., 2006). Both Rapid Eye Movement (REM) sleep and slow wave sleep, two of the five sleep cycles that make up 65-80% of nightly sleep, are involved in memory encoding and consolidation (Diekelmann & Born, 2010). When individuals decrease their sleep by even just an hour or two below the recommended amount, they could end up missing out on one or more cycles of either REM or slow wave sleep, a reduction of 20-25% of these critical stages (Carskadon & Dement, 2011). For students, this decline in sleep and decrease in critical sleep stages may result in a lowered ability to learn, and subsequently worse academic performance, than students who consistently obtain a full night's sleep (Curcio et al., 2006; Trockel, Barnes, & Egget, 2000). Academic performance is also consistently predicted by daytime sleepiness, a natural consequence of not getting enough sleep (Curcio et al., 2006; Dewald et al., 2010). Taken to an extreme, when individuals have been deprived of sleep altogether, studies have shown that they are less able to perform complex cognitive tasks that require attention and focus, further

impeding learning and cognitive performance (Lim & Dinges, 2010; Pilcher & Walters, 1997; Scott, McNaughton, & Polman, 2006).

Physical health is also associated with adequate sleep. Numerous studies have demonstrated that inadequate sleep is related to a number of physical health problems, including having an unhealthy Body Mass Index (BMI), experiencing bodily pain, and having an increased risk for cardiovascular events, artery calcification, strokes, obesity, diabetes, and hypertension (Buysse, Grunstein, Horne, & Lavie, 2010; Duggan, Reynolds, Kern, & Friedman, 2014; Editorial: “Sleep and Health,” 2012; Gruber, 2013; Haack & Mullington, 2005; Wells & Vaughn, 2012; Zee & Turek, 2008). Additionally, poor sleepers are less likely to engage in healthy eating habits, such as maintaining a balanced diet and eating breakfast (Lentino, Purvis, Murphy, & Deuster, 2013). With regards to mental health, lower sleep quality and quantity are related to an increase in psychiatric disorders and psychological stressors, such as depression, anxiety, tension, fatigue, and confusion (Pilcher, Ginter, & Sadowsky, 1996; Strine & Chapman, 2005). Among college students, for whom depression is common, insomnia associated with depression also carries a risk of suicidal ideation (Gellis & Lichstein, 2009; Hershner & Chervin, 2014). Increased substance use is often a coping mechanism to deal with stress, and is also linked to poorer sleep quality (Kloss, Nash, Horsey, & Taylor, 2011). Within the college student population, alcohol use can lead to increases in negative decision making, such as driving after drinking, as well as driving both after drinking and when sleepy (Gruber, 2013; Hershner & Chervin, 2014). Additionally, sleep deprivation is also related to a decreased immune system, and sleep duration has been shown to be a major risk factor for mortality (Duggan et al., 2014; Ferrara & De Gennaro, 2001; Wells & Vaughn, 2012).

An important question to answer, considering the increasing trend towards less sleep and the mounting evidence of the problems inadequate sleep can cause, is how sleep can be improved. Researchers and practitioners have developed the concept of “sleep hygiene” as one important method of improving sleep. Sleep hygiene denotes a group of environmental factors, behavioral practices, and psychological factors that work together to promote higher quality and longer lasting sleep (Buboltz, Soper, Brown, & Jenkins, 2002; Lacks & Roterts, 1986; Hershner & Chervin, 2009; Wells & Vaughn, 2012). Environmental factors include such things as limiting noise and light in the sleeping environment and sleeping on a comfortable mattress and in a room that is at a comfortable temperature (Brown et al., 2002; Buboltz et al., 2002; Muzet, 2007). Behavioral practices encompass aspects such as maintaining a regular sleep-wake schedule, exercising and using substances at the most appropriate time of day, and decreasing the use of technology around bedtime (Brown et al., 2002; Driver & Taylor, 2000; Ferrara & De Gennaro, 2001; Hershner & Chervin, 2014). Important psychological factors to take into consideration include state of mind and mental arousal before bedtime, thought patterns while in bed, and not associating the bed with activities uncondusive to sleep (Gellis & Lichstein, 2009; Halson, 2008; Lacks & Roterts, 1986). Research has demonstrated that many poor sleepers do not practice adequate sleep hygiene and that even having knowledge about sleep hygiene is only weakly related to the actual practice of these sleep enhancing habits (Brown et al., 2002; Gellis & Lichstein, 2009).

Therefore, once armed with the knowledge of sleep hygiene practices, individuals must also be motivated to change their current sleep behavior in order to affect any lasting and positive change on sleep patterns (Aloia, Arnedt, Riggs, Hecht, & Borrelli 2004; Blunden, Chapman, & Rigney, 2012). Change, however, is a complex process (Norcross, Krebs, &

Prochaska, 2011). Recent theories of behavioral change view change as occurring in stages, from pre-contemplation of the problem all the way to maintaining the change once accomplished (Norcross et al., 2011; Prochaska & Norcross, 2002). Individuals must have the desire and motivation to work their way through these stages and to overcome the natural ambivalence about change that occurs throughout the process (Lundahl & Burke, 2009; Miller & Rollnick, 2013; Norcross et al., 2011; Rollnick & Miller, 1995). A treatment method called motivational interviewing (MI) was developed to assist individuals' advance through the change process, as well as to assess for readiness for change and increase intrinsic motivation to make changes (Miller & Rollnick, 2004; Miller & Rollnick, 2013; Rollnick & Miller, 1995). Originally designed for working with resistance to changing substance use behavior, the use of MI has expanded to working with changes in other behavioral health domains (Lundahl & Burke, 2009; Miller & Rollnick, 2013). Efficacy of MI has been demonstrated in a variety of areas and is a promising new component of treatments designed to influence sleep related factors (Aloia et al., 2004; Cain, Gradisar, & Moseley, 2011; Cassoff, Knauper, Michaelsen, & Gruber, 2013; Miller & Rollnick, 2013).

## **Rationale**

Students entering college are usually in a poor position to develop the proper sleep related habits that will allow them to be successful. As adolescents, they have learned to place sleep at the bottom of the priority list behind academics, extra-curricular activities, and socializing, and often have created a pattern of changing their sleep schedules on the weekends to sleep longer and later in the day than their high school weekday schedules allowed (Carskadon, 1990; Crowley & Carskadon, 2010; Gruber, 2013; Wolfson & Carskadon, 1998). Going to college permits these students the freedom to determine their own schedules, with sleep

once again falling low on the list of concerns behind school work, athletics, and social events (Brown et al., 2002; Marhefka, 2012). It would not be uncommon for a freshman student to be overwhelmed by the different environment and the change in demands as he or she transitions from high school to college, and to let go of important healthy behaviors such as nutrition, exercise, and sleep (Trockel et al., 2000).

Students, especially those in their first or second year of college, are not getting the sleep they need and often do not know enough about proper sleep habits to fix the problem even if they had the motivation (Hicks, Lucero-Gorman, & Bautista, 1999; Marhefka, 2012). With these facts in mind, it becomes glaringly obvious that students need to be exposed to interventions that teach them about the importance of sleep for their well-being and academic success, provide them with knowledge of proper sleep hygiene, and encourage the development of motivation to change their current behavior. All of these components together are necessary for change to occur, as individually they are not enough to make a difference. Critically, studies have shown that just learning about the importance of sleep and knowing about sleep hygiene does not change behavior (Brown et al., 2002; Moseley & Gradisar, 2009; Suen, Hon, & Tam, 2008). Rather, individuals' self-efficacy and desire to change are also important components in actually achieving the behavioral change (Cassoff et al., 2013; Miller & Rollnick, 2004; Miller & Rollnick, 2013). Motivational interviewing has become an accepted empirically supported method to incorporate into treatments involving behavioral change (Lundahl & Burke, 2009; Miller & Rollnick, 2013), and therefore becomes a welcome addition to the effort to motivate changes in sleep related practices.

## **Significance to Counseling Psychology**

This dissertation is designed to test a sleep hygiene intervention for college students, an at-risk population for inadequate sleep (Buboltz et al., 2002). The field of psychology works to affect change through prevention and direct intervention of problems affecting well-being (Chwalisz & Obasi, 2008; Danish & Forneris, 2008); the proposed design could be conceptualized as striving towards both of those goals. In its current form, the intervention looks to positively change the current (i.e., poor) sleep habits of students, thereby improving their overall health and academic performance, to name but a few benefits. To accomplish this goal, the investigator will present students with information about sleep and sleep hygiene, in the form of a classroom lecture, and then will meet individually with a few students over the course of several weeks. During these individual meetings, the investigator and participants will co-construct goals to change participant-identified sleep difficulties and monitor progress towards these goals. The investigator will utilize personalized feedback and aspects of motivational interviewing to enhance participants' motivation to change their current sleep behaviors. If the study results in positive changes for the students who are already poor sleepers, the intervention could then also be adapted to be used as a preventative course to teach students how to get better sleep before their sleep practices become established as problematic habits. Moreover, the study proposes to attempt to further the field by continuing the search to create and utilize effective strategies to invoke and motivate the desire for the change process.

## **Operational Definitions**

*Sleep Duration:* The amount of time actually spent sleeping for a given night, also known as sleep quantity. This is different than the amount of time physically spent in bed (Galambos Lascano, Howard, & Maggs, 2013).

*Sleep Quality*: The subjective experience of having received “deep” or “restful” sleep as well as more quantitative measures such as sleep duration, time taken to fall asleep (sleep latency), and number of times one wakes up during the night due to various disturbances (i.e., noise, having to use the bathroom, etc.; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989; Galambos et al., 2013).

*Daytime Sleepiness*: The propensity of an individual to doze off during the day while engaged in certain soporific activities, such as watching TV or while a passenger in a car. Daytime sleepiness is distinguished from tiredness and fatigue because it represents the actual propensity to fall asleep (Johns, 1991).

*Sleep Hygiene*: The practices and behaviors that influence the quality of sleep, including (but not limited to), for example, having a consistent sleep-wake cycle, avoiding caffeine and other stimulants close to bedtime, and maintaining a good sleep environment (Buboltz et al., 2002; Gellis & Lichstein, 2000). See Chapter 2 for a more in-depth discussion of sleep hygiene.

*Motivational Interviewing*: “Motivational interviewing is a collaborative, goal-oriented style of communication with particular attention to the language of change. It is designed to strengthen personal motivation for and commitment to a specific goal by eliciting and exploring the person’s own reasons for change within an atmosphere of acceptance and compassion” (Miller & Rollnick, 2013, p. 29).

## **Research Questions**

Q1: To what extent does utilizing an individualized approach to sleep intervention, focusing on teaching and encouraging the use of sleep hygiene practices and incorporating the use of personalized feedback, promote differences in sleep quality (as measured by the Pittsburgh Sleep Quality Index), daytime sleepiness (as measured by the Epworth Sleepiness Scale), the practice

of sleep hygiene behaviors (as measured by the Adolescent Sleep Hygiene Scale), and overall psychological well-being (as measured by the Clinical Outcomes in Routine Evaluation Outcome Measure) between groups who do and do not receive the intervention?

Q2: To what extent does utilizing an individualized approach to sleep intervention promote enhanced subjective sleep quality (as measured by the Pittsburgh Sleep Quality Index), decreases in daytime sleepiness (as measured by the Epworth Sleepiness Scale), enhanced utilization of the practice of sleep hygiene behaviors (as measured by the Adolescent Sleep Hygiene Scale), and overall improvement in psychological well-being (as measured by the Clinical Outcomes in Routine Evaluation Outcome Measure) over the course of a one-month period and three months after the end of the intervention for the individualized treatment group (i.e., the Treatment 1 group)?

Q3: To what extent does utilizing an individualized approach to sleep intervention (i.e., Treatment 1 group) change daily sleep patterns such as sleep duration, sleep latency, consistency of sleep-wake schedule, and morning refreshment (all as measured by the National Sleep Foundation Diary) over the course of a one-month period?

### **Hypotheses**

- 1) The intervention will create positive changes, such that those individuals in the Treatment 1 group will see an improvement in subjective sleep quality (as measured by the Pittsburgh Sleep Quality Index), a decrease in daytime sleepiness (as measured by the Epworth Sleepiness Scale), an increase in the utilization of sleep hygiene practices (as measured by the Adolescent Sleep Hygiene Scale), and improvement in overall psychological well-being (as measured by the Clinical Outcomes in Routine Evaluation

Outcome Measure), as compared to the individuals in the Treatment 2 and Control 1 groups.

- 2) The intervention will create positive changes for the Treatment 1 group, such that those individuals in the Treatment 1 group will see an improvement in subjective sleep quality (as measured by the Pittsburgh Sleep Quality Index), a decrease in daytime sleepiness (as measured by the Epworth Sleepiness Scale), an increase in the utilization of sleep hygiene practices (as measured by the Adolescent Sleep Hygiene Scale), and improvement in overall psychological well-being (as measured by the Clinical Outcomes in Routine Evaluation Outcome Measure), over the course of the intervention and at three months after the intervention.
- 3) The intervention will promote changes in daily sleep patterns for the Treatment 1 group, such that individuals in the Treatment 1 group will have increased sleep duration, decreased sleep latency, more consistency in their sleep-wake cycles, and an increase in morning refreshment (all as measured with the National Sleep Foundation Sleep Diary) over the course of the intervention.

## II. Review of the Literature

### Sleep and Health

Sleep is a basic component of human functioning, a physiological state that is a time of rest and recuperation for the mind and body (Halson, 2008; Muzet, 2007; Suen et al., 2008). During sleep, both mind and body are restored through cell reparation and growth; learning and memory consolidation also occur (Curcio et al., 2006; Gruber, 2013; Halson, 2008; Wong et al., 2013). Importantly, physical, cognitive, and even emotional processes are susceptible to becoming impaired by sleep loss (Curcio et al., 2006; Gruber, 2013; Wong et al., 2013). Children and teenagers need approximately 9 to 11 hours of sleep a night, while adults are recommended to sleep 8 to 10 hours a night (Ferrara & De Gennaro, 2001; Kloss et al., 2011; Marhefka, 2012; Taylor & Bramoweth, 2010), although individual differences do exist (Ferrara & De Gennaro, 2001; Savis, 1994). However, many people are not sleeping the recommended amount and are therefore becoming susceptible to a number of health concerns related to sleep loss (National Sleep Foundation, 2014b).

Sleep impairment has been related to a number of physical and mental health domains. Shorter sleep duration has been associated in many studies with risks of cardiovascular events, strokes, artery calcification, obesity, diabetes, and hypertension (Buysse et al., 2010; Duggan et al., 2014; Editorial: "Sleep and Health," 2012; Gruber, 2013; Wells & Vaughn, 2012), as well as psychiatric disorders (Strine & Chapman, 2005). Additionally, in a study of partial sleep restriction, pain in the back, stomach, and body were found to be more pronounced in those participants who had their sleep restricted than in those who did not, suggesting that lack of sleep plays a role in the onset or amplification of pain (Haack & Mulligton, 2005). Decreased sleep quantity and lower sleep quality has been related to increases in psychological stressors, such as

feelings of depression, tension, fatigue, and confusion (Pilcher et al., 1996). Further, sleep deprivation has been linked to decreased immune functioning (Ferrara & De Gennaro, 2001; Leeder, Glaister, Pizzoferro, Dawson, & Pedlar, 2012; Reilly & Edwards, 2007; Reilly, 2009). Lastly, sleep duration has been found to be a major risk of mortality by any cause (Duggan et al., 2014; Wells & Vaughn, 2012). Even when examining sleep during childhood, sleep duration has been shown to be correlated with adult mortality (Duggan et al., 2014).

On the other hand, sufficient sleep has been associated with a number of positive health outcomes. For instance, good sleep has been demonstrated to predict healthy blood pressure and body mass index (Wong et al., 2013). A positive relationship has been found to exist between sleep satisfaction and self-reported health (Pilcher et al., 1996). Further, sleeping a sufficient amount has been related to increases in optimism and well-being, leading to higher life satisfaction (Haack & Mullington, 2005; Wong et al., 2013).

### **Sleep and Performance**

Sleep is thought to be highly intertwined with learning and cognitive performance (Curcio et al., 2006; Gruber, 2013; Hershner & Chervin, 2014). The dual process model, a theory that relates sleep to memory, proposes that mechanisms of procedural memory are reliant on REM sleep and mechanisms of declarative memory are reliant on slow wave or non-REM (nREM) sleep (Curcio et al., 2006; Hershner & Chervin, 2014; Naitoh, Kelly, & Englund, 1990). A second theory, the sequential processing theory, proposes that memory requires the progression through certain sleep stages, such that memory is formed during nREM sleep and consolidated during REM sleep (Hershner & Chervin, 2014). Either way, it is clear that sleep plays a key function in learning and intellectual performance (Curcio et al., 2006; Hershner & Chervin, 2014). Because sleep is thought to be so important in consolidation and encoding, even

depriving an individual of a few hours of sleep in which REM or nREM sleep is cut short then affects these memory mechanisms (Ahrberg, Dresler, Niedermaier, Steiger, & Genzel, 2012; Gruber, 2013; Hershner & Chervin, 2014). Further, sleep deprivation studies looking at 24 hours of sleep deprivation have found noticeable differences in performance on complex cognitive tasks, potentially because of the individuals' decreased ability to focus attention and concentrate (Lim & Dinges, 2010; Pilcher & Walters, 1997; Scott et al., 2006). Specifically, simple attention and vigilance are most effected, with short-term sleep deprivation causing moderate to large effects on these domains (Lim & Dinges, 2010).

For students, the link between sleep and cognitive performance translates, at least correlationally, to effects on academic performance. In one study of medical students studying for their board exams, sleep quality and stress were related to exam grades, with those students exhibiting the most stress and the worst quality sleep receiving the lowest grades (Ahrberg et al., 2012). In first year college students, students' later bedtimes and wake times were correlated with lower GPAs (Trockel et al., 2000). Even for high school students, those that report higher grades had more consistent sleep habits and reported better subjective sleep quality than students who received lower grades (Curcio et al., 2006; Wells & Vaughn, 2012; Wolfson & Carskadon, 1998). Additionally, in a meta-analysis of studies on children and adolescent sleep, school performance was positively correlated with increased sleep quality and quantity and decreased daytime sleepiness (Dewald et al., 2010). Though these studies were not experimental, daytime sleepiness and fatigue, resulting from poor sleep, has consistently been shown to be the best predictor of poor academic performance (Curcio et al., 2006; Dewald et al., 2010).

## **Sleep and College Students**

Research has shown that college students specifically are a population who are particularly affected by sleep difficulties and need to be further studied (Buboltz et al., 2002; Cheng et al., 2012; Forquer, Camden, Gabriau, & Johnson, 2008). Beginning in adolescence, individuals develop chronic, poor sleep habits (Gruber, 2013; Marhefka, 2012; Wolfson & Carskadon, 1998). This generation of adolescents have even more reasons to stay up late at night than ever before and are experiencing less parental control over their sleep schedule (Crowley & Carskadon, 2010). Teens report a habit of having later weekend bedtimes and later weekend wake times to help recover from their weekday sleep debt, a habit that begins the cycle of unstable sleep (Crowley & Carskadon, 2010). Once in college, students face changing academic and personal demands, have even more freedom to create their own schedules (including sleep schedules), still experience delayed circadian rhythms, continue their habits of differing sleep schedules from weekdays to weekends to fight sleep debt, and have inadequate sleep hygiene habits built over the years as they have grown up (Brown et al., 2002; Cheng et al., 2012; Doane, Gress-Smith, & Breitenstein, 2014; Hershner & Chervin, 2014; Kloss et al., 2011; Marhefka, 2012; Pilcher et al., 1996; Schulke & Zimmermann, 2014; Zimmermann, 2011).

All of these factors accumulate to create a population who is chronically, partially sleep deprived (Ferrara & De Gennaro, 2001; Hershner & Chervin, 2014; Kenney, LaBrie, Hummer, & Pham, 2012; Kloss et al., 2011; Tsai & Li, 2004). The ideal amount of sleep for young adults is a recommended 8.5 to 9 hours nightly; however, college students are consistently found to sleep on average only 6.5 to 7.5 hours a night (Cheng et al., 2012; Ferrara & De Gennaro, 2001; Kloss et al., 2011; Lund, Reider, Whiting, & Pritchard, 2010; Taylor & Bramoweth, 2010). As many as 50-60% of college students report low sleep quality and feeling regularly sleep deprived

(Ahrberg et al., 2012; Cheng et al., 2012; Kloss et al., 2011; Lund et al., 2010), as well as report daytime sleepiness (Ahrberg et al., 2012; Hershner & Chervin, 2014).

Numerous studies with this population have found chronic sleep deprivation to be related to a number of psychosocial variables (Brown et al., 2002; Buboltz, Brown, & Soper, 2001; Buboltz et al., 2002; Pilcher et al., 1996; Wolfson & Carskadon, 1998). Sleep and depression are commonly found to be associated, with a key feature of depression being disturbed sleep (Hershner & Chervin, 2014). Depression is common among college students (Doane et al., 2014; Hershner & Chervin, 2014), and insomnia is believed to increase depression and suicidal ideation (Gellis & Lichstein, 2009; Hershner & Chervin, 2014). Ameliorating sleeping concerns may help decrease depression and positively affect mood (Doane et al., 2014; Hershner & Chervin, 2014). Further, an increase in negative mood states and a decrease in positive affect have been correlated with poorer sleep (Lund et al., 2010; Naitoh et al., 1990; Pilcher et al., 1996; Taub & Berger, 1973; Wong et al., 2013), and poor quality sleepers have been found to report higher levels of stress on both weekdays and weekends (Lund et al., 2010). Sleep quality has also been correlated with the experience of anxiety for both adolescents and young adults (Alapin et al., 2010; Doane et al., 2014; Reilly & Deykin, 1983; Wells & Vaughn, 2012; Wong et al., 2013), with self-reported anxiety increasing in the transition from high school to the first year of college (Doane et al., 2014).

There is a growing concern, especially on college campuses, about the interactions between sleep and alcohol and drug use (Gruber, 2013; Kenney et al., 2012). Students report increasing their use of alcohol and marijuana to cope with poor sleep, with use being found to correlate with poorer sleep quality (Kloss et al., 2011). Poorer sleep quality has been found to correlate with heavy episodic drinking (the riskiest type of alcohol use), daily alcohol use, and

alcohol related consequences (Kenney et al., 2012; Lund et al., 2010), and has been found to mediate the interaction between alcohol use and poorer academic performance (Singleton & Wolfson, 2009). Additionally, students are increasingly using alcohol as a sedative or sleep aid (because alcohol decreases sleep latency) which can lead to building a tolerance to alcohol and experiencing increasingly worse sleep (Kenney et al., 2012; Lund et al., 2010; Taylor & Bramoweth, 2010). This behavior may lead some students to engage in what is known as a stimulant-sedation loop, in which the individuals use caffeine and other stimulants to stay awake during the day and counteract daytime sleepiness, and alcohol or other sedatives to induce sleep at night and counteract the earlier effects of the stimulants (Lund et al., 2010; Marhefka, 2012; Taylor & Bramoweth, 2010). Research has found that students with evening circadian preferences, or those whose bodies naturally stay awake longer at night and sleep later in the day, are especially likely to experience poorer sleep and poorer ways of coping with stress, often drinking to cope with stress, and possibly experiencing a reciprocal causality between poor sleep and drinking to cope with the stress (Digdon & Landry, 2013). Additionally, these students are more likely to use stimulant drinks to fight off commonly experienced daytime sleepiness or to combat the jet lag like symptoms experienced at the beginning of the week (Schulke & Zimmermann, 2014; Tran et al., 2014; Whitter et al., 2014).

Another significant concern among this population is the risk associated with sleepy driving (Gruber, 2013; Hershner & Chervin, 2014; Wells & Vaughn, 2012). Research has demonstrated that after 24 hours of sleep deprivation, individuals' functioning is similar to when a person has a blood alcohol level of 0.1%, which is 0.02% over the legal driving limit (Hershner & Chervin, 2014). Additionally, 55% of accidents that are sleep related involve individuals under the age of 25 (Forquer et al., 2008). Studies demonstrate that students underestimate the potential

risks of sleepy driving and that accidents or “near misses” are a frequent occurrence when individuals are sleep deprived (Hershner & Chervin, 2014). One study of college students found that 16% of their sample had fallen asleep while driving and 2% had experienced accidents due to sleepiness (Taylor & Bramoweth, 2010). Further, college students may be more likely than other age groups to drive after drinking *and* when sleepy, creating a dangerous state of impairment even when the person is not completely intoxicated (Gruber, 2013; Hershner & Chervin, 2014; Kloss et al., 2011; Wells & Vaughn, 2012).

The American College Health Association’s (ACHA) National College Health Assessment (NCHA) found that for students, sleep difficulties were ranked third after stress and anxiety in factors negatively affecting their academic performance (ACHA, 2015), and in another recent study, sleep was ranked second only to stress (Hershner & Chervin, 2014). Approximately 80% of students believe that their school performance is affected by getting inadequate sleep and feeling tired during the day (Hershner & Chervin, 2014), and 28.7% have reported feeling as though their sleep difficulties have been “very difficult to handle” within the past 12 months (ACHA, 2015). The ACHA-NCHA (2015) also found that only 11.8% of students felt rested in the morning six or seven days a week, and 58.2% reported feeling tired or sleepy during the day on 3 or more days of the week. Correspondingly, daytime sleepiness has been linked to poorer performance in school (Curcio et al., 2006) and students with more irregular sleeping patterns have been found to have lower GPAs than students with more regular sleeping patterns (Hershner & Chervin, 2014; Medeiros, Mendes, Lima, & Araujo, 2001; Onyper, Thacher, Gilbert, & Gradess, 2012; Pilcher & Walters, 1997). However, college students show elevated efficacy beliefs relative to their actual performance after incidents of partial sleep deprivation, indicating that students may believe that pulling an “all-nighter” to

study is beneficial to their performance when, in fact, it is detrimental (Hershner & Chervin, 2014). This lack of awareness of sleep deprivation and performance creates no motivation to change sleeping habits (Hershner & Chervin, 2014).

## **Sleep Hygiene**

The term “sleep hygiene” refers to a group of practices that promote higher quality and a longer duration of sleep and encompasses sleep habits and behaviors, environmental conditions, and psychological factors (Buboltz et al., 2002; Lacks & Roterts, 1986; Mastin, Bryson, & Corwyn, 2006; Mindell, Meltzer, Carskadon, & Chervin, 2009; Stepanski & Wyatt, 2003; Wells & Vaughn, 2012). General sleep hygiene includes daily behaviors, pre-sleeping behaviors, daily wake times and bedtimes, and the physical sleep environment (Brown et al., 2002; Gellis & Lichstein, 2009; Lacks & Roterts, 1986). “Sleep hygiene” was first coined by Peter Hauri in the context of making recommendations about sleep to individuals with insomnia (Stepanski & Wyatt, 2003). These recommendations have since been further studied and modified, with most researchers agreeing on a similar list of practices of sleep hygiene (Brown et al., 2002; Buboltz et al., 2002; Gellis & Lichstein, 2009; Halson, 2008; Lacks & Roterts, 1986; Mastin et al., 2006; Mindell et al., 2009; Stepanski & Wyatt, 2003; Wells & Vaughn, 2012). For the purpose of this research, good sleep hygiene practices (gathered from the aforementioned literature) encompass the following:

- Going to sleep and waking up at a similar time each day of the week
- Limiting daytime napping
- Limiting exercise in the three to five hours prior to bedtime
- Limiting alcohol, nicotine, and caffeine intake in the three to five hours prior to bedtime

- Avoiding the use of technology in the hour prior to bedtime, including television, mobile phones, and handheld electronics
- Decreasing time spent in bed not sleeping (i.e., lying awake thinking, worrying, etc.)
- Limiting arousing activities prior to bedtime, including (but not limited to) school work, paying bills, or having an argument
- Using the bed only for sleep and sex
- Sleeping in a comfortable environment, including proper firmness of the mattress and comfortable temperature of the room and bed
- Sleeping in a quiet environment free from distracting noises
- Sleeping in a dark environment free from light emanating from digital alarm clocks, mobile telephones, computers, and light sources outside of the bedroom

Sleep hygiene is thought to be an important component in promoting healthy sleep across a wide age range (Brown et al., 2002; Mindell et al., 2009; Stepanski & Wyatt, 2003; Suen et al., 2008). It is therefore important to become aware of individuals' knowledge of sleep hygiene, actual adherence to sleep hygiene, and how current sleep hygiene habits affect sleep (Brown et al., 2002; Buboltz et al, 2002; LeBourgeois, Giannotti, Cortesi, Wolfson, & Harsh, 2005; Suen et al., 2008). Currently, research has found only a weak relationship between knowledge and practice of sleep hygiene (Brown et al., 2002; Suen et al., 2008). However, the research has demonstrated that good practice of sleep hygiene is related to higher quality of sleep (Brown et al., 2002; Mindell et al., 2009; Suen et al., 2008). Additionally, individuals designated as "poor sleepers" have been shown to practice poor sleep hygiene by not following many of these guidelines (Gellis & Lichstein, 2009). Many of the individual components of sleep hygiene have

been specifically studied to demonstrate their effects on sleep (Brown et al., 2002; Driver & Taylor, 2000; Hershner & Chervin, 2014; Muzet, 2007).

**Alcohol.** The effect of alcohol on sleep has been found to vary depending on phase of sleep (Brown et al., 2002; Halson, 2008; Stepanski & Wyatt, 2003). Alcohol has been shown to decrease sleep latency, or time it takes to fall asleep, and is therefore used by many as a sleeping aid (Halson, 2008; Hershner & Chervin, 2014; Kenney et al., 2012; Lund et al., 2010; Stepanski & Wyatt, 2003; Taylor & Bramoweth, 2010; Wells & Vaughn, 2012). However, even when ingested up to six hours previous to bedtime, it creates fragmented sleep in the latter part of the night, thereby disrupting sleep and causing poorer sleep quality (Halson, 2008; Hershner & Chervin, 2014; Lacks & Rotert, 1986; Stepanski & Wyatt, 2003). Alcohol has also been shown to decrease both REM and nREM sleep (Lacks & Rotert, 1986; Wells & Vaughn, 2012).

**Caffeine.** Caffeine is one of the most widely used substances used to help regulate the sleep-wake cycle and to decrease daytime sleepiness (Stepanski & Wyatt, 2003). However, research has shown that caffeine and other stimulants (i.e., marijuana, OTC prescriptions, energy drinks) have a negative effect on sleep quality (Brown et al., 2002; Halson, 2008; Hershner & Chervin, 2014; Lund et al., 2010). First, research demonstrates that stimulants increase sleep latency, and second, that they decrease essential REM sleep (Halson, 2008; Hershner & Chervin, 2014). In children, caffeine use was associated with a decrease in overall sleep duration (Mindell et al., 2009). Additionally, the effects of caffeine can last from five to seven hours, necessitating limiting its usage to the earlier part of the day, or to before 3 pm (Hershner & Chervin, 2014).

**Exercise.** Exercise is considered by many, including the American Sleep Disorders Association, to be a good, non-pharmaceutical remedy for sleep difficulties, and has therefore been incorporated into sleep hygiene practices (Buboltz et al., 2002; Driver & Taylor, 2000).

Although the exact mechanisms of the effect of exercise on sleep remain unclear, research has clearly demonstrated positive effects of exercise on sleep (Brown et al., 2002; Buboltz et al., 2002; Driver & Taylor, 2000). Exercise consistently promotes longer sleep duration, decreases sleep latency, and has been shown to increase nREM sleep (Buboltz et al., 2002; Driver & Taylor, 2000). Individuals who exercise regularly reported a decrease in daytime tiredness and subjective sleepiness (Driver & Taylor, 2000). The optimal time frame for exercising appears to be five to six hours before bedtime, but not closer than three hours to bedtime (Driver & Taylor, 2000; Lacks & Rotert, 1986; Savis, 1994).

**Noise.** Noise is considered to be unwanted sounds, often those that cause annoyance (Muzet, 2007). Noise disrupts sleep because a sleeping body can still respond to noises in the environment (Muzet, 2007). Noise can cause several sleep disturbances, including increasing sleep latency, increasing nocturnal awakenings (especially in the morning hours), and reducing subjective sleep quality (Muzet, 2007). Individuals designated as “poor sleepers” have been found to sleep in noisier environments (Gellis & Lichstein, 2009). College students in particular may experience noisier environments, such as in the college dorm setting, yet likely have a more difficult time in reducing that noise (Brown et al., 2002).

**Technology.** The continual use of technology is becoming an integral part of many people’s lives, use which does not necessarily decrease prior to bedtime (Ferrara & De Gennaro, 2001; Hershner & Chervin, 2014; National Sleep Foundation, 2014b; Thomée, Härenstam, & Hagberg, 2011). A recent large, representative sample of American adults reported that 90% of their participants used electronics within an hour of bedtime at least a few nights a week (Chang et al., 2015). For children, having a television in the bedroom and watching television prior to bed are both associated with a decrease in total sleep duration (Mindell et al., 2009; Stepanski &

Wyatt, 2003; National Sleep Foundation, 2014b). College students report the use of computers, cell phones, music devices, and video games before bed at an alarming rate, and a majority experience inadequate sleep (Hershner & Chervin, 2014; Thomée et al., 2011). Exposure to the bright light of these devices is thought to suppress melatonin, delaying the timing of melatonin release that normally triggers sleep and instead causing an increase in evening time alertness (Chang et al., 2015; Teixeira et al., 2013). Overall, the use of technology is associated with difficulties in falling asleep and waking up, repeated awakenings during the night, disruption during the night from cell phones that have not been turned off, daytime sleepiness, drowsy driving, and less restful sleep (Arora et al., 2013; Dworak, Schierl, Bruns, & Strüder, 2007; Hershner & Chervin, 2014; National Sleep Foundation, 2014b; Thomée, Eklöf, Gustafsson, Nilsson, & Hagberg, 2007; Thomée et al., 2011).

### **College Students and Sleep Hygiene**

Despite the importance of sleep hygiene and the typical level of dysfunction among collegiate sleepers, studies have shown that students are not actually very knowledgeable about sleep hygiene (Hicks et al., 1999). In one study of sleep hygiene in college students, broken down by ethnic groups, only 57% of the Euro-American students had accurate knowledge of proper sleep hygiene, the highest percentage of all the groups (Hicks et al., 1999). Additionally, individuals in all of the ethnic groups overestimated their knowledge of sleep hygiene and overestimated the application of this knowledge to their own sleep practices (Hicks et al., 1999). For instance, many college students believe that they can compensate for lost sleep during the week by changing their sleep schedule to increase sleep on the weekends, an erroneous conclusion (Brown et al., 2002; Forquer et al., 2008; Pilcher & Walters, 1997; Tsai & Li, 2004). However, it is clear that for the college student population, some sleep hygiene behaviors are

easier to change than are others (i.e., maintaining a consistent sleep schedule versus decreasing environmental noise in the dorms), and thus should be emphasized to create a better chance of affecting change (Brown et al., 2002; Hershner & Chervin, 2014).

### **Motivating Change**

Even if students were knowledgeable about the best sleep improving practices, they must still be motivated to make changes in order for them to benefit from that knowledge (Aloia et al., 2004; Blunden et al., 2012). A treatment method called motivational interviewing (MI) has been gaining in popularity in clinical settings and research as a brief intervention used to increase motivation for and resolve ambivalence about change (Lundahl & Burke, 2009; Miller & Rollnick, 2013; Rollnick & Miller, 1995). MI utilizes a client centered approach, an empathetic and nonjudgmental atmosphere, and key questions assessing readiness for change in order to increase the client's intrinsic motivation for change (Aloia et al., 2004; Miller & Rollnick, 2004; Miller & Rollnick, 2013; Rollnick & Miller, 1995). Originally created to work through resistance to change in treating alcohol and substance use problems, the use of MI has expanded to working with several other problem domains, including decreasing risky behavior and increasing positive health behaviors (Lundahl & Burke, 2009; Miller & Rollnick, 2013).

**Efficacy of MI.** The efficacy of MI as a brief intervention has been established through numerous studies across a wide variety of problem domains (Burke, Arkowitz, & Menchola, 2003; Hettema, Steele, & Miller, 2005; Lundahl & Burke, 2009; Vasilaki, Hosier, & Cox, 2006). Meta-analyses of MI studies have consistently found small but significant effect sizes ( $d = 0.28$  to  $d = 0.40$ ) of using MI in comparison to waitlist or no treatment controls, and have found MI to be approximately equal in effectiveness to other alternative treatment groups (Hettema et al., 2005; Lundahl & Burke, 2009; Miller & Rollnick, 2013; Vasilaki et al., 2006). Importantly, MI

based treatments combined with personalized feedback of assessment results (termed “Motivational Enhancement Therapy” or MET) for alcohol use have been shown to have greater efficacy than MI alone and to outperform various other treatments in numerous alcohol-use related outcome measures (Lundahl & Burke, 2009; Miller & Rollnick, 2013). Additionally, effects of MI interventions appear early, tend to be stable for six months to one-year post-treatment, and then diminish after one-year post-treatment (Burke et al., 2003; Hettema et al., 2005).

**MI and Substance Use.** For the adolescent and college student population, the use of brief motivational interviewing (BMI) interventions have also been shown to be efficacious for different problem areas. For heavy drinking college students mandated to an alcohol reduction treatment, BMI has been used to successfully decrease alcohol use and negative alcohol related consequences (Hustad et al., 2014). Hustad and colleagues (2014) utilized a two meeting intervention in which participants were assessed at the first meeting and received the BMI at the second meeting. These students met one-on-one with a counselor, and treatment incorporated the use of personalized feedback about their alcohol use to guide the session (Hustad et al., 2014). In a study of adolescent smoking cessation, Patten et al. (2008) found that a weekly, four-session intervention utilizing the spirit and techniques of MI led to an increase in self-efficacy and readiness to quit smoking for these individuals. This intervention attempted to capitalize on enhancing self-efficacy and exploring ambivalence regarding change (Patten et al., 2008).

**MI and Sleep.** With regard to the sleep literature, there have been few studies in individualized formats that utilize MI to affect change on a sleep related behavior. However, two studies have incorporated the spirit of MI into interventions designed to increase adherence to

continuous positive airway pressure (CPAP) treatment for obstructive sleep apnea (OSA; Aloia et al., 2004; Olsen, Smith, Oei, & Douglas, 2012).

Olsen, Smith, Oei, and Douglas (2012) created a manualized motivational interview nurse therapy (MINT) intervention that is delivered in an individual format by a nurse. The MINT intervention includes three sessions with the individual that focus on exploring motivation for CPAP adherence, receiving personalized feedback, creating a decisional balance of pros and cons of treatment, generating a change plan, assessing for motivation to change, reinforcing attempts at change, and exploring ambivalence about change (Olsen et al., 2012). This intervention was found to be effective in increasing adherence to treatment and self-efficacy of change for the intervention group compared to the no-intervention control group (Olsen et al., 2012).

Aloia and colleagues (2004) designed a motivational enhancement (MET) approach to increase adherence to CPAP treatment that incorporated the five key principles of MI (as conceptualized by MI researchers at the time; i.e., developing discrepancy, expressing empathy, avoiding arguing and accepting ambivalence, rolling with resistance, and supporting self-efficacy). Their treatment consisted of two face-to-face, 45 minute sessions with a nurse therapist and a 15 minute follow up phone call, each spread a week apart (Aloia et al., 2004). The sessions include assessing readiness for change, exploring ambivalence, providing personalized feedback, building motivation for treatment adherence, identifying discrepancies between current behavior and future goals, strengthening motivation, and setting goals (Aloia et al., 2004). In a large scale randomized control trial in which MET for CPAP was compared to a traditional education treatment (ED) and standard care (SC), MET and ED outperformed SC in adherence to the treatment (Aloia et al., 2007). However, as the MET treatment did not perform above and

beyond ED, the authors speculate that perhaps more than two one-on-one motivational sessions are needed to enhance the treatment effects (Aloia et al., 2007).

### **Interventions to Improve Sleep**

To date, there have been a few studies that utilize a specific theoretical perspective (i.e., cognitive-behavioral therapy) to provide an individualized intervention aimed to improve sleep in college students. Alternately, sleep hygiene interventions, some of which incorporate motivational interviewing, have been delivered in a group format for high school-aged adolescents with moderate success. Each of these will be detailed below.

**Individual Format.** An intervention study that utilized an e-mail format of Cognitive Behavioral Therapy for Insomnia (CBT-I) treatment to improve sleep has some methodological similarities to the proposed study due to its individualized format (Trockel, Manber, Chang, Thurston, & Taylor, 2011). Trockel and colleagues (2011) selected two first-year residence halls on the Dartmouth campus and invited the students to participate in one of two 8-week e-mail based programs. The intervention group received a CBT-I based sleep-health promoting program called “Refresh”, while the control group received a CBT based health promoting program called “Breathe” (Trockel et al., 2011). Each program lasted for 8 weeks and lessons were sent out via e-mail weekly to the students in each condition. Students following the “Refresh” program were encouraged to keep daily sleep logs and taught strategies to improve their sleep health. These strategies included incorporating mindfulness meditations and cognitive restructuring into their sleep habits (Trockel et al., 2011).

Students in the “Breathe” program received similar lessons (i.e., mindfulness meditation and cognitive restructuring) that were focused on improving mood and coping skills to handle stress rather than focused on improving sleep. These students were also encouraged to keep daily

logs on a variety of tasks unrelated to sleep (Trockel et al., 2011). Overall, the study found that utilizing the “Refresh” treatment program was related to more improvements in sleep quality and a reduction of depressive symptoms in comparison to the “Breathe” program (Trockel et al., 2011), thus demonstrating efficacy for a weekly, individual intervention program specifically designed to target sleep habits in college students.

**Group Format.** In a review of the pertinent literature, Blunden, Chapman, and Rigney (2012) found only 8 published studies and 4 pilot studies in abstract format concerning school-based, group sleep education programs for children, adolescents, and college students. Their review determined that these studies were successful in increasing knowledge about sleep but were less consistent in improving behavioral sleep outcomes, including sleep hygiene practices (Blunden et al., 2012).

One such study utilized a school based intervention grounded in cognitive behavioral therapy to provide education about general health and well-being, including sleep related components (i.e., sleep needs, consequences of poor sleep, good sleep hygiene practices, etc.) to adolescents in the 11<sup>th</sup> grade (mean age = 15.6 years; Moseley & Gradisar, 2009). Their study used a randomized control trial of two groups (program class vs. class as usual) who were assessed over three time points (pre-program, post-program, and 6-week follow-up). The program class received four 50-minute classes over a 4-week time span, including one lesson which incorporated an intent to change behavior questionnaire based upon the five stages of change outlined in the Transtheoretical Model of Behavior Change (Moseley & Gradisar, 2009; Norcross et al., 2011). The findings, however, were limited and were not maintained at the 6-week follow-up (Moseley & Gradisar, 2009).

A second school-based program designed specifically to address sleep hygiene practice was conducted by de Sousa, Araujo, and Azevedo (2007) with a sample of Brazilian adolescents (mean age = 15.98 years). De Sousa and colleagues (2007) designed a “Sleep Hygiene Week” program in which a 50-minute class period each day for a week was devoted to different sleep hygiene related activities. The findings of de Sousa et al.’s study was again limited and the authors recognized the need to not only increase knowledge about sleep but actually motivate a change in behavior.

With the necessity of the motivation component in mind, Cain, Gradisar, and Moseley (2011) modified the Moseley and Gradisar’s earlier intervention to incorporate a motivational interviewing (MI) framework. Six classrooms from three secondary schools participated, with half of the classrooms randomized into the control condition and half into the intervention condition (Cain et al., 2011). For the intervention condition, students once again had four 50-minute classes held once per week. The presenter was a secondary school teacher as well as a psychologist trained in MI (Cain et al., 2011). The MI components that were incorporated included a decisional balance sheet, role play activities to explore ambivalence, a behavioral experiment to change sleep behaviors, and discussion of barriers and relapse prevention (Cain et al., 2011). For students who received the intervention, motivation to change sleep related behavior was higher than for the students in the control group, and 76.1% of students in the intervention class reported attempting to make changes to their sleep habits (Cain et al., 2011). Cain and colleagues (2011) recommend future studies to focus on motivating students to maintain their behavior changes over time.

A second review of school-based sleep promotion programs emphasized the need to further integrate motivational components into programs and to individualize these programs

(i.e., tailoring them to the individual students) in order to maximize the benefit of using the MI approach (Cassoff et al., 2013). Cassoff and colleagues (2013) suggest that attitudes towards sleep, self-efficacy for changing behaviors, and social factors influencing motivation to change are all important factors that need to be incorporated into the discussion of sleep hygiene promotion.

### **Current Study**

Due to a lack of methodologically similar studies in this field, there is a clear need for an experimental study that attempts to demonstrate changes in sleep through an individualized intervention format designed to focus on and change sleep hygiene practices. This format represents a natural progression of the literature in which Brown and colleagues (2002) propose that using sleep hygiene instruction with college students would likely improve their sleep practices, based upon their findings that practicing proper sleep habits is related to better overall sleep. Suen and colleagues later (2008) agreed that encouraging the practice of these sleep hygiene behaviors is most important in improving sleep, based upon their finding that better sleep hygiene practice is related to better sleep. However, no studies have yet taken the next step and designed a face-to-face individualized intervention for college students to teach and improve the practice of sleep hygiene behaviors, while also increasing the motivation for this behavioral change. Therefore, an intervention that not only teaches these habits but encourages the behavior change, as proposed in the current study, will be an important contribution to the field.

### **III. Method**

#### **Design**

This study utilized a mixed between and within-groups, quasi-experimental intervention design with repeated measures assessment. All participants were assessed with an initial screening measure (Appendix A) in which they reported their subjective sleep quality (along with several other health variables) on a scale of 1 to 10. Fourteen individuals (i.e., 14.4% of the sample) who scored their subjective sleep quality as a 4 or below (i.e., less than a 5 or a “Moderate” problem rating) were contacted for further participation in the study, in order to obtain a group of individuals who considered their current sleep habits to be a problem area in need of changing. This contact resulted in obtaining a treatment group of eight individuals with self-reported poor sleep quality, heretofore known as the Treatment 1 group.

These participants received four weekly individual feedback sessions with the investigator to discuss their sleep habits, goals for change, and motivation for change. The investigator utilized components of motivational interviewing during the individual feedback sessions in order to help facilitate the individuals’ motivation for change and confidence in their ability to change their sleeping habits (Miller & Rollnick, 2004; Miller & Rollnick, 2013; Rollnick & Miller, 1995). The participants in the Treatment 1 group also completed three weekly sleep diaries. After the first week, the diaries were used during the meetings to provide the individuals with personalized feedback about their sleep. This group completed a pre-test, midpoint evaluation (two weeks after the pre-test), post-test (five weeks after the pre-test), and a three month (i.e., after the post-test) follow up post-test, each of which measured the individuals’ sleep quality, daytime sleepiness, sleep hygiene behaviors, and overall psychological wellness.

The design used a second treatment group, the Treatment 2 group, to assess the efficacy of only receiving education about sleep hygiene in an attempt to replicate findings from previous studies that reported that education only is not enough to change behavior (detailed in earlier sections). The Treatment 2 group included three classrooms of participants who received a 50-minute lecture on the importance of sleep, sleep hygiene, and its applications (Treatment 1 group individuals were also included in the lecture portion of the study). These participants did not undergo individual meetings with the investigator. Participants in the Treatment 2 group completed the pre- and post-tests at the same time as the individuals in the Treatment 1 group.

Finally, a control group, comprising a fourth classroom of students, was utilized as a baseline comparison group. The Control group did not receive any educational information about sleep hygiene, nor did they have individual meetings with the investigator. The individuals in Control group completed the pre- and post-tests at the same time as the individuals in the treatment groups. A summary of the groups can be found in Table 1, below.

**Table 1: Description of the Groups**

<b>Group Name</b>	<b>N</b>	<b>Intervention</b>	<b>Testing Points</b>
Treatment 1	8	Sleep lecture, weekly individual meetings	Pre-test, mid-point, post-test, 3 month follow-up
Treatment 2	63	Sleep lecture	Pre-test, post-test
Control 1	26	None	Pre-test, post-test

### **Participants**

Participants were 97 (62.8% women, 37.1% men) undergraduate students at Auburn University. After receiving permission from the department, the investigator contacted instructors of College of Education undergraduate counseling classes to ask permission to recruit students from their classes for participation in the study. The instructors agreed, and students from four classes were recruited. Participants ranged in age from 18 to 27 (mode = 19 years, *SD* = 1.43 years) and identified as 77.3% Caucasian/White, 16.5% African American/Black, 2.1%

Asian American/Pacific Islander, 2.1% Hispanic or Latino(a), and 1% Other. The participants were all completing their undergraduate education. First year students represented 53.6% of participants, sophomore students 28.9%, juniors 7.2%, seniors 9.3% and fifth years or above 1%. The majority of the participants were full time students (96.9%), were living independently from their parents (91.8%), did not reside with a child for whom they were the primary caretaker (100%), and did not live with a roommate in the same room (71.1%). They reported their college GPAs to range from 1.60 to 4.00 ( $M = 2.99$ ,  $SD = .50$ ) and high school GPAs to range from 1.70 to 4.40 ( $M = 3.66$ ,  $SD = .40$ ). The participants reported their sexual orientation to be majority (81.4%) heterosexual, with 19.6% reporting their sexual orientation to be gay male, lesbian, asexual, other or declining to answer. A majority of participants (80.4%) reported their relationship status to be single with 19.6% stating that they were in a relationship (i.e., no individuals reported being co-habiting, married, or divorced). For their place of residence, 49.5% of the participants reported living in a dorm room, 38.1% in an off-campus apartment, 11.3% in an off-campus house, and 1% in an on-campus apartment. Four individuals reported that they had been diagnosed with a sleeping disorder and were excluded from consideration for participation in the intervention. Each group was comprised of individuals with fairly similar demographics (with the exception of the Treatment 1 group having equal numbers of men and women), as is detailed below.

**Treatment 1 Group.** There were eight individuals in the Treatment 1 group (50% women, 50% men). With regard to ethnicity, 87.5% of participants identified as Caucasian/White and 12.5% identified as African American/Black. With regard to age, five participants (62.5%) reported their age to be 19, two (25%) reported their age to be 20, and one (12.5%) reported being 18 years old. Six of the participants (75%) reported being first-year college students, one

(12.5%) reported being a sophomore, and one (12.5%) reported being a senior. With regard to their residence, half (50.0%) of the participants reported residing in a dorm room and half (50.0%) reported residing in an off-campus apartment. Two individuals reported residing with roommates in the same room (25.0%) while six reported that they resided alone in their rooms (75.0%).

**Treatment 2 Group.** Sixty-three individuals comprised the Treatment 2 group (61.9% women, 38.1% men). With regard to ethnicity, 74.6% of participants identified as Caucasian/White, 17.5% as African American/Black, 3.2% as Asian American/Pacific Islander, and 1.6% as Hispanic or Latino(a), Other, or unreported. Participants in the Treatment 2 group ranged in age from 18 to 25, with a modal age of 19. With regards to year in school, 52.4% reported being a first-year college student, 30.2% a sophomore, 6.3% a junior, 9.5% a senior, and 1.6% a fifth year or above. With regard to their residence, 52% reported residing in a dorm room, 33.0% in an off-campus apartment, and 14.3% in an off-campus house. A majority of the participants in Treatment 2 group (68.3%) reported residing alone, with 31.7% reporting residing with a roommate in the same room.

**Control Group.** Twenty-six individuals comprised Control group (69.2% women, 30.8% men). With regard to ethnicity, 80.8% of participants identified as Caucasian/White, 15.4% as African American/Black, and 3.8% as Hispanic or Latino(a). Participants in the Control group ranged in age from 18 to 27, with a modal age of 19. With regard to year in school, 50.0% reported being a first-year college student, 30.8% a sophomore, 11.5% a junior and 7.7% a senior. With regard to their residence, 46.2% reported residing in an off-campus apartment, 42.3% in a dorm room, 7.7% in an off-campus house, and 3.8% in an on-campus apartment. A

majority of the participants in Control group (76.9%) reported residing alone while 23.1% reported residing with a roommate in the same room.

## **Measures**

**Initial Screening Measure.** A Wellness Survey was created as an initial screening measure to assess individuals' subjective distress regarding sleep. Participants were asked to rate on a scale of 1 (*very poor*) to 10 (*very good*) their perception of their overall health, general sleep quality, general physical fitness, general nutrition habits, and general motivation to succeed academically. Only the response to the question of general sleep quality was considered in selecting a group of students who would be eligible to participate in the intervention. Appendix A contains the Wellness Survey.

**Demographics.** Demographic information gathered from participants included: gender, age, race/ethnicity, year in school, major, college GPA, high school GPA, type of residence (i.e., dorm, apartment, etc.), if they resided with their parents or a child who they took care of, if they resided in the same room with a roommate, and marital status. Participants were also asked if they had ever been diagnosed with a clinical sleep disorder. Individuals who responded affirmatively to this question were ruled out of participating in the intervention (i.e., Treatment 1 group) but were allowed to be members of the Treatment 2 or Control groups. Appendix C contains the Demographic Questionnaire.

**Pittsburgh Sleep Quality Index.** Self-reported sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The PSQI is a 19 item measure that assesses seven components of sleep quality for the previous one-month time period (Buysse et al., 1989). The first four items are open ended and ask the participant to record their usual sleep and wake times, as well as typical sleep latency and

duration (e.g.: “During the past month, when have you usually gone to bed at night?”). For the remaining 14 items, participants are asked how often they experience different symptoms of sleep disturbance such as “Wake up in the middle of the night or early morning” and “How often have you had trouble staying awake while driving, eating meals, or engaging in social activities?” (Buysse et al., 1989). These responses are rated on a four-point scale (*not during the past month, less than once a week, once or twice a week, or three or more times a week*). The 19 items are broken down into seven component subscales (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime functioning) which are scored from 0 to 3 (Buysse et al., 1989). The component scores are then summed to create one global score of sleep quality, with a range of 0 to 21 (Baron, Reid, & Zee, 2013; Buysse et al., 1989). A higher PSQI score is indicative of sleep disturbance, with scores  $\geq 5$  typically associated with a clinical sleep disturbance (Baron et al., 2013; Buysse et al., 1989).

In the study of the measure’s development, the PSQI had an internal reliability coefficient (Cronbach’s  $\alpha$ ) of 0.83 for global index of sleep quality, indicating a high degree of internal consistency between the components (Buysse et al., 1989). The seven component scores demonstrated a more modest internal reliability, with Cronbach’s  $\alpha$  coefficients ranging from 0.85 for Habitual Sleep Efficiency to 0.46 for Sleep Disturbance (Buysse et al., 1989). Additionally, the test-retest reliability over a one-month time period was demonstrated to be 0.85 for the global score of sleep quality (Buysse et al., 1989). Finally, Buysse and colleagues (1989) reported that the cutoff score of 5 or greater on the global sleep quality score correctly identified 88.5% of the clinical patients and control participants in their sample ( $\kappa = 0.75, p < 0.001$ ), representing a sensitivity of 89.5% and a specificity of 86.5%.

As indicated by Brown and colleagues (2002), the PSQI has been utilized in a number of studies to measure sleep quality and has increasingly been used when studying the college student population. Therefore, the PSQI represents a well-established measure with demonstrably good reliability and validity that is appropriate for use with the college student population (Brown et al., 2002). Appendix D contains the PSQI.

**Epworth Sleepiness Scale.** Self-reported daytime sleepiness was assessed using the Epworth Sleepiness Scale (ESS; Johns, 1991). The ESS is composed of eight items representing different situations of daily life in which a person might become sleepy, such as “Watching TV,” “Sitting quietly after a lunch without alcohol,” and “As a passenger in a car for an hour without a break” (Johns, 1991). Participants then rate their tendency to become sleepy in these situations on a scale of 0 (*no chance of dozing*) to 3 (*high chance of dozing*). The score is summed for a total between 0 and 24, with higher scores indicating increased sleepiness (Baron et al., 2013; Johns, 1991). Specifically, scores from 0 to 9 indicate an average amount of daytime sleepiness, scores from 10 to 15 indicate moderate daytime sleepiness, and scores 16 or over indicate excessive daytime sleepiness that may require medical attention (Johns, 1991).

The ESS has demonstrated reliable ability to distinguish between groups of patients with known differences in their levels of sleepiness as measured by the Multiple Sleep Latency Test ( $F = 50.00$ ;  $df = 6,173$ ;  $p < 0.0001$ ), and correlates significantly with daytime and nighttime sleep latency (Johns, 1991). In a study of medical students, the test-retest reliability coefficient of the ESS over a five-month time period was found to be 0.82 (Johns, 1992; Knutson, Rathouz, Yan, Liu, & Lauderdale, 2006). In this same study, internal consistency was demonstrated to have an alpha of 0.73 for the medical students and 0.88 for a sample of various sleep disorder patients, thus demonstrating an adequate level of consistency between the eight items of the measure

(Johns, 1992). Additionally, a factor analysis performed on the data demonstrated that the ESS only measures one variable (i.e., daytime sleepiness) for both the student and the patient groups (Johns, 1992). Appendix D contains the Epworth Sleepiness Scale.

**Adolescent Sleep Hygiene Scale.** Storfer-Isser, LeBourgeois, Harsh, Tompsett, and Redline (2013) developed the Adolescent Sleep Hygiene Scale in order to assess theoretically based sleep hygiene domains that are thought to be related to better quality and quantity of sleep. The scale was normed using a sample of 16 to 19 year-olds ( $M = 17.7$ ) and is thus appropriate for the age group represented in this study. The scale is a 33 item scale and is divided into eight subscales to represent different domains of sleep hygiene (i.e., physiological, cognitive, emotional, sleep environment, sleep stability, substance use, daytime sleep, and having a bedroom routine; Storfer-Isser, LeBourgeois, Harsh, Tompsett, & Redline, 2013). Examples of such items are: “During the day, I take naps that last more than 1 hour,” “After 6:00 in the evening, I drink beer (or some other drinks with alcohol),” “I fall asleep while watching TV,” and “I go to bed feeling upset”. Individuals respond to the items by on a six-point scale, indicating how frequently they engage in each behavior (i.e., 0%- *never* to 100%- *always*). Each response is assigned a number i.e., *never*- 6 points to *always*- 1 point) and items are summed (Stofer-Isser et al., 2013). A few items that are included on the measure for the theoretical interest of the scale developers are not incorporated into the total score (ex: “During the school week, I “sleep in” more than 1 hour past my usual wake time). One item is reversed coded. Scores for the subscales are calculated by averaging the items on the subscale and taking a mean of the subscale scores to create a total sleep hygiene score (Storfer-Isser et al., 2013) with higher scores indicating more successful utilization of the different domains of sleep hygiene practices (Stofer-Isser et al., 2013).

Stofer-Isser et al. (2013) conducted a confirmatory factor analysis for the Adolescent Sleep Hygiene Scale that led to a revised factor structure with six-factors and 24 of the original items. The factors were physiological, behavioral arousal, cognitive/emotional, sleep environment, sleep stability, and daytime sleep, which depart only slightly from the eight domains presented in the measure. The Adolescent Sleep Hygiene Scale was demonstrated to have a higher internal consistency than previously published measures of sleep hygiene ( $\alpha = 0.84$ ) and acceptable internal consistency on the subscales, ranging from  $\alpha = 0.60$  (physiological) to  $\alpha = 0.81$  (cognitive/emotional). Stofer-Isser et al. (2013) demonstrated that the measure and its subscales were adequately correlated with numerous sleep outcome measures (ex: less daytime sleepiness,  $r = -0.26$ ) as well as behavioral problems and school competency (ex: internalizing and externalizing behaviors,  $r$ 's =  $-0.22$ ; school competency,  $r = 0.25$ ). Importantly, the sleep environment domain was associated with multiple problems such as lower sleep efficiency and greater daytime sleepiness, pointing to the criticalness of this aspect of sleep hygiene (Stofer-Isser et al., 2013). Appendix D contains the Adolescent Sleep Hygiene Scale.

**Clinical Outcomes in Routine Evaluation Outcome Measure.** General psychological wellness was assessed using the Clinical Outcomes in Routine Evaluation Outcome Measure (CORE-OM), a 34-item general (i.e., pan-theoretical and pan-diagnostic) measure of psychological distress (CORE, 2016). The measure includes four subscales to assess subjective well-being (four items), symptoms experienced (12 items), general life functioning (12 items), and risk of harm (six items). Individuals answer all items using a 5-point scale that ranges from 0 (*not at all*) to 4 (*most of the time*). Examples of such items include, “I have felt OK about myself” (well-being), “I have felt tense, anxious or nervous” (symptoms), “I have felt able to cope when things go wrong” (functioning), and “I have thought of hurting myself” (risk). Each

subscale is averaged to produce a mean score that can be used to indicate current psychological distress (CORE, 2016). A score of 2.0 or below on a subscale mean is considered below the clinical cut-off score (i.e., in a healthy range; CORE, 2016).

Evans and colleagues (2002) conducted a study to determine the validity and reliability of the measure in both clinical and non-clinical samples. Internal reliability of the measure was found to be between 0.75 and 0.95 for all subscales as well as the full scale (Evans et al., 2002). Test-retest reliability was found to be between 0.87 and 0.91 for all domains except the risk of harm domain (i.e., 0.64); as risk of harm is by nature reactive and situational, this outcome was not wholly unexpected. Evans et al. (2002) compared the CORE-OM to a number of various measures of psychological functioning and found appropriate correlations that suggest good convergent validity. An exploratory principal-component analysis revealed that the items group into three components: problems, risk, and positively worded items (Evans, 2002). The positively worded items likely consist of the items on the subjective well-being and general life functioning subscales. Evans et al. (2002) conclude that the CORE-OM is a reliable and valid instrument to use with an adult population to assess for psychological well-being. Appendix D contains the CORE-OM.

**Sleep Diary.** The National Sleep Foundation provides a Sleep Diary on their website (<http://sleepfoundation.org/content/nsf-official-sleep-diary>) for individuals who wish to track their sleep (National Sleep Foundation, 2014a). The diary briefly explains to users the importance of sleep and provides a few instructions, including that the diary requires only a few minutes a day to complete and that the diary can help a person identify patterns in their sleep habits. The diary itself is separated out into two sections, a “Morning” and an “End of Day” section. The morning section, containing nine questions, first asks for the starting date and for

the individual to label which day of the week is “Day 1,” “Day 2,” etc. (National Sleep Foundation, 2014a). Two questions ask the individual to report a time of day for “I went to bed last night at” and “I got out of bed this morning at”. Next, an item states “Last night I fell asleep” and individuals have the choice of three responses (i.e., *easily*, *after some time*, *with difficulty*). Three free-response questions are then asked, namely, “I woke up during the night” (with options for “# of times” and “# of minutes”), “Last night I slept a total of”, and “My sleep was disturbed by”. Then individuals respond to “When I woke up for the day, I felt” and have three response options (i.e., *refreshed*, *somewhat refreshed*, *fatigued*). Lastly, individuals have the option to record any other notes that they believe may have a bearing on their sleep (National Sleep Foundation, 2014a).

The “End of Day” section is formatted similarly to the “Morning” Section and also contains nine questions. First, individuals again label which day of the week corresponds to “Day 1,” “Day 2,” etc. Next, three free-response questions are asked, namely, “I consumed caffeinated drinks in the” with options for *morning*, *afternoon*, *evening*, *n/a* and a space to answer “How many?”, “I exercised at least 20 minutes in the” with options for *morning*, *afternoon*, *evening*, *n/a*, and “Medications I took today” (National Sleep Foundation, 2014a). The next three questions assess for different daytime activities, such as “Took a nap” (with individuals responding *yes* or *no*, and “If Yes, for how long?”), “During the day, how likely was I to doze off while performing daily activities” (with response choices of *no chance*, *slight chance*, *moderate chance*, *high chance*), and “Throughout the day, my mood was” (with four options, i.e., *very pleasant*, *pleasant*, *unpleasant*, *very unpleasant*). Participants then respond to “Approximately 2-3 hours before going to bed, I consumed” with four response options (i.e., *alcohol*, *a heavy meal*, *caffeine*, *not applicable*). Lastly, individuals can freely respond to “In the hour before going to

sleep, my bedtime routine included” and list any activities not already addressed by the diary (National Sleep Foundation, 2014a). Appendix E contains the NSF Sleep Diary.

## **Intervention**

**Educational Component.** At the outset of the study, participants in both the Treatment 1 and Treatment 2 groups received a lecture from the investigator on the topic of the importance of sleep and sleep hygiene (Appendix F). This lecture contained information gleaned from the investigator’s research on sleep as well as through discussions with knowledgeable sleep experts (e.g., dissertation chair faculty member). The information provided the participants with a basic understanding of what sleep is (i.e., stages, components), the importance of sleep for physical health, mental health and academic performance, how much sleep young adults need and reasons why many young adults are sleep deprived, as well as numerous examples of sleep hygiene practices and common sleep disorders.

**Individual Feedback Sessions.** In addition to the educational component of the intervention, participants in the Treatment 1 group participated in four feedback sessions with the investigator which served as the individualized sleep hygiene intervention program. The three key elements to the intervention were weekly completion of the sleep diaries, weekly feedback from the investigator about the sleep diaries, and utilization of the spirit of motivational interviewing during the meetings. A manual for this intervention was not created, as the individualized nature of the four sessions did not allow for the sessions to be scripted; therefore, the intervention cannot be said to be a “standardized” treatment. However, each session followed a general pattern, with similar themes discussed across participants, as can be seen below in Table 2.

The first session was an assessment session and lasted approximately one hour for all participants. During this meeting, the investigator discussed with the individual his or her difficulties with sleep and sleep hygiene, goals for changing sleep habits, and motivation for change. Through this discussion, the individual's motivation for change was subjectively assessed by the investigator, who paid particular attention to use of "change talk" (i.e., words that indicate from the MI perspective that an individual is ready and willing to make changes to a behavior). However, no objective measure of motivation for change was given to the individuals. At the end of the meeting, participants were given sleep diaries and taught how to use them (Appendix E). Participants completed one sleep diary for each of the three remaining weeks of the study. These diaries were the focus of meetings two through four, which each lasted approximately 20-30 minutes. The sleep diary acted as a behavioral monitoring device for the individuals, as daily recordings of the sleep variables obliged the participants to be more aware of their sleep habits on a daily basis. During the sessions, the investigator examined the sleep diary in detail with the participant and discussed progress towards goals, strategies for addressing each individual's particular sleep concerns, and any changes in motivation for changing their behaviors, constituting the individualized feedback element of the intervention.

Lastly, the investigator incorporated the components of the spirit of motivational interviewing, i.e., partnership, acceptance, compassion, and evocation, during these meetings to help facilitate the individuals' motivation for the desired change in sleep behavior (Miller & Rollnick, 2004; Miller & Rollnick, 2013; Rollnick & Miller, 1995). Specifically, time was spent in the sessions engaging with the participants, focusing the conversations towards specific sleep related problems, evoking change talk and personal motivation from the participants, and when applicable, planning together specific actions that each individual could take in changing their

sleep hygiene, following the natural progression of the phases of MI and the stages of change (Miller & Rollnick, 2013; Norcross et al., 2011). However, as the intervention was not created to be a strict motivational interviewing brief therapy, treatment fidelity to the style of motivational interviewing was not assessed as part of this study.

**Table 2: Content of the Individual Sleep Hygiene Intervention Program Feedback Sessions**

Week 1	Rapport building Assessment of sleep difficulties Assessment of motivation to change problematic behaviors Co-creation of goals for changing behavior Introduction of deep breathing/relaxation exercise (some participants as applicable) Overview of how to use sleep diary
Week 2	Personal feedback from investigator about sleep diary Adjustment of goals as necessary Completion of mid-point evaluation
Week 3	Personal feedback from investigator about sleep diary Adjustment of goals as necessary
Week 4	Personal feedback from investigator about sleep diary Discussion of long-term goals Discussion of utility of the study

## Procedure

**Phase 1.** After receiving approval for the study from the Auburn University Institutional Review Board (IRB), participants were recruited through four College of Education undergraduate counseling classes taught by instructors other than the investigator; all students in these classes were asked to participate in the study. All students who agreed to the initial participation (73% of those recruited) read and signed the informed consent letter (Appendix B) and answered the demographic questionnaire (Appendix C). All participants were then given the initial screening questionnaire, the Pittsburgh Sleep Quality Index, the Epworth Sleepiness Scale, the Adolescent Sleep Hygiene Scale, and the CORE-OM to complete at the beginning of a class period (Appendix D). All students were awarded extra-credit points in their counseling class for completing these measures. The investigator contacted individuals who reported having poor

subjective sleep quality on their screening questionnaire and asked if they were interested in completing the second phase of the study, the individualized intervention. Students were offered a chance to win a JawBone fitness tracker in a raffle for phase 2 participation. The following week, the investigator presented a 50-minute lecture (Appendix F) on sleep hygiene to three of the four counseling classes, which had been previously designated as the Treatment 2 classes.

**Phase 2.** All individuals who responded to the investigator's request to participate in phase 2 (i.e., nine students, 9% of the sample) began the intervention phase of the study a week after receiving the sleep hygiene lecture. The investigator contracted with them to have four individual feedback sessions, once per week over a month's time (which fell at the end of the spring semester). One student was not able to continue meeting after the first session and did not participate further in phase 2. Thus, there were a total of eight students who completed the intervention and comprised the Treatment 1 group. At the end of the second meeting, the individuals completed the questionnaire packet to provide a mid-intervention comparison point.

**Phase 3.** Participants in all three groups completed the questionnaire packet again in class at the end of the intervention period to provide a post-intervention comparison point. The Treatment 1 group individuals were also contacted three months after the last feedback session and asked to provide a final comparison point.

### **Statistical Analyses**

The data was analyzed using the SPSS statistical package. Several mixed methods repeated measures ANOVA tests were run to compare the changes over time on the PSQI, ESS, ASHS, and CORE-OM between the three groups. Post-hoc tests were run when significant and marginally significant differences were found.

One-way repeated measures ANOVA tests were also run for just the Treatment 1 group to measure changes on these measures during the evaluation (using pre-test, mid-point, and post-test) as well as after the intervention (using pre-test, mid-point, post-test, and follow-up). Post-hoc tests were run when significant differences were found.

Sleep diary data from the individuals in the Treatment 1 group were analyzed graphically to examine information not captured by the previously mentioned outcome measures and to study variables unique to each individual's sleep related difficulties. This information includes (but is not exclusive to) such variables as sleep latency, sleep-wake times, and refreshment upon waking.

## IV. Results

### Overview

The following chapter reports the results of analyses used to test the study's hypotheses. First, numerous simple correlations between the four major variables of sleep quality, daytime sleepiness, sleep hygiene, and psychological well-being, as well as other important variables from the measures for both the pre-test and the post-test assessments are presented. Second, the results of several one-way analysis of variance (ANOVA) tests are given to determine equivalence of groups at the beginning of the intervention. Then, statistics that describe various elements of the sample based upon specific questions within the measures are reported, along with each measures' reliability at pre-test and post-test. To test Hypothesis 1, the results of several mixed methods repeated measures ANOVAs comparing the outcome measures at pre-test and post-test for the full sample are presented. To test Hypothesis 2, the results of several repeated measures ANOVAs that examined only the Treatment 1 group's outcomes on the measures from pre-test through three-month follow-up are given. Finally, to test Hypothesis 3, each of the participants in the Treatment 1 group are briefly described, with their goals for change stated and their progress towards those goals displayed graphically.

### Simple Correlations Between Variables

Correlations were computed between total scores for each of the measures used as well as between certain variables of interest from the measures with data from all of the participants ( $N = 97$ ). The most pertinent are presented below. Tables 2 (pre-test results) and 3 (post-test results) display matrices of the various correlations.

**Pre-test.** At the start of the intervention, contrary to expectations, a positive correlation was found between self-reported hours of sleep a night on the PSQI and sleep quality, as

assessed by the global PSQI score ( $r = 0.444, p < 0.001$ ), such that the more hours of sleep participants reported, the lower their reported sleep quality (i.e., as sleep quality is measured by an instrument that provides higher scores to define poorer sleep quality). Negative correlations were found to exist between the sleep stability subscale on the ASHS and sleep quality, as well as number of hours of sleep a night ( $r = -0.267, p = 0.008$ , and  $r = -0.261, p = 0.010$ , respectively), such that individuals reporting less stability in their sleep duration from night to night also had lower sleep quality and slept fewer hours per night. Sleep stability was positively correlated with utilization of sleep hygiene practices, as measured by the total ASHS score ( $r = 0.238, p = 0.019$ ). Therefore, individuals reporting greater stability in their sleep from night to night also reported better utilization of sleep hygiene practices. Contrary to expectations based on past research, sleep quality was not significantly related to sleep hygiene practices ( $r = -0.079, ns$ ) nor was it significantly related to psychological well-being as assessed by the total CORE-OM score ( $r = 0.078, ns$ ). Daytime sleepiness, as assessed by the total ESS, was negatively correlated with sleep hygiene ( $r = -0.328, p = 0.001$ ), such that greater daytime sleepiness was related to less utilization of sleep hygiene practices. Daytime sleepiness was found to positively correlate with sleep quality, ( $r = 0.241, p = 0.017$ ), such that the better quality of sleep individuals reported, the less daytime sleepiness they reported.

**Table 3: Pre-Test Correlation of Measures for the Full Sample**

Variable	1	2	3	4	5	6
1. Global PSQI						
2. Hours of Sleep	.444***					
3. Sleep Stability	-.267**	-.261**				
4. Total ESS	.241**	-.043	-.232**			
5. Total ASHS	-.079	-.051	.238**	-.328***		
6. Total CORE-OM	.078	.008	.015	.208*	-.704	

*Note:* PSQI = Pittsburgh Sleep Quality Index. ESS = Epworth Sleepiness Scale. ASHS = Adolescent Sleep Hygiene Scale. CORE-OM = Clinical Outcomes in Routine Evaluation Outcome Measure. \* $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ .

**Post-test.** At the finish of the intervention, reported hours of sleep a night and sleep quality were again found to be positively correlated ( $r = 0.279$ ,  $p = 0.006$ ), again suggesting that the more sleep individuals reported, the worse their sleep quality, contrary to expectations. Further, sleep quality was positively correlated with daytime sleepiness, suggesting that individuals reporting better sleep quality had higher levels of daytime sleepiness, also contrary to expectations ( $r = 0.247$ ,  $p = 0.015$ ). However, sleep quality was negatively related to sleep stability from night to night ( $r = -0.256$ ,  $p = 0.009$ ), such that individuals' reported sleep quality increased as their sleep stability increased. Sleep quality was negatively correlated to sleep hygiene, such that individuals' reported sleep quality improved as their utilization of sleep hygiene improved ( $r = -0.391$ ,  $p < 0.001$ ). Sleep quality was positively correlated with psychological well-being ( $r = 0.404$ ,  $p < 0.001$ ) as well as significantly and positively correlated with each of the CORE-OM subscales (see Table 3), suggesting that greater psychological well-being was associated with better sleep quality. Daytime sleepiness was found to be negatively correlated with sleep hygiene ( $r = -0.369$ ,  $p < 0.001$ ), such that better utilization of sleep hygiene was associated with less daytime sleepiness. Daytime sleepiness was positively correlated with psychological well-being ( $r = 0.305$ ,  $p < 0.001$ ), suggesting that less daytime sleepiness is related

to better psychological well-being. Finally, sleep hygiene was negatively correlated to psychological well-being ( $r = -0.433, p < 0.001$ ), as well as significantly negatively correlated with each of the CORE-OM subscales (see Table 3), suggesting that better sleep hygiene utilization is associated with better psychological well-being.

**Table 4: Post-Test Correlation of Measures for the Full Sample**

Variable	1	2	3	4	5	6	7	8	9	10
1. Global PSQI										
2. Hours of Sleep	.279**									
3. Sleep Stability	-.265**	-.034								
4. Total ESS	.247*	.200*	-.149							
5. Total ASHS	-.391***	-.137	.556***	-.369***						
6. Well-Being Subscale	.280**	.226*	-.178	.260**	-.405***					
7. Problems Subscale	.397***	.264**	-.163	.300***	-.407***	.733***				
8. Life-Functioning Subscale	.301**	.152	-.071	.273**	-.363***	.797***	.732***			
9. Risk of Harm Subscale	.207*	.037	.058	.139	-.266**	.380***	.389***	.486***		
10. Total CORE-OM	.404***	.236	-.150	-.43***	-.433***	.870***	.903***	.919***	.552***	

*Note:* PSQI = Pittsburgh Sleep Quality Index. ESS = Epworth Sleepiness Scale. ASHS = Adolescent Sleep Hygiene Scale. CORE-OM = Clinical Outcomes in Routine Evaluation Outcome Measure. \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

### Equivalence of Groups

Several one-way analysis of variance (ANOVA) tests were conducted to establish equivalence of groups (i.e., Treatment 1, Treatment 2, and Control) on the outcome measures at the start of the intervention, as participants were not randomly assigned into groups.

On the pre-test, a one-way ANOVA revealed that the three groups were equivalent on sleep quality (i.e., global PSQI),  $F(2, 94) = 0.260, ns$ , daytime sleepiness (i.e., total ESS),  $F(2, 94) = 0.766, ns$ , and use of sleep hygiene (i.e., total ASHS),  $F(2, 94) = 0.706, ns$ . However, a one-way ANOVA revealed that the three groups were significantly different on psychological well-being at pre-test (i.e., total CORE-OM),  $F(2, 93) = 6.051, p = 0.003$ . Post-hoc follow up tests using the Tukey HSD comparison found the Treatment 1 group to have lower psychological well-being than both the Treatment 2 and Control groups. Therefore, the groups were found to be

largely equivalent at the beginning of the intervention with the exception that the Treatment 1 group (i.e., self-reported poor sleepers) were also somewhat lower in psychological well-being than the other two groups.

### **Description of Measures**

This section presents the reliability of each of the measures and various sample statistics based upon items of interest within the measures.

**PSQI.** For this sample, reliability of the PSQI at pre-test was  $\alpha = 0.606$  ( $M = 37.075$ ,  $SD = 12.034$ ), which is markedly lower than has been found in previous research (i.e.,  $\alpha = 0.83$  in Buysse et al., 1989). Only 44.3% of the participants reported that they go to sleep before midnight each night, with 66% of the participants taking 15 minutes or more to fall asleep once in bed. Further, in assessing sleep duration, 53.6% of participants reported sleeping for over 7 hours a night, with 46.4% reporting sleeping 7 hours or less every night, similar to rates reported in other studies. Of the various reasons for getting poor sleep, individuals reported the most difficulty with waking up during the night, with 53.6% reporting waking up during the night more than once a week. However, 81.4% of the individuals reported that their overall subjective sleep quality was “very good” or “fairly good”. Daytime dysfunction can be conceptualized as similar to daytime sleepiness; 66% of the sample admitted to a small amount of daytime dysfunction. In looking at overall sleep quality, 39.1% of the individuals were found to be healthy sleepers, while 60.9% were found to be poor sleepers, according to the clinical cutoff.

The reliability of the PSQI at post-test was  $\alpha = 0.722$  ( $M = 11.083$ ,  $SD = 5.467$ ), which is considered to be adequate reliability (i.e., an  $\alpha$  of 0.70 or higher). At the end of the intervention, only 37.1% of participants reported going to sleep before midnight each night, with 52.6% of participants taking 15 minutes or more to fall asleep once in bed. In examining sleep duration,

50.5% reported sleeping for over 7 hours a night and 49.5% reported sleeping 7 hours or less a night. Of the various possible causes of sleep disturbance, individuals again reported having the most trouble with waking up during the night, with 45.4% reporting waking up during the night more than once a week. Nonetheless, 86.6% of individuals rated their subjective sleep quality to be “very good” or “fairly good”, with 61.9% admitting to a small amount of daytime dysfunction. At the end of the study, 42.2% of individuals were found to be healthy sleepers according to their overall PSQI and 57.8% to be poor sleepers.

**ESS.** The pre-test reliability for this sample was  $\alpha = 0.831$  ( $M = 18.381$ ,  $SD = 7.777$ ), an adequate reliability. At the start of the intervention, 56.7% of the participants reported an average amount of daytime sleepiness, with 36.1% and 7.2% reporting a moderate and excessive amount of daytime sleepiness, respectively.

The post-test reliability for this sample was  $\alpha = 0.798$  ( $M = 8.687$ ,  $SD = 4.183$ ), also an adequate reliability. At the end of the study, 56.7% of participants again were classified as having a normal amount of daytime sleepiness, with 38.1% and 5.2% classified as having moderate and excessive amounts of daytime sleepiness, respectively.

**ASHS.** The reliability of the ASHS at pre-test was  $\alpha = 0.789$  ( $M = 139.705$ ,  $SD = 18.280$ ), an adequate reliability. Of the individuals in this sample, 86.6% reported “sometimes” to “always” staying up an hour or more past their normal bedtime on weeknights and 91.8% on weekends. Additionally, while only 41.2% of individuals reported getting up an hour or more past their normal weekday wake times “sometimes” to “always,” 88.7% reported doing so on weekends “sometimes” to “always”. Using a ASHS mean of 4 out of 6 or higher to represent adequate to excellent sleep hygiene, 40.2% of the sample reported poor sleep hygiene and 59.8% reported adequate to excellent sleep hygiene.

At post-test, the reliability of the scale was  $\alpha = 0.818$  ( $M = 141.615$ ,  $SD = 18.913$ ), also an adequate reliability. At post-test, 88.7% of individuals reported “sometimes” to “always” staying up an hour or more past their normal weeknight bedtime and 87.6% past their normal weekend bedtimes. Further, 52.6% of individuals reported getting up an hour or more past their normal weekday wake times and 87.6% past their normal weekend wake times “sometimes” to “always”. In examining total ASHS, 36.1% of the participants reported poor sleep hygiene and 63.9% adequate to excellent sleep hygiene at the end of the study.

**CORE-OM.** The reliability of the CORE-OM at pre-test was  $\alpha = 0.939$  ( $M = 27.857$ ,  $SD = 19.334$ ), an excellent reliability. Any subscale mean on the CORE-OM of 2.0 or below is considered to be psychologically healthy. In this sample, 86.5% of individuals were in the healthy range on the well-being subscale, 84.4% on the symptoms/problems subscale, 95.8% on the life-functioning subscale, and 100% on the risk of harm subscale. According to the total CORE-OM, 94.8% of the sample fell within the healthy range for overall psychological well-being.

The reliability of the CORE-OM at post-test was  $\alpha = 0.943$  ( $M = 24.500$ ,  $SD = 18.726$ ), also an excellent reliability. At the end of the study, 87.6% of individuals were in the healthy range on the well-being subscale, 88.7% on the symptoms/problems subscale, 93.8% on the life-functioning subscale, and 100% on the risk of harm subscale. According to the total CORE-OM, 97.9% of the sample fell within the healthy range for overall psychological well-being.

### **Mixed Methods Repeated Measures Analysis of Variance Tests**

To test Hypothesis 1, several mixed methods repeated measures analysis of variance (ANOVA) tests were conducted to examine change on the outcome measures between the three groups over the time of the intervention (i.e., from pre-test to post-test for all participants).

A significant main effect for change in sleep quality (as measured by the global PSQI) over time was found, Wilks' Lambda = 0.931,  $F(1, 94) = 6.936$ ,  $p = 0.010$ . However, the interaction of time by treatment group was not found to be significant, Wilks' Lambda = 0.951,  $F(2, 94) = 2.447$ ,  $p = 0.092$ , and does not support the hypothesis that change over time in sleep quality is affected by the treatment group. However, as the interaction was approaching significance, post-hoc  $t$ -tests comparing the change in mean scores for each group from pre-test to post-test were run to determine which group may have experienced change over time. The change in sleep quality over time for the Treatment 1 group was significantly different than the change for the Treatment 2 and for the Control groups ( $t(69) = -2.039$ ,  $p = 0.045$  and  $t(32) = -2.549$ ,  $p = 0.016$ , respectively). There was not a significant difference in the change of mean scores over time between the Treatment 2 and Control groups,  $t(87) = -0.160$ , *ns*. These results suggest that the interaction, though it did not reach statistical significance, was due to the Treatment 1 group improving in their overall sleep quality over time while the Treatment 2 and Control groups maintained their overall sleep quality throughout the study, as can be seen in the figure below.

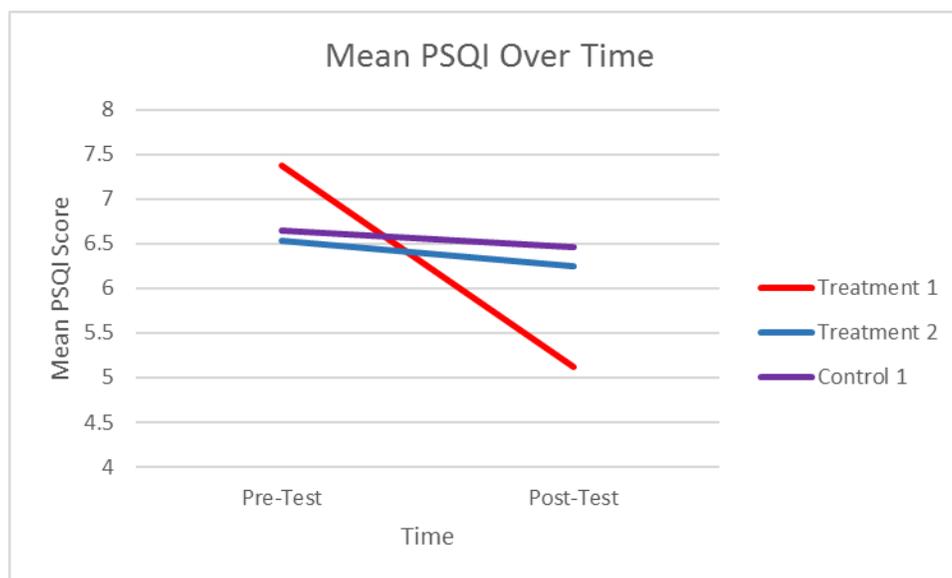


Figure 1: Mean PSQI Score Over Time

A significant main effect for change in daytime sleepiness (as measured by the total ESS) over time was also found, Wilks' Lambda = 0.935,  $F(1, 94) = 6.574$ ,  $p = 0.012$ . However, the interaction of time by treatment group was not found to be significant, Wilks' Lambda = 0.951,  $F(2, 94) = 2.436$ ,  $p = 0.093$ , and does not support the hypothesis that change over time in daytime sleepiness is affected by the treatment group. However, as the interaction was approaching significance, post-hoc  $t$ -tests comparing the change in mean scores for each group from pre-test to post-test were run to determine which group may have experienced change over time. The change in daytime sleepiness over time for the Treatment 1 group was significantly different than the change for the Treatment 2 and for the Control groups ( $t(69) = -2.089$ ,  $p = 0.040$  and  $t(32) = -2.046$ ,  $p = 0.049$ , respectively). There was not a significant difference in the change of mean scores over time between the Treatment 2 and Control groups,  $t(87) = -0.540$ ,  $ns$ . These results suggest that the interaction, though not statistically significant, was due to the Treatment 1 group decreasing their daytime sleepiness over time while the Treatment 2 and Control groups maintained their overall daytime sleepiness throughout the study, as can be seen in the figure below.

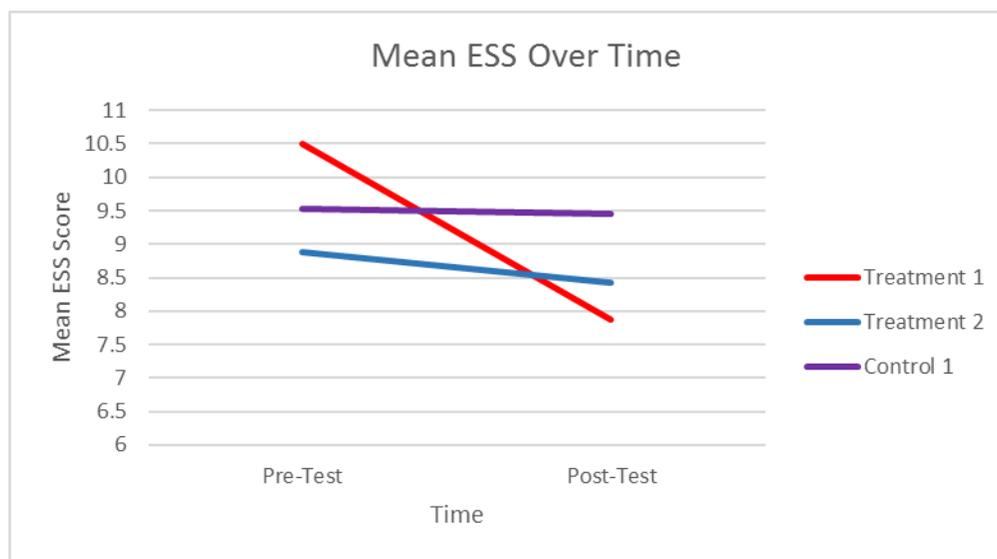


Figure 2: Mean ESS Score Over Time

A significant main effect for change in sleep hygiene over time (as measured by the total ASHS) was found, Wilks' Lambda = 0.943,  $F(1, 94) = 5.646$ ,  $p = 0.020$ . Additionally, a significant interaction of time by treatment group was also found, Wilks' Lambda = 0.848,  $F(2, 94) = 8.457$ ,  $p < 0.001$ , partial  $\eta^2 = 0.152$ . Post-hoc  $t$ -tests comparing the change in mean scores for each group from pre-test to post-test were run to determine where the interaction occurred. The change in sleep hygiene over time for the Treatment 1 group was significantly different than the change for the Treatment 2 and Control groups, ( $t(69) = 3.318$ ,  $p = 0.001$ , and  $t(32) = 2.220$ ,  $p = 0.034$ , respectively). There was also a significant difference in the change of mean scores over time between the Treatment 2 and Control groups,  $t(87) = -2.638$ ,  $p = 0.010$ . These results suggest that the interaction found was due to the Treatment 1 group improving in their use of sleep hygiene habits over time, with the Treatment 2 group slightly decreasing in their use of sleep hygiene, and the Control group slightly improving in their use of sleep hygiene over the course of the study, as can be seen in the figure below.

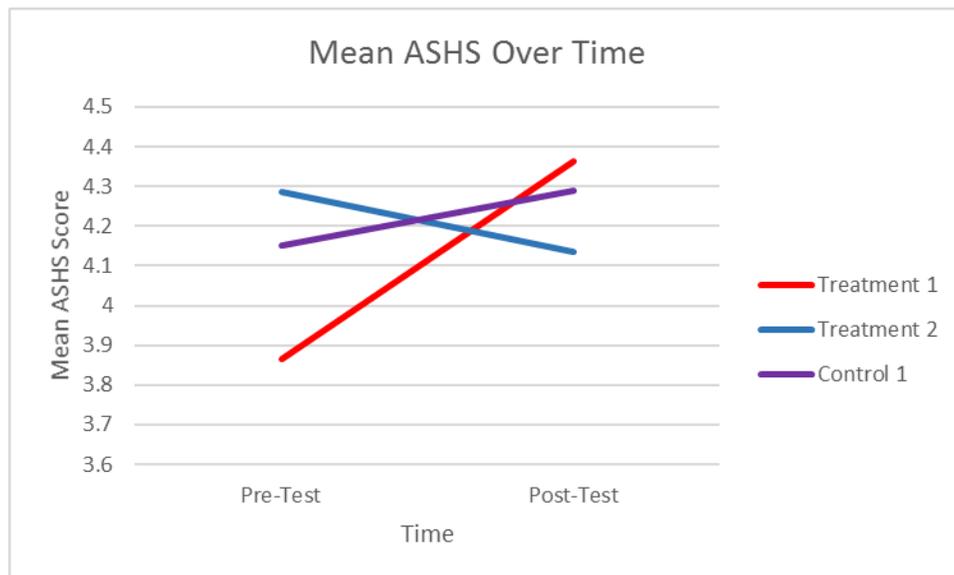


Figure 3: Mean ASHS Score Over Time

Lastly, a significant main effect for change in psychological well-being (as measured by the total CORE-OM) was found to be significant, Wilks' Lambda = 0.909,  $F(1, 93) = 9.337$ ,  $p =$

0.003. However, the interaction of time by treatment group was not found to be significant, Wilks' Lambda = 0.977,  $F(2, 93) = 1.086$ , *ns*. The change over time for psychological well-being can be seen in the figure below.

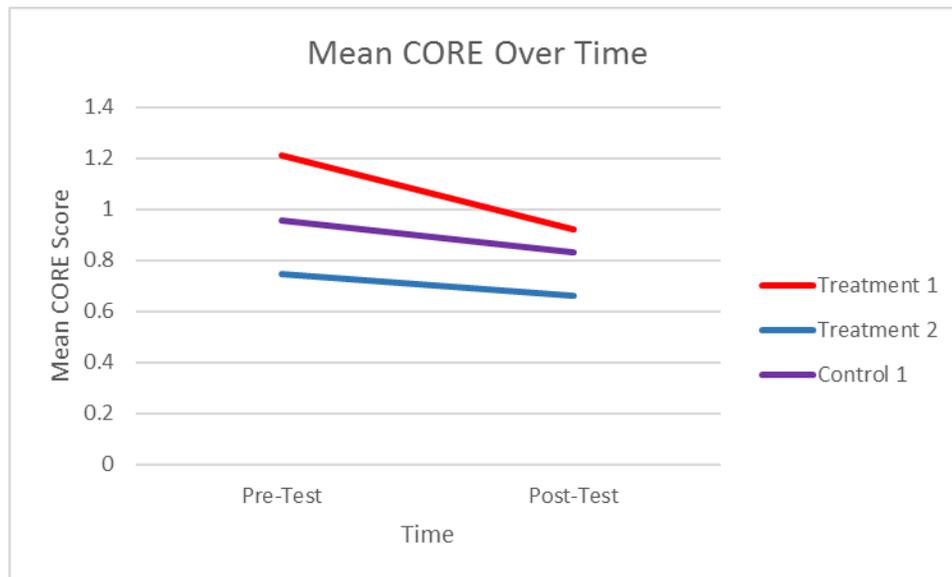


Figure 4: Mean CORE-OM Score Over Time

Overall, Hypothesis 1 was unsupported, as differences between the groups on the outcome measures over time largely failed to reach significance. However, it is clear that the Treatment 1 group did experience the most movement over time on the outcomes measures.

### Intervention Results

**Longitudinal changes.** Several one-way repeated measures analysis of variance (ANOVA) tests were conducted in order to test Hypothesis 2, that the Treatment 1 group would experience changes in their sleep outcomes over time. These longitudinal changes on the outcomes measures for the Treatment 1 group were examined by comparing the data points at the beginning of the intervention (Time 1), at the mid-point of the intervention (Time 2), and at the end of the intervention (Time 3), a time frame which spanned approximately five weeks. A three-month post-intervention (Time 4) time point is also included for follow-up comparisons.

Change in overall sleep quality throughout the intervention was assessed with a one-way repeated measures ANOVA and was found to be significant, Wilks' Lambda = 0.282,  $F(2, 6) = 7.640$ ,  $p = 0.022$ , partial  $\eta^2 = 0.718$ . Pairwise comparisons revealed that there was a significant difference between Time 1 and Time 3,  $p = 0.020$ , suggesting that the individuals in the intervention group did experience an improvement in their overall sleep quality (i.e., a lower score on the PSQI) from the beginning of the intervention to the end of the intervention, supporting Hypothesis 2. However, change in overall sleep quality after the intervention was not found to be significantly different than at pre-test despite a negative trend to the data, Wilks' Lambda = 0.273,  $F(3,3) = 2.669$ , *ns*. Therefore, the results suggest that any improvements that the intervention group made in their overall sleep quality (i.e., a better score on the PSQI) were not sustained to a significant degree three months after the intervention, contrary to Hypothesis 2.

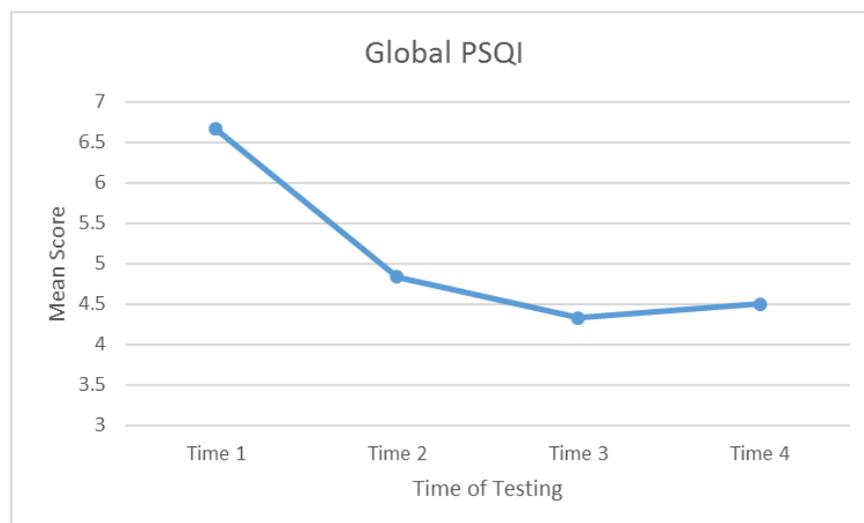


Figure 5: Estimated Longitudinal Means of PSQI for Treatment 1 Group

Change in daytime sleepiness throughout the intervention was assessed with a one-way repeated measures ANOVA and was not found to be significant, Wilks' Lambda = 0.459,  $F(2, 6) = 3.536$ ,  $p = 0.097$ . This result does not support Hypothesis 2 in that there was not a significant

change over time for daytime sleepiness for the participants in the Treatment 1 group during the intervention. Change in daytime sleepiness three months after the intervention was also not found to be significant, Wilks' Lambda = 0.356,  $F(3, 3) = 1.809$ , *ns*. This result does not support Hypothesis 2 in that there was not significant sustained change in daytime sleepiness for the participants in the Treatment 1 group after the intervention. However, the change was moving in a negative direction (as shown in the graph below) from Time 1 to Time 4, suggesting a trend towards decreased daytime sleepiness throughout the intervention and even three months later.

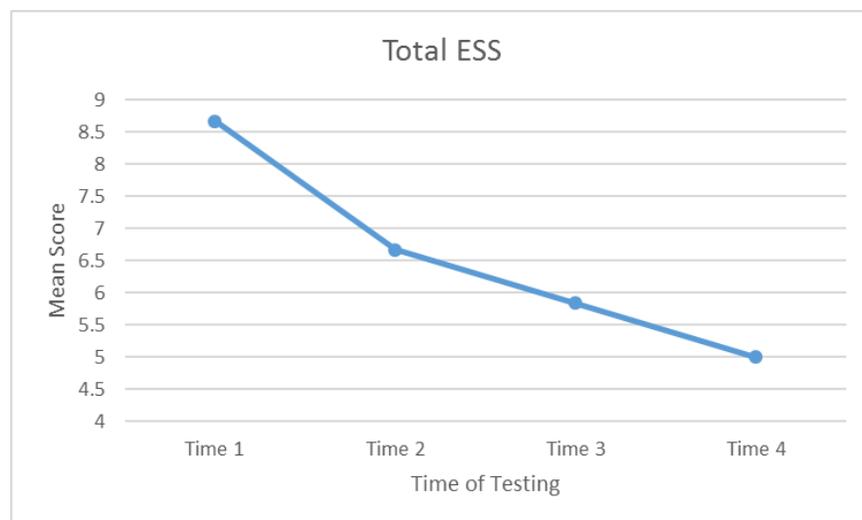


Figure 6: Estimated Longitudinal Means of Total ESS for the Treatment 1 Group

Changes in overall use of sleep hygiene practices throughout the intervention were assessed with a one-way repeated measures ANOVA and were found to be significant, Wilks' Lambda = 0.266,  $F(2, 6) = 8.287$ ,  $p = 0.019$ , partial  $\eta^2 = 0.734$ . Pairwise comparisons reveal that there was a significant difference between Time 1 and Time 2,  $p = 0.012$ . The changes appear to have maintained from Time 2 to Time 3, as there were not significant differences between these time points. The results suggest that the individuals in the intervention group did experience an improvement in their overall utilization of sleep hygiene practices over the course of the intervention, supporting Hypothesis 2. However, changes in overall use of sleep hygiene

practices after three months were not found to be significant, Wilks' Lambda = 0.135,  $F(3, 3) = 6.385$ ,  $p = 0.081$ . The change between Time 1 and Time 2, as stated above, was not found to be sustained after a three-month period, contrary to Hypothesis 2.

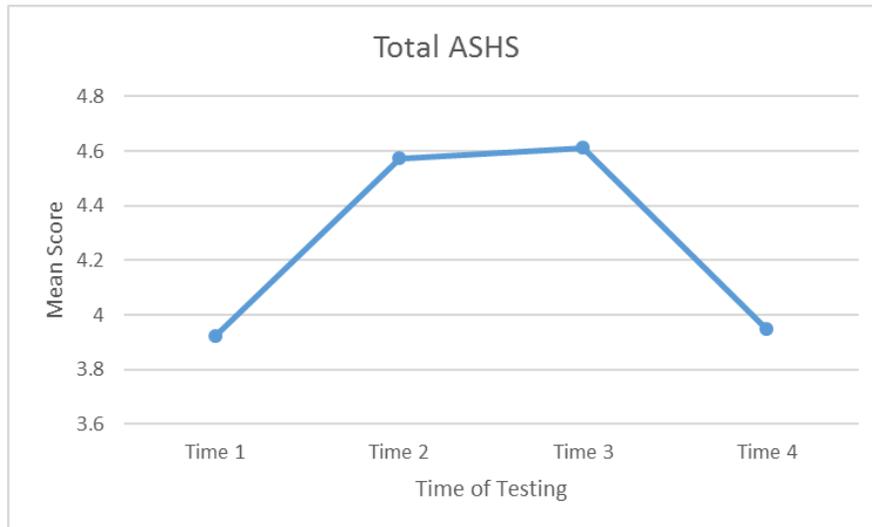
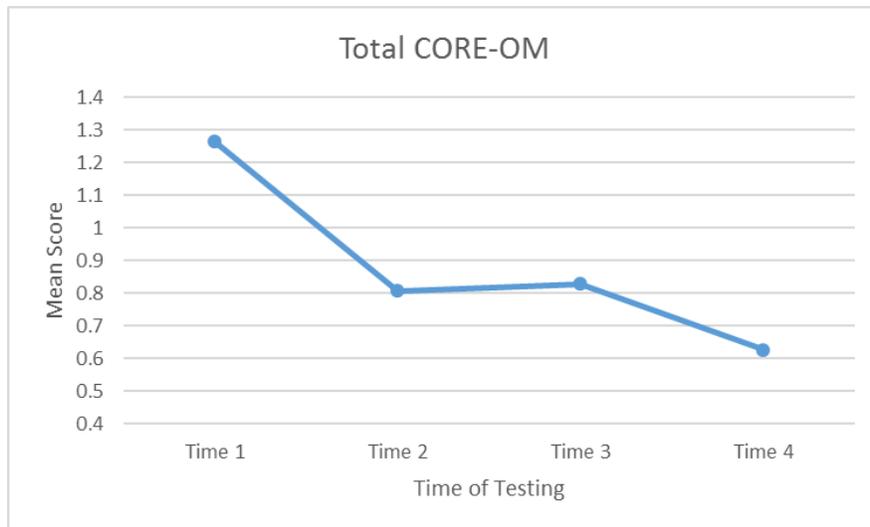


Figure 7: Estimated Longitudinal Means of ASHS for the Treatment 1 Group

Finally, changes in overall psychological well-being throughout the intervention were assessed with a one-way repeated measures ANOVA and were not found to be significant, Wilks' Lambda = 0.506,  $F(2, 6) = 2.928$ ,  $p = 0.130$ . This result does not support Hypothesis 2 in that there was not a significant change over time for overall psychological well-being for the participants in the Treatment 1 group. However, there was positive change in psychological well-being that approached significance from Time 1 to Time 2, followed by a slight (non-significant) decline in psychological well-being from Time 2 to Time 3. This finding suggests a trend towards increased psychological well-being for at least part of the intervention (as can be seen in the graph below). Changes in overall psychological well-being three-months after the intervention were not found to be significant, Wilks' Lambda = 0.340,  $F(3, 3) = 1.942$ , *ns*. This result does not support Hypothesis 2 in that there was not a sustained change over time for psychological well-being. However, change from Time 1 to Time 4, though not significant, did

move in a negative direction, thus suggesting a trend towards increased psychological well-being even after the end of the intervention.



*Figure 8: Estimated Longitudinal Means of CORE-OM for the Treatment 1 Group*

### **Individual Analyses**

Lastly, each of the participants in the Treatment 1 group are presented individually, with descriptions of the individual, his or her sleep issues, goals for the intervention, and response to the intervention detailed. Graphs of the most pertinent data from their sleep diaries as they relate to the participants' individualized problems and goals are also displayed, including bedtimes, wake times, sleep duration, sleep latency, morning refreshment, number of times awake during the night, minutes awake during the night, and daytime napping. These data points potentially reflect more accurate data than the above discussed questionnaires, as the questionnaires are subjective, retrospective self-report data and the sleep diaries, though also self-report, were used daily and thus less subject to inaccurate recall.

**Participant 1.** Participant 1 was 19-year-old male and a freshman. Participant 1 was unique in that he was already very knowledgeable about sleep and sleep hygiene. In particular, he had previously spent some time tracking his own sleep cycles, and was very conscientious in

his attempts to time his sleep-wake cycle so as not to wake up (via an alarm) during a REM stage. However, Participant 1 reported that he often felt groggy upon waking in the morning and fatigued throughout the day despite having generally adequate sleep duration. He was unwilling to go to bed any earlier than his already set bedtime, but assented to waking up ten minutes earlier and incorporating a stretching exercise into his morning routine. His goals from the beginning of the intervention were thus to remain firm in his 11 pm bedtime and to begin stretching soon after waking, which, it was hoped, would help him to feel more alert and keep him from returning to bed after taking his morning shower. During the second week, the goal of incorporating a healthy snack or light exercise in the afternoon was added to help combat what he described as a “mid-afternoon slump”.

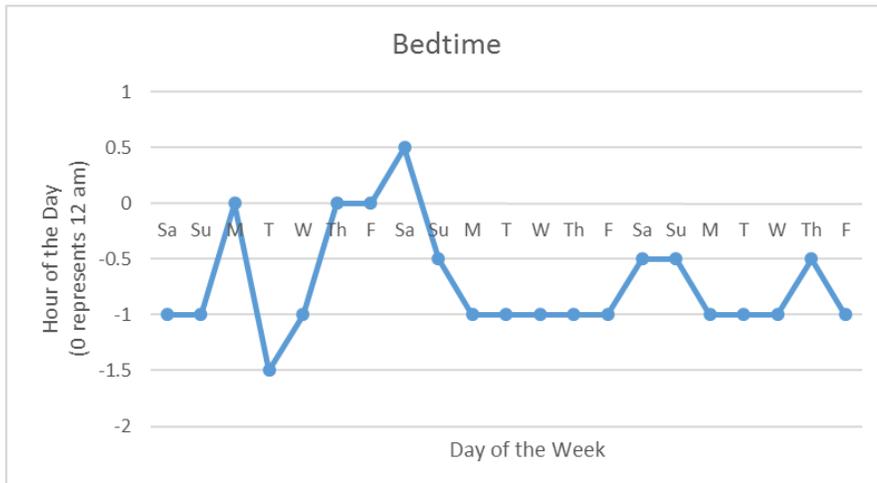


Figure 9: Sleep Diary Bedtimes for Participant 1

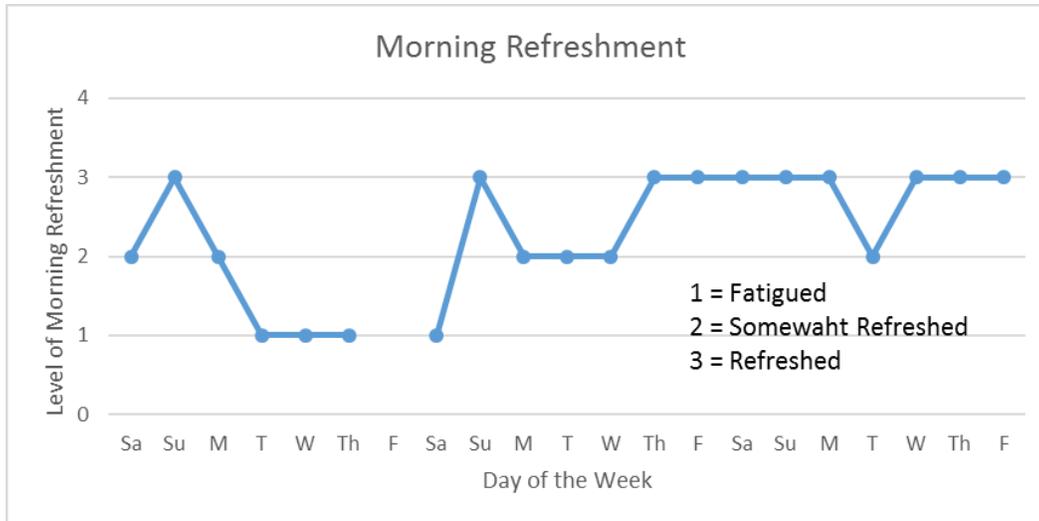


Figure 10: Sleep Diary Morning Refreshment for Participant 1

As can be seen from the above graphs, Participant 1 was able to maintain an 11 pm (i.e., graphed as -1 on the scale) bedtime throughout the intervention remarkably well. At times when his bedtime deviated from his goal, he either went to sleep earlier or was often only 30 minutes to an hour late, which often coincided with weekend nights. Participant 1 also reported a general increase in his feelings of being refreshed in the mornings, largely due to his ability to successfully incorporate stretching into his morning routine. At the end of the intervention, he indicated that the stretching helped him to feel more awake in the morning. When asked what he would take away from the study, Participant 1 responded with:

Well, I noticed that we haven't been focusing on like, planning out, how long I sleep, just, getting regular sleep. And I'm learning that that's more important for your body to get used to than planning when you can get in your certain cycles.

**Participant 2.** Participant 2 was a 19-year-old female and a freshman. She reported that she struggled some with depression and anxiety and often had difficulties with falling asleep and maintaining being asleep. Participant 2 also seemed to have little awareness of the importance of keeping a regular sleep-wake cycle, as she would vary the times she woke up in the mornings depending on her class schedule, which led to drastically different durations of sleep each night

of the week (typically ranging from 6.5 to 9.5 hours). During the first session, Participant 2 was taught basic relaxation exercises and agreed to try to utilize them before going to sleep to help her to calm some of her anxiety. She also set a goal of trying to regulate her sleep-wake cycle to increase the overall amount of sleep she received night to night. This goal was broken into two parts: first, Participant 2 set an earlier bedtime for herself, and then later she focused on waking up at a similar time each day.

As can be seen by the graphs below, Participant 2 was able to maintain her goal of a 12 to 1 am bedtime for most of the first two weeks that she tracked her sleep. However, during the last week she reported experiencing an increase in anxiety due to academic demands that “threw her off” her routine. Overall, her sleep duration did increase throughout the study, even if the amount of times she awoke during the night did not stabilize to a lower number than she reported at the start of the intervention.

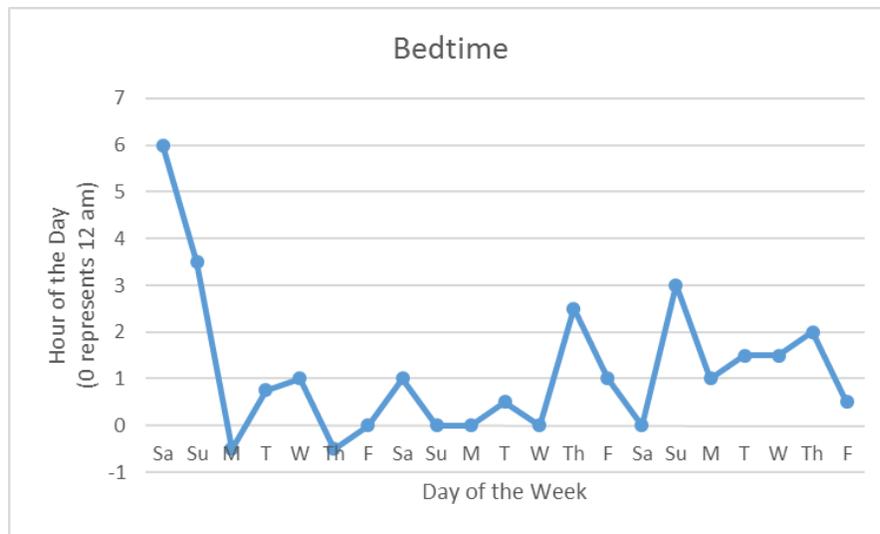


Figure 11: Sleep Diary Bedtimes for Participant 2

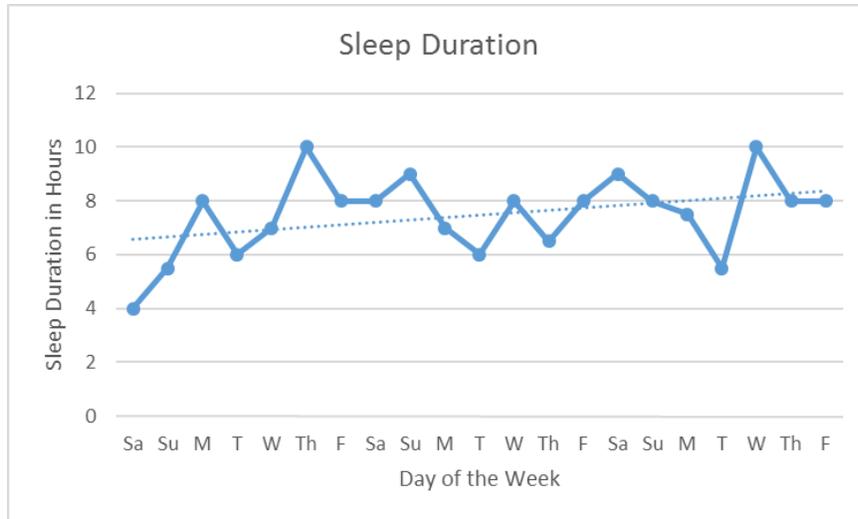


Figure 12: Sleep Diary Sleep Duration for Participant 2

Participant 2 expressed that overall, she enjoyed the idea of having a routine each night that included relaxing (when she remembered to use the relaxation exercises) and sticking to a bedtime. For a long-term goal she expressed, “I’m going to try to keep going to sleep around the same time, because it definitely does help.” In thinking about what she had learned during the study, Participant 2 stated, “I definitely put more thought into it [her sleep] than I have before.”

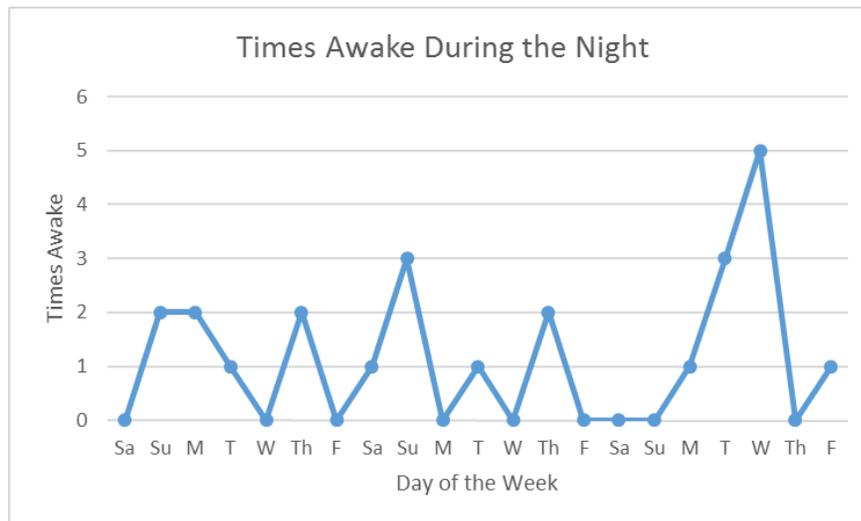


Figure 13: Sleep Diary Number of Times Awake During the Night for Participant 2

**Participant 3.** Participant 3 was a 20-year-old woman and a sophomore. She expressed that she had “never liked to sleep” as a child, but began to sleep especially poorly during her

freshmen year. She reported at the beginning of the study that she was sleeping four to six hours a night, and that she would usually begin weeks trying to maintain a routine, but would give up on the routine if early in the week she was not able to stick to it. Goals for Participant 3 included planning specific weeknight and weekend bedtimes to aim for at least six hours of sleep a night, increasing this amount if possible as the intervention continued. It became necessary after the first session for Participant 3 to begin each week by planning different bedtimes for different nights of the week depending on her social and academic obligations that she foresaw. In particular, Participant 3 focused on not going to bed past certain hours of the morning (i.e., 2 am or 4:30 am depending on the night) and for the most part was able to stick to this goal after the first week of the study, as can be seen in the graph below. However, she often had trouble recognizing that she was meeting her goals and making progress in changing her sleep hygiene. Thus, the investigator utilized encouragement and reminders that setbacks were not failures to help reframe her point of view on progress towards goals.

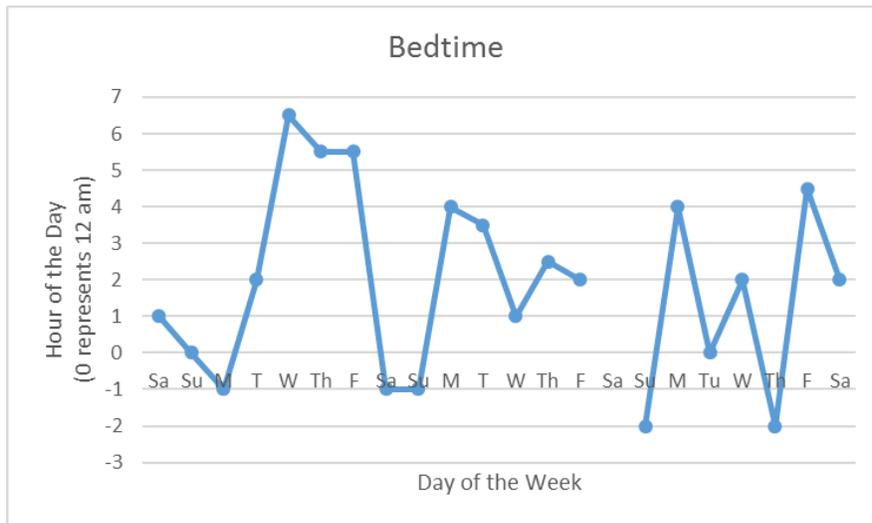


Figure 14: Sleep Diary Bedtimes for Participant 3

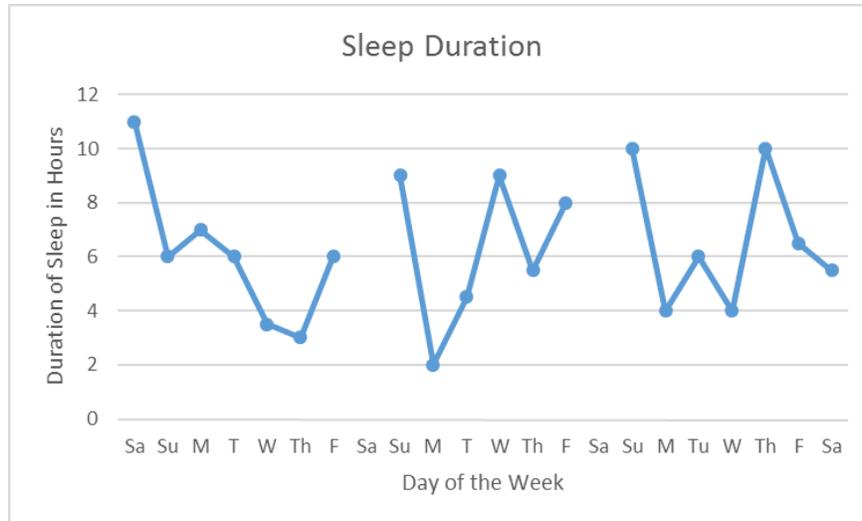


Figure 15: Sleep Diary Sleep Duration for Participant 3

Despite somewhat erratic sleep duration, she did meet her goal of sleeping for at least 6 hours a night on 12 of the 20 nights she reported her sleep duration. At the end of the study,

Participant 3 stated:

I feel like paying attention to the sleeping patterns made a difference for me, because like, I'm pretty all or nothing. So I'm usually pretty good at like, well, not usually, *sometimes* I'm really good at like, taking care of my overall health and like, trying to sleep well and eat well and all that. But once I stop, because I get stressed and start focusing on other things, it just kind of all falls apart completely.... And although I never really got a chance to end up on a schedule during this study... I feel like I was more conscious of trying to get as much sleep as possible, because it could have really, like because I know how I respond to stress, it like could have easily turned into basically no sleep at all for like four weeks straight. Which wouldn't have ended well. So I think that like it was good that it was on the forefront of my mind and like, made me more aware of trying to create time to go to sleep and go to bed early.

A long-term goal for her was to “try to implement a bedtime and actually try to stick with it, going forward” in order to remind her that she should be sleeping, and thus continue to build healthy habits that would help her to combat stress and lay a good foundation for later in life.

**Participant 4.** Participant 4 was a 19-year-old freshman male. He expressed at the beginning of the intervention that he has always been a poor sleeper due to frequent anxiety, and often felt unable to move from the couch to the bed at night to begin getting ready for sleep. He

reported that he often used the TV as white noise and averaged 5 hours of sleep a night before the study started. Several goals were set throughout the study to attempt to lessen his pre-sleep anxiety and regulate his sleep-wake cycle. Some of these goals included not looking at the clock after getting in bed, setting alarms on his phone to remind him to move from his couch to his bed, utilizing relaxation activities taught to him by the investigator, and getting in bed between 11 and 11:30 pm each night to try to help him to sleep for eight hours.

As can be seen by the graphs below, Participant 4 had a difficult time meeting his goals. He indicated that his academic load was very difficult during the time of the intervention and that he often forgot what was discussed in his sessions (such as setting alarms and using the relaxation exercises). Participant 4 was not able to successfully maintain an earlier bedtime, but he did report sleeping for over eight hours a night for half of the nights that he reported his sleep duration.

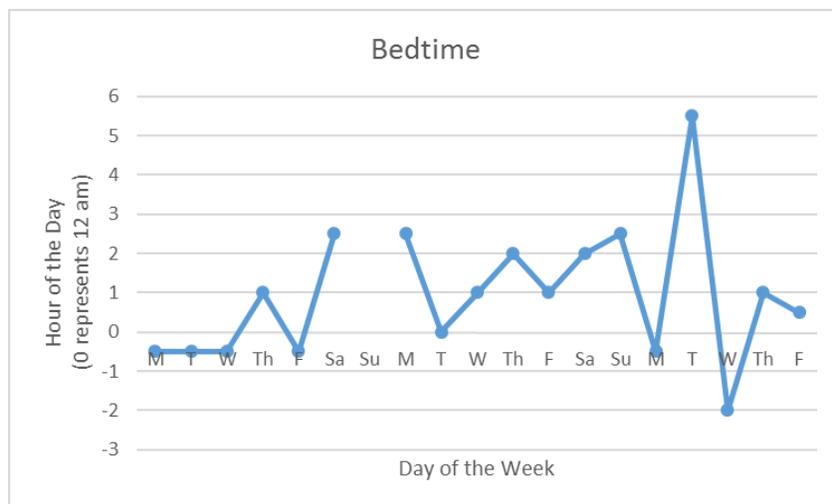


Figure 16: Sleep Diary Bedtimes for Participant 4

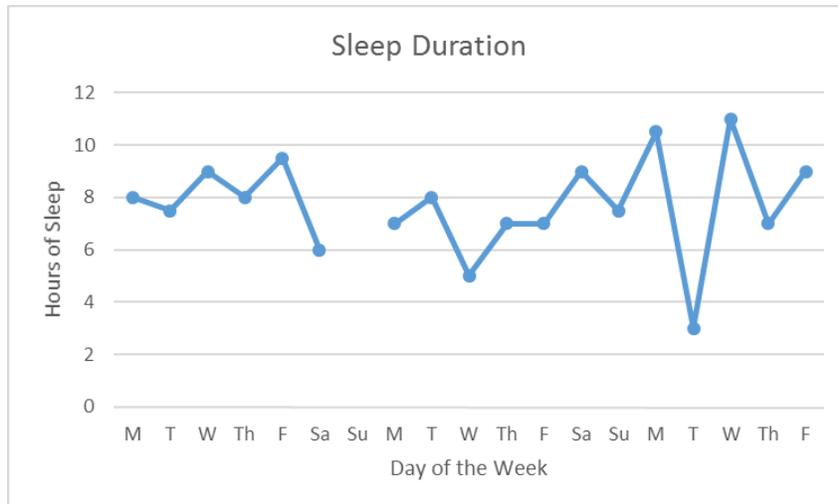


Figure 17: Sleep Diary Sleep Duration for Participant 4

At the end of the intervention, Participant 4, demonstrating some ambivalence but also the beginnings of motivation to change his sleep behavior going forward, stated:

I just need to be more consistent and not be all over the place with my sleeping. I guess I could try to get a routine. I feel like a routine might help. Because if I do these certain things, then I know that I'm supposed to go to bed then. I could try. I don't really have a routine now so I could try.

He decided in the short-term to focus on not pulling all-nighters during final exam week (i.e., the week following the end of the intervention), and set an alarm on his phone during the meeting to cue him to begin getting ready for bed that night.

**Participant 5.** Participant 5 was an 18-year-old woman and a freshman. Despite reporting sleeping an average of nine hours every night, Participant 5 felt that she frequently struggled with falling asleep due to anxiety. To the investigator, her anxiety manifested as a tendency towards generalized and obsessive-compulsive anxiety. Goals for Participant 5 included utilizing various anxiety management strategies in the hour or two before bed and during the night should she awake (such as praying, reading her bible, chatting with her roommates, and using a deep breathing exercise), as well as maintaining a consistent 11 pm bedtime. Aside from the third week of the intervention, during which Participant 5 reported

feeling very stressed about social and academic commitments, she was able to make significant progress towards her goals. She reported feeling adequately rested most days, maintained a bedtime between 10:30 pm and 12:30 am, and felt confident that her utilization of anxiety management techniques had been helpful on all but one night in which she was awake for an hour in the middle of the night due to anxiety.

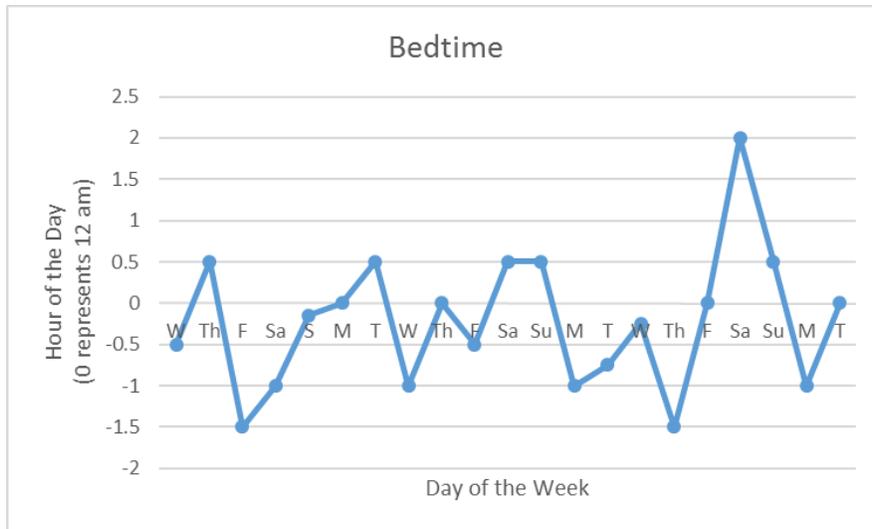


Figure 18: Sleep Diary Bedtimes for Participant 5

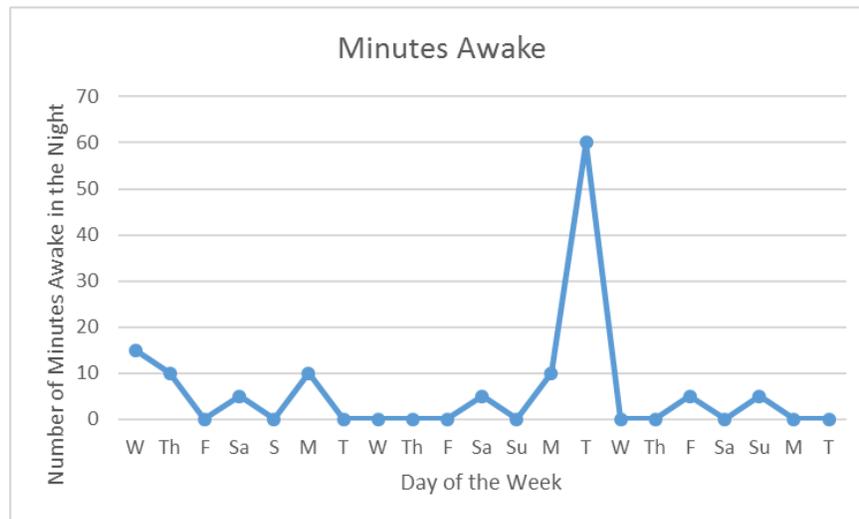


Figure 19: Sleep Diary Minutes Awake During the Night for Participant 5

Importantly, Participant 5 expressed that when she was not sleeping as well as usual, she was able to notice this change and how it affected her during the day, which she believed she

would not have been able to do prior to the study. Moving forward, she said, “In the busier weeks, I have to think more about my sleep.” For Participant 5, the most useful parts of the study were changing her evening routine to allow for more relaxation, utilizing the anxiety management strategies, and developing a greater awareness of her sleep habits. “It [the study] helped me!” she said in her last meeting. “I noticed that since I got the stuff [her school work] done earlier, and I know how much I’ve studied or how much I have left, I can go to bed and not think about it,” which she believed significantly alleviated some of her anxiety that had previously kept her from being able to fall asleep at night.

**Participant 6.** Participant 6 was a 19-year-old freshman male. He described himself as very busy with social obligations and organizations on campus, and admitted that while he liked to sleep (i.e., nine to ten hours a night), he did not often think about other aspects of his health, such as eating healthily and exercising. Participant 6 expressed that he was often fatigued and potentially “stretching himself too thin” with all of his activities by not giving himself enough down time. His social calendar also prevented him from maintaining a consistent sleep-wake cycle, as he would often be out late two to four nights a week with friends. Goals for Participant 6, therefore, centered around improving his overall well-being. He attempted to begin practicing self-care activities to help him feel more rejuvenated each week, to plan and implement an appealing morning routine that would help regulate his sleep-wake cycle, to drink less soft-drinks, and to increase his weekly exercise.

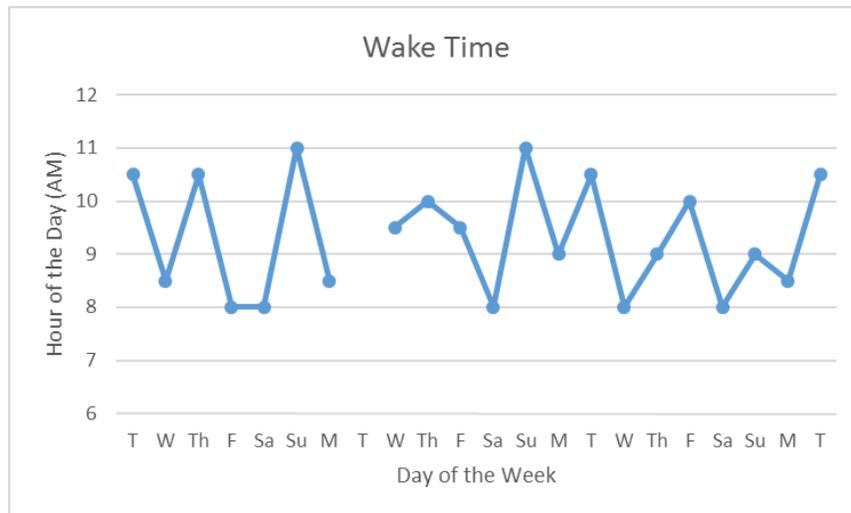


Figure 20: Sleep Diary Wake Times for Participant 6

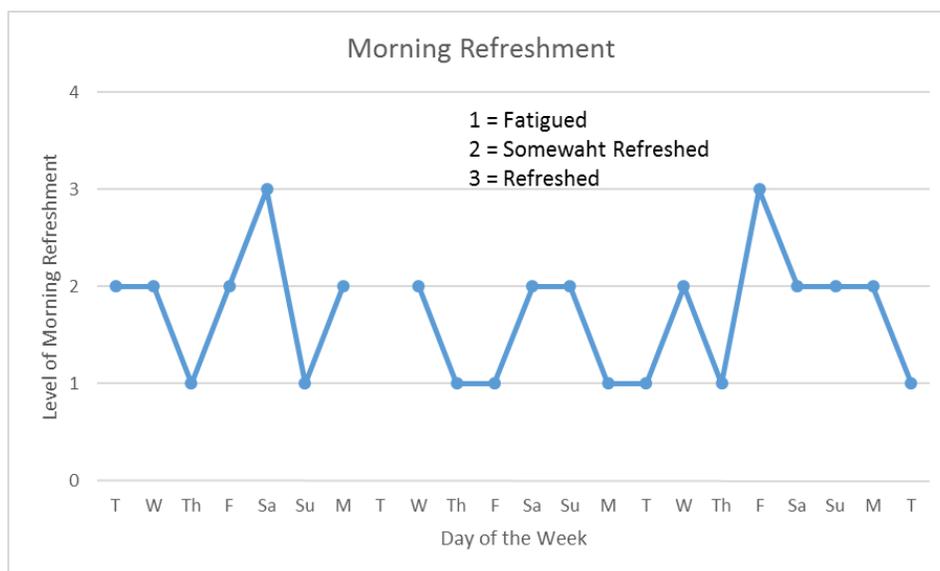


Figure 21: Sleep Diary Morning Refreshment for Participant 6

Unfortunately, Participant 6 sprained his ankle during the intervention and was not able to exercise much beyond walking to class. However, he was successful in bringing his sleep-wake times to a more regular schedule by shifting his wakeup time to be closer to 9 to 9:30 am than 11 am to 12 pm, drinking less soft-drinks, and feeling somewhat more rested each morning upon waking. At the end of the intervention, Participant 6 reported that he would miss the weekly meetings, as he felt like the “challenges” helped him to meet these small personal goals he had been setting for himself over the weeks. Additionally, he set a goal of “trying to go to

sleep by midnight” for the remaining two week of the semester “because that would be *very* helpful” in being more successful during final exams. Lastly, Participant 6 stated that he had enjoyed focusing more closely on his health related habits and becoming more aware of how these habits affected his sleep.

I kind of like reflecting on my week to really see what I’ve been doing... A more realization of what I’m doing over the week. I realize how tired I get, and now I know why...I’m tired and so I know what I can change. If I’m feeling tired I know, I can get home early or do homework early... It’s helped me a lot... My grades have been better this semester.

**Participant 7.** Participant 7 was a 19-year-old female who was a freshman and specified that she was an out-of-state student. Consequently, she reported experiencing severe anxiety during the course of her freshmen year, mainly due to being far from her family and home and with transitioning to college life. Participant 7 reported that it generally took her several hours to fall asleep on any given night (i.e., two to four) so she would attempt to be preventative and be in bed by 9 or 10 pm. However, she would end up staying in bed for sometimes 12 or more hours a day between sleeping, trying to fall asleep, being awake during the middle of the night, and taking afternoon naps. Thus, to begin to combat her supreme difficulty falling asleep and daytime fatigue, one of Participant 7’s goals included getting out of bed earlier in the day (i.e., 9 am) to allow for her body to naturally feel more tired at an appropriate bedtime 12 to 15 hours later. She also focused on not staying in bed when she was not tired and limiting her time spent napping during the day.

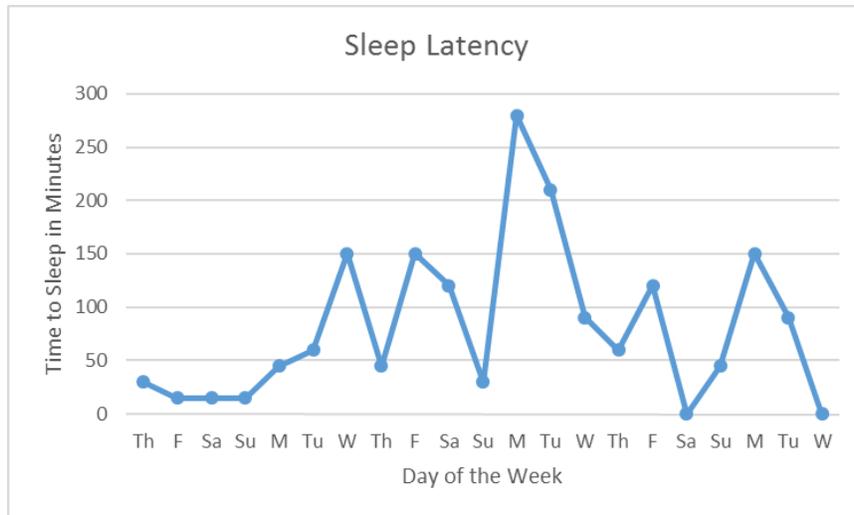


Figure 22: Sleep Diary Sleep Latency for Participant 7

As can be seen in the above graph, Participant 7 continued to struggle with falling asleep throughout the intervention. At week 3, it was decided to shift her wake time goal to 9:30 am from 9 am, as she indicated that 9:30 am “wasn’t as bad”. She also added behavioral incentives for meeting her goals, such as treating herself to ice cream if she woke up at 9:30 am most days of the week. As can be seen in the graphs below, participant 7 became markedly more successful in maintaining a consistent 9:30 to 10 am wake time during the second half of the study, and was able to demonstrably decrease the number of hours she spent napping during the day.

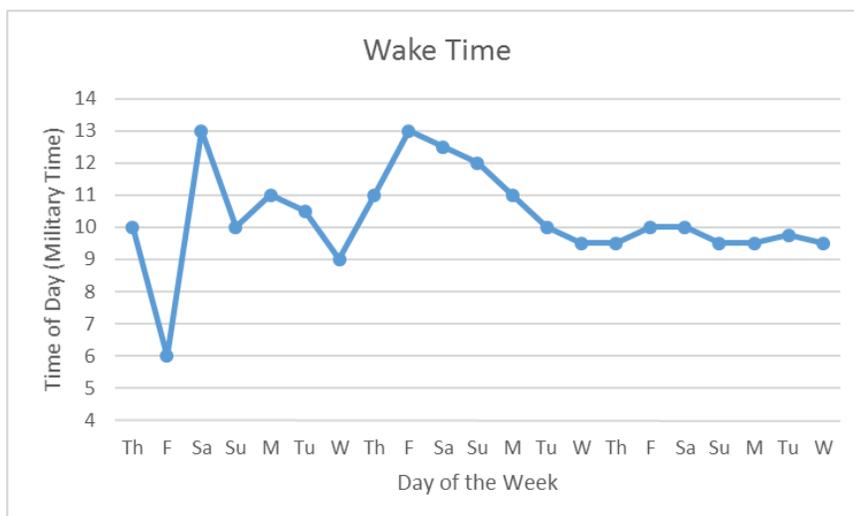


Figure 23: Sleep Diary Wake Times for Participant 7

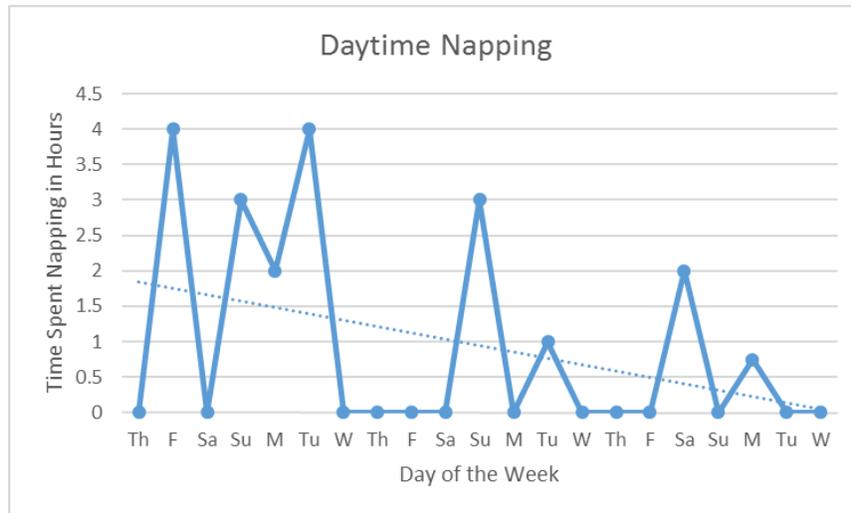


Figure 24: Sleep Diary Daytime Napping for Participant 7

Overall, Participant 7 was able to make considerable progress on her goals and felt like she was subjectively getting better quality sleep. In regards to her daytime fatigue, she stated:

When I wake up I still feel tired. I feel like it’s because I was used to be getting 12 hours of sleep and now it’s like 8 or 10. But then I feel fine throughout the rest of the day.

Participant 7 stated that going forward she wanted to continue maintaining an earlier wake time schedule to encourage her body to develop a more regulated circadian rhythm.

I feel like it [waking up earlier] helps me fall asleep faster, which is exactly what you said. I feel like I don’t have to think about how I’m going to fall asleep, I just get in bed and it will slowly happen. So I don’t have to think about it as much, which is good.... I’m happy. It’s working!

She also indicated that “the breathing exercises and the sleep noises” were the most useful part of the study, “because I never would have considered that...I wouldn’t even have thought about it if you hadn’t brought it up.”

**Participant 8.** Participant 8 was a 20-year-old male and a senior, although he was technically graduating after his third year at the university. Thus, by his academic standing he did not actually fall within the study’s target group, but his age was comparable to the other Treatment 1 group participants and he was allowed to participate in the intervention.

Participant 8 reported that his problems only began during the semester that the intervention took place, and that he would spend most nights sleeping on his couch with the TV on in the background. As he was planning to graduate at the end of the semester, he reported that he was often very preoccupied by a heavy course load and his attempts to secure a job for when he graduated. His goals were to incorporate a relaxation exercise into his bedtime routine (which he accomplished easily and utilized for the duration of the intervention almost nightly), to sleep for seven to eight hours a night, and to have a consistent bedtime.

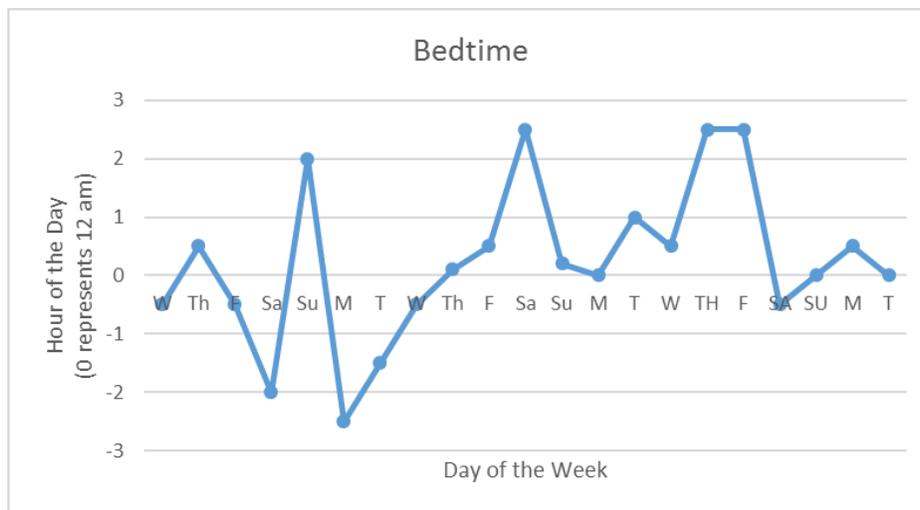
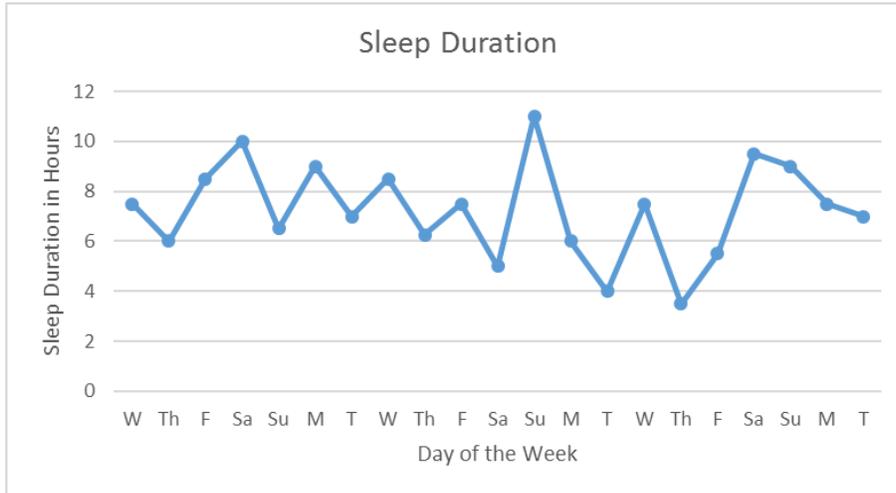


Figure 25: Sleep Diary Bedtimes for Participant 8

As can be seen by the above graph, he was able to keep his bedtime consistently between 10:30 pm and 12:30 am for most nights during the week, though he had later weekend bedtimes due to some traveling for a job interview and celebrating being hired for a job. As demonstrated in the graph below, he was also able to sleep for seven or more hours a night for approximately 2/3 of the nights that he reported his sleep duration. At the end of the intervention, Participant 8 stated what he had learned:

Really that my sleep schedule is not nearly as steady as I thought it was .... I did try, but this has probably been the most busy few weeks of time that I've had since I've been in college...my sleeping was a lot more volatile in this past few weeks than it has been, uh, earlier on in the semester.... I feel like the study helped me get back on track, or at least enlighten me on how bad my sleeping habits were and some ways to improve them. Like

the breathing exercises. I feel like that was a form of meditation that helps slip into a new mode of thinking. Helps you slow down, reduce heart rate, get some good sleep.



*Figure 26: Sleep Diary Hours of Sleep for Participant 8*

## V. Discussion

This chapter provides a discussion of the findings presented in Chapter IV, the implications of those findings, the limitations of the study, and suggestions for future directions for related research and clinical work. As previously stated, the purpose of the present study was to gain a better understanding of what interventions might be necessary to motivate and change sleep hygiene behavior to ultimately improve college students' sleep. The current study extended the literature by testing a face-to-face individualized intervention designed to teach students about the importance of sleep and the usefulness of sleep hygiene practices that incorporated components of motivational interviewing and personalized feedback to increase motivation to change sleep related behavior. The study utilized a three group quasi-experimental design, comparing treatment effects across the groups longitudinally. Effects for the treatment group that received the individualized intervention were also analyzed through visual analyses of graphical behavioral data.

### **Implications of Findings**

**How They Sleep.** Several characteristic of the current sample are of note, especially as they relate to samples in previous research on various sleep related outcomes. First, this study found that students who reported sleeping more also reported experiencing a lower quality of sleep. Previous research has shown that sleeping for too long (i.e., 8-10 hours a night) can potentially be as unhealthy and unhelpful as sleeping too little and thus be related to sleep problems (Grandner & Krinke, 2004). However, it seems unlikely that the participants in this sample were sleeping for an amount that could be considered “too much” sleep (see Figure 27 and Table 4), as approximately half of the sample reported sleeping for less than 7 hours a night on average and only 14% of the sample reported sleeping for over 9 hours a night consistently.

With a range of 4 to 11 hours a night reported though, it may be the few participants on the upper end of this range who do sleep “too much” and do not feel as though they benefit from their extended slumber.

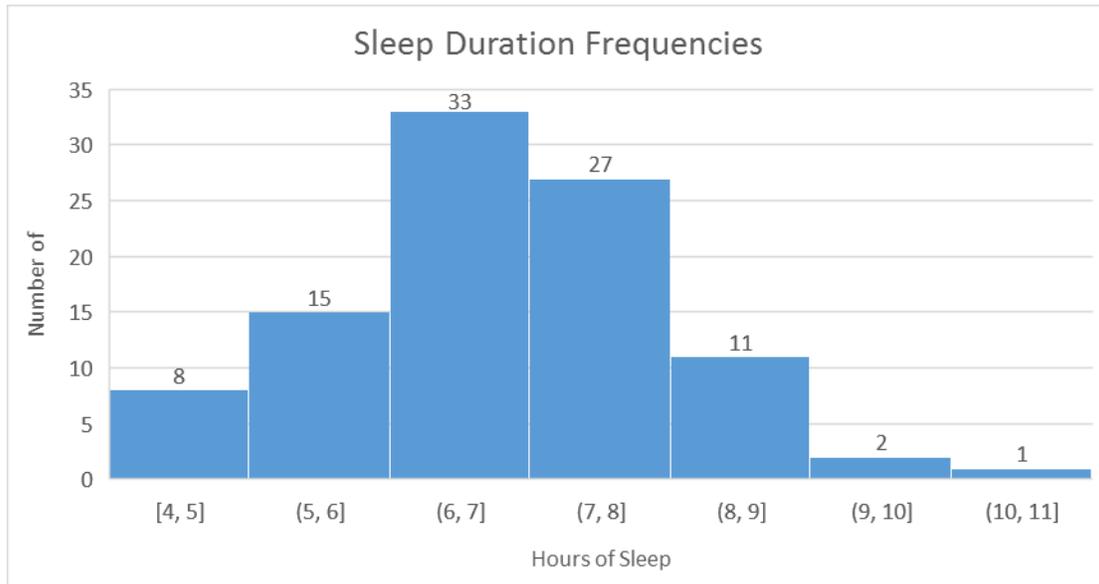


Figure 27: Reported Sleep Duration Frequencies

Table 5: Sleep Duration Descriptives

Sleep Duration	(Hours)
Mean	7.12
Standard Deviation	1.21
Median	7
Mode	7
Low Range	4
High Range	11

Next, the results strongly imply that sleep stability, as conceptualized as a regulated sleep-wake routine, is important in improving sleep quality and sleep duration. Sleep stability can be viewed as a component of sleep hygiene, and thus it is not surprising that the current study found a positive relationship between sleep hygiene and sleep stability, consistent with previous literature (Kang & Chen, 2009). As the practice of sleep hygiene was also linked to improved sleep quality and less daytime sleepiness, it seems possible that an important factor in

improving the quality of sleep may be in improving sleep stability and helping students maintain a consistent sleep-wake cycle. Indeed, the study found that better utilization of sleep hygiene was associated with less daytime sleepiness, both of which were related to higher subjective sleep quality and better psychological health at the post-test.

However other, somewhat contradictory results, merit comment as well. First, a majority of participants indicated that they varied their sleep schedules from weekdays to weekends most of the time, usually sleeping in later on weekends. This change in weekend sleep schedule likely represented an effort by the students to “catch up” on sleep debt that they experienced from receiving inadequate amounts of sleep during the week (Crowley & Carskadon, 2010; National Institute of Neurological Disorders and Stroke, 2014). And yet, a majority of the participants reported feeling satisfied with their overall quality of sleep, even though many of them (i.e., over half) were rated as poor sleepers by objective sleep measures, experienced daytime dysfunction from sleepiness, and did not utilize good sleep hygiene practices. Thus, it would seem that participants’ objective and subjective sleep outcomes are at odds with one another, a common finding in research even when sleep is measured via polysomnography (Baker, Maloney, & Driver, 1999; Carskadon, Dement, Mitler, Guilleminault, Zarcone, & Spiegel, 1976; Landry, Best, & Liu-Ambrose, 2015; Weaver, Kapur, & Yueh, 2004). One possibility is that students are less aware of what constitutes poor sleep habits, and thus may believe that they are doing a better job of regulating their sleep schedules and following sleep hygiene habits than they actually are. A second, and related, possibility is that students are actually unaware of the negative toll that their poor habits are taking on their overall health, and thus subjectively believe that they are functioning better than they objectively are, as research has shown that sleep loss can impair

judgment, specifically about the impact of sleep on functioning (Hershner & Chervin, 2014; Peri, 2016).

**Failure to Support Hypothesis 1.** Overall, Hypothesis 1 was unsupported, as the only significant interaction for changes between groups over time was on the utilization of sleep hygiene practices. However, the Treatment 1 group's change on overall sleep quality, daytime sleepiness, and use of sleep hygiene practices was significantly different than the change on these same variables made by the Treatment 2 and Control groups. These results could be explained in at least three ways. First, perhaps neither the educational piece of the intervention nor the one-on-one intervention with the Treatment 1 group were powerful enough to affect differences between the three groups on the broad outcome measures, necessitating stronger interventions. Second, it is possible that the interventions did not work as intended by the investigator due to details in the delivery of the intervention. Lastly, it is likely that the small sample size of the Treatment 1 group affected the power of the statistical tests in being able to detect a significant level of change; should this intervention be utilized again in the future, the investigator would do well to increase the number of participants receiving the individualized treatment. It is interesting to note that the failure to see improvement in the Treatment 2 group actually supports previous research that education on the importance of sleep and sleep hygiene is not enough of an intervention by itself to change sleep habits and sleep related outcomes (Brown et al., 2002; Moseley & Gradisar, 2009; Suen, Hon, & Tam, 2008). Thus, in effect, the Treatment 2 group becomes a second control group.

**Mixed Support for Hypothesis 2.** When considered longitudinally, the Treatment 1 group did experience positive changes in their overall sleep quality, such that they reported an improved sleep quality from the beginning of the study through to the end of the intervention,

partially supporting Hypothesis 2. Outcomes on the three other variables of interest, daytime sleepiness, use of sleep hygiene, and psychological well-being, also changed over the course of the intervention, with a nonsignificant trend towards improvement on all three variables. These results imply that perhaps the intervention was not long enough to effect enough change for the participants' improvements to reach significance, or that possibly the intervention was not strong enough to effect significant change. Indeed, Trockel et al.'s (2011) successful individualized email-based study lasted for a duration of 8 weeks, twice the length of the current intervention. Therefore, it is possible that a longer intervention would have been more effective. Additionally, no changes were sustained to a significant degree three months after the intervention, which also does not support Hypothesis 2. Previous meta-analyses of studies utilizing MI, however, have found that MI does tend to lose its effectiveness over time, potentially contributing to the lack of continued effectiveness of the present intervention which incorporated some MI components.

**Support for Hypothesis 3.** Finally, in considering the individual progress of each member of the Treatment 1 group, it can be concluded that Hypothesis 3 was largely supported. All of the participants, with the exception of Participant 4, found the intervention helpful in some way and reported positive changes on the specific areas of their sleep behavior that were problematic at the beginning of the intervention. These results can be explained by considering the factors that allowed most of the participants to benefit from the intervention and the barriers that were also present to preclude further change.

A large factor in participants experiencing improvement was related to their initial motivation at the start of the intervention. Participants who appeared to be moderately to highly motivated to change their behavior (as subjectively assessed by the investigator) were much more willing and likely to implement suggestions and behavioral changes discussed in their

meetings, and specifically to find strategies that they believed would work for them. Conversely, Participant 4 in particular demonstrated a much lower motivation to even attempt behavior change, and thus in the end was not successful in doing so, admitting that he often even forgot what was discussed in his meetings about possible changes to his sleep hygiene. Level of motivation is likely related to the stage of change that a participant is in, with participants who are already in the preparation or action stage being much more willing and ready to attempt to change their behavior than someone in the pre-contemplation or contemplation stage of change (Prochaska & Norcross, 2002). Thus, it would seem likely that someone in a lower stage of change in particular would benefit from a longer intervention in which they could gradually move through the stages to reach a place of higher motivation.

A second factor that positively influenced change was the participants' increasing awareness throughout the study of their sleep habits or overall health habits. Many of the participants reported that a major take-away from the study would be an increased sense of awareness of how their sleep schedule affected their waking lives or just more awareness of the importance of sleep in general. This heightened awareness seemed to then cause an increase in motivation to regulate sleep schedules and make other important changes to their health habits. Lastly, two other factors were present that promoted change. One participant had such severe sleep difficulties to begin with that the only likely changes were going to be positive, and a few participants were able to successfully utilize strategies to promote better anxiety management, which seemed to positively affect their sleep quality.

Finally, where change was only somewhat successful or largely unsuccessful, two key factors, in addition to a lower level of motivation, seemed to be involved. First, for participants who experienced subclinical or clinical levels of depression and/or anxiety, it is not appropriate

to believe that a few sessions where anxiety management is discussed for five to ten minutes would be enough to diminish those symptoms to the point where the participants' sleep is no longer being affected. It is likely that for such individuals, ongoing therapy, perhaps with special attention paid to sleep hygiene, would be the best course of treatment in treating all the symptoms present. Second, when participants had difficulty meeting their behavior change goals, they often stated that social or academic obligations had created unavoidable conflicts. For example, if a student was scheduled for 8 or 9 am classes on two days a week, but afternoon classes the other three days, they felt it necessary to schedule their sleep around their classes, such that they experienced large variability in their wakes times. Relatedly, as the participants were college students, they often indicated that parties, social events, or time spent out with friends were activities that they were not willing to compromise on in an effort to go to sleep at the same time every night. It is important to recognize that activities such as classes and socializing with friends are central to the college student life, and thus likely to be barriers in always following the best sleep hygiene practices.

### **Limitations**

There are at least four potential limitations and qualifications concerning the results of the present study. A first concern is the selection of the participants for the Treatment 1 group and the size of the group. The investigator decided to select students with self-reported poor quality sleep to receive the individualized intervention in order for the study to be conceived of as an intervention on a problem behavior (i.e., poor sleep). This approach is different than if the students selected for the treatment did not find their sleep or sleep related behaviors to be problematic because these individuals would therefore be less likely to have a behavior in need of changing. This approach also limited the number of participants for the group, as a large

percentage considered their sleep to be unproblematic. However, the current approach to participant selection introduces the possibility that any progress made by individuals in the Treatment 1 group were simply regressions towards the mean and limits the power of the statistical tests in determining the strength of the intervention. A future study might do well to include a group of individuals with slightly less severe self-reported sleep difficulties to see if they also experience any improvements in their overall sleep quality, and to utilize a larger treatment group.

A second potential limitation for the study is the method of data collection. The four main outcome measures were all given as retrospective self-report questionnaires, which introduces the possibility of bias if the participants could not accurately recall their average bedtimes, wake times, sleep durations, etc. as they were answering the items. By their very nature, these questionnaires are only approximations of sleep related behaviors. Additionally, the sleep diaries used by the Treatment 1 groups were also self-report, though potentially somewhat more accurate as the participants were asked to complete the diary in stages throughout each day, and thus less subject to inaccurate recall. However, the sleep diaries themselves were not always used correctly by the participants. Several of the one-on-one meetings involved a participant spending a few minutes thinking back over their week and completing the diary at the beginning of the meeting, and in most of the sessions the investigator made changes to what the participant had written on their diary after clarification of a variable. The best solution to these issues of correct measurement would be to use a form of sleep actigraphy, at least for the Treatment 1 group. This method was ruled out in the present study due to lack of funding, but has been shown to be a valuable and viable option in other research. Specifically, de Zambotti and colleagues (2015) found that the Jawbone UP, one of the many currently popular wrist actigraphy devices, had

good overall agreement with traditional polysomnography techniques for total sleep time, sleep efficiency, and time awake after the onset of sleep in a sample of adolescents. Importantly, these devices are unobtrusive and do not require participants to sleep in a lab. Thus, future studies would likely benefit from using such devices to measure the various sleep variables.

Alternatively, Participant 7 offered the suggestion of using a sleep diary on a smartphone application that could notify the individual throughout the day to complete items or make notes on sleep related habits, as he stated that he sometimes felt “too lazy or too tired” to fill out the diary by hand. If such an app existed, it could also be used by the participants in working towards their goals through use of alarms and reminder notifications. Lastly as a limitation concerning data collection, only participants in the Treatment 1 group were assessed four times which detracted from the internal validity of the study. Future studies would do well to assess all participants at each data collection point, as simply completing the measures more often could have been a factor in promoting changes in the Treatment 1 group over the Treatment 2 and Control groups.

A third limitation is the lack of standardization of the intervention and lack of assessment of treatment fidelity, as briefly discussed in Chapter 3. As such, it is likely that this study would be very difficult to replicate without more standardization. Therefore, here are some general guidelines for individuals wishing to replicate this intervention:

- 1) Investigators should be trained mental health professionals and view the individual sessions as therapeutic encounters rather than casual conversations about change.
- 2) Investigators should have some training in motivational interviewing and theories of behavior change and be proficient at providing counseling that incorporates MI and stages of change theories.

- 3) Investigators should be very knowledgeable about sleep and sleep hygiene practices, either through self-study or didactic training in the form of classes, workshops, or training with a sleep expert.
- 4) Sessions should be similar across participants and follow the structure laid out in Table 2 (above).

Additionally, to address treatment fidelity to the MI component of the intervention, future studies could have an outsider researcher listen to tapes of the individual sessions to assess for the investigator's fidelity to the spirit of MI. It would also likely be useful to more objectively assess the participants' motivation for change, either through use of a motivation ruler (or similar assessment tool) or through qualitative assessment of participants' use of change and sustain talk.

Finally, a fourth limitation of the study is the relative lack of control that the investigator had over the participants' lives outside of the study that naturally affected their ability to make changes in their sleep habits. For instance, Participant 8 recognized that he had been busier during the month of the study than he normally had been throughout the rest of the academic year, which caused him to get overall less sleep than he might have reported had the study taken place at a different time. His comments speak to the larger issue of neither the investigator nor the participants having complete control over the participants' physical environments or schedules during the time of the study. Participants carried on living and working in their natural environment throughout the study rather than in a laboratory environment, which led to variations from participant to participant in those environments regarding roommates, noises, comfortableness, etc. that might have affected their ability to sleep well. Further, each student's class schedule imposed upon them certain schedules for sleeping, especially if they had 8 or 9 am classes on some days but later classes on other days. College students also face enormous

social pressures, including to spend time with their peers, to go out drinking, and to generally go to bed late on weekends, that interfere with maintaining a regular sleep schedule and sleep habits. For example, Participant 3 and Participant 6 especially felt their social obligations to be competing with their sleep related goals at numerous points throughout the study, specifically in relation to Greek (i.e., sorority and fraternity) related events. Lastly, the intervention ended just before final exams, a time when sleep is typically irregular for many students. Future studies might find it useful to provide the intervention at different time points in the academic year to ascertain whether or not there is a “less busy” time of the semester in which to focus more closely on sleep. However, as college students do generally have multiple demands on their time throughout the year and interventions in artificial situations may exaggerate results, continuing to study interventions of this kind in the more naturalistic setting of college students’ normal day-to-day lives might prove more fruitful.

### **Directions for Future Research and Clinical Implications**

Despite these limitations, the results of the present study suggest several practical implications and direction for future research. In terms of future research, it would be useful to extend the current findings by examining whether a longer intervention period creates increased and longer lasting changes in sleep hygiene. As many of the Treatment 1 group participants mentioned, the intervention in its current form allowed them to become more aware of their sleep habits, which may be a crucial first step to generating lasting changes. Thus, a longer intervention may allow participants to increase their awareness of their current sleep hygiene, learn more about sleep and sleep hygiene, try out different strategies, and ultimately decide what works best for them in their individual contexts to creating and maintaining change.

Another focus for future research should be on the use of wrist actigraphy devices for measuring sleep related outcomes, as more precise measurements allow for a better understanding of potential changes. Wrist actigraphy devices marketed to consumers as “wellness devices”, such as the FitBit or the JawBone UP, have become increasingly popular and have the potential to be extremely useful in sleep research, but as yet remain largely untested (Russo, Goparaju, & Bianchia, 2015). These devices use detection of movement to determine whether a person is in “light” sleep or “deep” sleep, which does not quite correspond to the sleep stages. However, some devices claim to be able to use heart rate monitoring to make determinations between REM and nREM sleep, and to have “smart alarms” that would wake the individual in a lighter phase of sleep so as not to disrupt a deep sleep cycle (Russo et al., 2015). The advantages of using these devices in research are manifold, including that they allow for multiple nights of tracking in a naturalistic setting and provide more objective measurements of sleep duration and sleep latency. Importantly, these devices could also allow the user to link sleep patterns with other behavioral data, such as patterns of alcohol use and exercise (Russo et al., 2015). As the intervention in the current study did appear to increase awareness of how sleep is related to other health factors, these wrist actigraphy devices could be especially useful in studies that look to further this study’s intervention.

Clinically, the current study also presents important implications. First, this study provided further evidence that many college students struggle to sleep well and sleep long enough for their sleep to positively affect their well-being. Many students do not practice good sleep hygiene behavior, and the ones that do seem not to practice healthy strategies consistently. Thus, students who come to their university’s counseling center for therapy regarding stress, anxiety, depression, academics, etc. may also likely be having difficulties with sleep, difficulties

could very well be effecting these other areas of their lives. Counselors are in a perfect position to work with students in improving their sleep hygiene, as they would provide a consistent weekly “check-in” and also be trained and available to help with combatting ambivalence about change and encouraging motivation. Face-to-face conversations about sleep habits may be more useful than the email interventions which have been shown to be effective (i.e., Trockel et al., 2011) as they provide that more personalized intervention and allow for the clinician to take into account an individual’s stage of change, level of motivation from week to week, and potential changes in goals, as well as provide encouragement for successfully attaining and/or maintaining changes. Additionally, students could be encouraged to be mindful of when they schedule classes, in an effort to achieve as much consistency as possible from day-to-day in their morning class schedules and, by consequence, their daily sleep-wake cycles.

Lastly, an intervention similar to the current study may prove fruitful as a preventative rather than problem-focused intervention. Literature has supported that the transition from high school to college can be difficult for many students, and that sleep habits are likely to be affected (Cheng et al., 2012; Gruber, 2013; Marhefka, 2012). If students were required to meet with a counselor or similarly trained professional as they began college (i.e., in the fall of their freshmen year) in a format similar to the intervention presented here, it may allow students to establish good sleep hygiene during this transitional phase, and preclude even worse difficulties further down the line in their collegiate career. Moving beyond the realm of college students, high schoolers may also benefit from a similar prevention-focused intervention so that when they begin college, they already have practice in utilizing good sleep hygiene. Ultimately, the most benefit might be to parents of young children who could be given the tools to teach their children

good sleep hygiene, and thus establish healthy sleep habits early in life that could be used over the course of one's life.

## **Conclusions**

In summary, the findings from this study suggest that an individualized approach to teaching sleep hygiene practices along with personalized feedback about progress towards co-constructed goals and assistance in countering ambivalence and increasing motivation for changing sleep related behaviors may be helpful in increasing overall sleep quality for college students. While this intervention was not wholly effective in helping participants to change their sleep habits, it did provide insight into the potentially most useful elements of an intervention, such as increased awareness of sleep related behaviors, and provided directions for future research, including the usefulness of collecting data through wrist actigraphy. Clinically, incorporating conversations about sleep hygiene and improving sleep in counseling sessions may be beneficial in improving students' overall wellness. Ultimately, much remains to be done in investigating the best way to change college students sleep related behaviors and in understanding the many areas that sleep effects other domains of collegiate life.

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Appendix B  
Informed Consent - Age 19 and Older

**Informed Consent**

for a Research Study Entitled: "How Did You Sleep?:  
Effects on an Individualized Sleep Hygiene  
Intervention Program on College Students' Sleep"

You are invited to participate in a research study about sleep and well-being. You were selected as a possible participant because you are an undergraduate at Auburn University. Please read this form and ask any questions you might have before agreeing to participate in this study.

This study is being conducted by Lauren David, B.A., an Auburn University doctoral student completing a doctoral dissertation project, under the direction of Dr. Joseph Buckhalt, professor in the Auburn University Special Education, Counseling, and Rehabilitation Department.

*Background Information:*

The purpose of this study is to explore how activities related to sleep relate to your overall sleep habits and health.

*Procedures:*

If you agree to participate in this study, you will be asked to do the following things: complete four questionnaires and a demographics information sheet which will take approximately 20 minutes. You may also participate in a 20 minute lecture on healthy sleep habits. Additionally, some individuals will be asked to meet one-on-one with the researcher once a week for four weeks to discuss your sleep habits. You will also be asked to track your sleep behavior over this time period. These meetings will last approximately 30 minutes to 1 hour each week. Total time of participation is expected to be about 3 hours over a month long period.

*Risks and Benefits of Being in the Study:*

The risks to participants are no greater than ordinarily encountered in daily life. Upon participation in this study, there is the unlikely risk of distress due to discussing wellness habits. If there is a need for psychological services to address any concerns, please contact the Auburn Student Counseling Services or Auburn Medical Clinic or refer to the following website to locate a mental health clinician in your area: <http://locator.apa.org>.

\_\_\_\_\_ Initials

Individuals who agree to meet one-on-one with the researcher agree to have these sessions videotaped. The recordings will be used to transcribe the information for data analysis only and will not be used for any other purpose.

The benefits to participation include an increased aware of how sleep affects health. Participants will also receive extra credit in their COUN1000 class. Individuals who participate in the one-on-one meetings will have a chance to enter into a raffle to win a JawBone fitness band.

*Confidentiality:*

The records of this study will be kept private. In any sort of report that might be published, information making it possible to identify a participant will not be included. Research records will be kept on a password protected computer and only the researcher will have access to the records. Data obtained will be retained for up to five years.

*Participation is Voluntary:*

Your decision whether or not to participate will not affect your current or future relations with the researcher or Auburn University. **Your participation is voluntary** and you may withdraw at any time without affecting those relationships previously identified.

*Contacts and Questions:*

The researcher conducting this study is Lauren David. **If you have questions about this study, please ask them now** or contact the researcher at lzd0012@auburn.edu or the project advisor, Dr. Joseph Buckhalt at (334) 844-2875 or [buckhja@auburn.edu](mailto:buckhja@auburn.edu). You will be provided with an additional copy of this form for your records. **If you have questions about your rights as a research participant**, you may contact the Auburn University Office of Research Compliance or the Institutional Review Board by phone (334)-844-5966 or e-mail at [IRBadmin@auburn.edu](mailto:IRBadmin@auburn.edu) or [IRBChair@auburn.edu](mailto:IRBChair@auburn.edu).

**HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE WHETHER OR NOT YOU WISH TO PARTICIPATE IN THIS RESEARCH STUDY. YOUR SIGNATURE INDICATES YOUR WILLINGNESS TO PARTICIPATE.**

\_\_\_\_\_  
Signature of the Participant

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of Investigator

\_\_\_\_\_  
Date

\_\_\_\_\_  
Initials

Appendix B (cont.)  
Informed Consent – Age 18 and Younger

**PARENTAL PERMISSION/CHILD ASSENT**  
for a Research Study Entitled: "How Did You Sleep?:  
Effects on an Individualized Sleep Hygiene  
Intervention Program on College Students' Sleep"

**Your son or daughter is invited to participate in a research study** about sleep and well-being. You were selected as a possible participant because you are an undergraduate at Auburn University. Your son or daughter is invited to participate because he or she is in the COUN1000 class. Since he/she is 18 or younger, we must have your permission to include him/her in the study. This study is being conducted by Lauren David, B.A., Auburn University, a doctoral student completing a doctoral dissertation project, under the direction of Dr. Joseph Buckhalt, professor in the Auburn University Special Education, Counseling, and Rehabilitation Department.

*Background Information:*

The purpose of this study is to explore how activities related to sleep relate to your overall sleep habits and health.

*Procedures:*

**If you decide to allow your son or daughter to participate in this study**, he/she will be asked to do the following things: complete four questionnaires and a demographics information sheet which will take approximately 20 minutes. He/she may also participate in a 20 minute lecture on healthy sleep habits. Additionally, some individuals will be asked to meet one-on-one with the researcher once a week for four weeks to discuss your sleep habits. He/she will also be asked to track his/her sleep behavior over this time period. These meetings will last approximately 30 minutes to 1 hour each week. Total time of participation is expected to be about 3 hours over a month long period.

*Risks and Benefits of Being in the Study:*

The risks to participants are no greater than ordinarily encountered in daily life. Upon participation in this study, there is the unlikely risk of distress due to discussing wellness habits. If there is a need for psychological services to address any concerns, please contact the Auburn Student Counseling Services or Auburn Medical Clinic or refer to the following website to locate a mental health clinician in your area: <http://locator.apa.org>. You are responsible for any costs associated with medical treatment for your son or daughter. The benefits to participation include an increased aware of how sleep affects health. To thank your son/daughter for participating, they will also receive extra credit in their COUN1000 class. Individuals who participate in the one-on-one meetings will have a chance to enter into a raffle to win a JawBone fitness band. Individuals who agree to meet one-on-one with the researcher agree to have these sessions videotaped. The recordings will be used to transcribe the information for data analysis only and will not be used for any other purpose.

*Confidentiality:*

**Your son's daughter's privacy will be protected.** The records of this study will be kept private. In any sort of report that might be published, information making it possible to identify a participant will not be included. Research records will be kept on a password protected computer and only the researcher will have access to the records. Data obtained will be retained for up to five years.

*Participation is Voluntary:*

If you (or your son/daughter) change your mind about his/her participation, he/she can be withdrawn from the study at any time. His/her participation is completely voluntary. If you chose to withdraw your son/daughter, his/her data can be withdrawn as long as it is identifiable. Your decision about whether or not to allow your son/daughter to participate or stop participating will not jeopardize your or his/her future relations with Auburn University, the SERC Department, or the researcher.

*Contacts and Questions:*

The researcher conducting this study is Lauren David. **If you (or your son/daughter) have questions about this study, please ask them now** or contact the researcher at [lzd0012@auburn.edu](mailto:lzd0012@auburn.edu) or the project advisor, Dr. Joseph Buckhalt at (334) 844-2875 or [buckhja@auburn.edu](mailto:buckhja@auburn.edu). You will be provided with an additional copy of this form for your records.

**If you have questions about your child's rights as a research participant,** you may contact the Auburn University Office of Research Compliance or the Institutional Review Board by phone (334)-844-5966 or e-mail at [IRBadmin@auburn.edu](mailto:IRBadmin@auburn.edu) or [IRBChair@auburn.edu](mailto:IRBChair@auburn.edu).

**HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE WHETHER OR NOT YOU WISH FOR YOUR SON OR DAUGHTER TO PARTICIPATE IN THIS RESEARCH STUDY. YOUR SIGNATURE INDICATES YOUR WILLINGNESS TO ALLOW HIM OR HER TO PARTICIPATE. YOUR SON'S/DAUGHTER'S SIGNATURE INDICATES HIS/HER WILLINGNESS TO PARTICIPATE.**

\_\_\_\_\_  
Signature of the Participant    Date

\_\_\_\_\_  
Signature of Investigator    Date

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Parent/Guardian Signature    Date

\_\_\_\_\_  
Printed Name

Appendix C  
Demographics Questionnaire

**Please answer the following questions honestly and to the best of your abilities.**

1) Age? \_\_\_\_\_

2) Gender? (circle one)

Male                  Female                  Transgender                  Other

3) Ethnicity? (circle all that apply)

African American/Black                  Asian American/Pacific Islander                  Hispanic or Latino(a)

Native American/American Indian                  Caucasian/White                  Other: \_\_\_\_\_

4) Sexual Orientation? (circle one)

Asexual                  Bisexual                  Gay Male                  Lesbian Female                  Heterosexual                  Other

5) Year in School? (circle one)

Freshmen                  Sophomore                  Junior                  Senior                  Fifth Year (+)

6) Are you a full time student? (circle one)

Yes      No

7) Cumulative College GPA: \_\_\_\_\_

8) Cumulative High School GPA: \_\_\_\_\_

9) What type of residence do you currently reside in? (circle one)

Dorm                  On-campus Apartment                  Off-campus Apartment                  House

10) Do you currently reside with your parents? (circle one)

Yes      No

11) Do you currently reside with any children of whom you are the primary caretaker? (circle one)

Yes      No

12) Do you currently reside with a roommate with whom you share the same room? (circle one)

Yes      No

12) What is your marital status? (circle one)

Single                  In a Relationship                  Cohabiting                  Married                  Divorced

13) Have you ever been diagnosed with a clinical sleep disorder? (circle one)

Yes    No

Appendix D  
Questionnaire Packet

Page 1 of 4

Subject's Initials \_\_\_\_\_ ID# \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_ AM  
PM

**PITTSBURGH SLEEP QUALITY INDEX**

**INSTRUCTIONS:**

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

1. During the past month, what time have you usually gone to bed at night?  
BED TIME \_\_\_\_\_
2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?  
NUMBER OF MINUTES \_\_\_\_\_
3. During the past month, what time have you usually gotten up in the morning?  
GETTING UP TIME \_\_\_\_\_
4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.)  
HOURS OF SLEEP PER NIGHT \_\_\_\_\_

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

5. During the past month, how often have you had trouble sleeping because you . . .
  - a) Cannot get to sleep within 30 minutes  
Not during the past month \_\_\_\_\_ Less than once a week \_\_\_\_\_ Once or twice a week \_\_\_\_\_ Three or more times a week \_\_\_\_\_
  - b) Wake up in the middle of the night or early morning  
Not during the past month \_\_\_\_\_ Less than once a week \_\_\_\_\_ Once or twice a week \_\_\_\_\_ Three or more times a week \_\_\_\_\_
  - c) Have to get up to use the bathroom  
Not during the past month \_\_\_\_\_ Less than once a week \_\_\_\_\_ Once or twice a week \_\_\_\_\_ Three or more times a week \_\_\_\_\_

d) Cannot breathe comfortably

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

e) Cough or snore loudly

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

f) Feel too cold

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

g) Feel too hot

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

h) Had bad dreams

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

i) Have pain

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

j) Other reason(s), please describe \_\_\_\_\_

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

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

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

Very good \_\_\_\_\_

Fairly good \_\_\_\_\_

Fairly bad \_\_\_\_\_

Very bad \_\_\_\_\_

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

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

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

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

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

No problem at all \_\_\_\_\_  
 Only a very slight problem \_\_\_\_\_  
 Somewhat of a problem \_\_\_\_\_  
 A very big problem \_\_\_\_\_

10. Do you have a bed partner or room mate?

No bed partner or room mate \_\_\_\_\_  
 Partner/room mate in other room \_\_\_\_\_  
 Partner in same room, but not same bed \_\_\_\_\_  
 Partner in same bed \_\_\_\_\_

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

- a) Loud snoring

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

- b) Long pauses between breaths while asleep

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

- c) Legs twitching or jerking while you sleep

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

d) Episodes of disorientation or confusion during sleep

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

e) Other restlessness while you sleep; please describe \_\_\_\_\_

---

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

## Epworth Sleepiness Scale

Name: \_\_\_\_\_ Today's date: \_\_\_\_\_

Your age (Yrs): \_\_\_\_\_ Your sex (Male = M, Female = F): \_\_\_\_\_

How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired?

This refers to your usual way of life in recent times.

Even if you haven't done some of these things recently try to work out how they would have affected you.

Use the following scale to choose the **most appropriate number** for each situation:

- 0 = would never doze
- 1 = slight chance of dozing
- 2 = moderate chance of dozing
- 3 = high chance of dozing

*It is important that you answer each question as best you can.*

Situation	Chance of Dozing (0-3)
Sitting and reading _____	_____
Watching TV _____	_____
Sitting, inactive in a public place (e.g. a theatre or a meeting) _____	_____
As a passenger in a car for an hour without a break _____	_____
Lying down to rest in the afternoon when circumstances permit _____	_____
Sitting and talking to someone _____	_____
Sitting quietly after a lunch without alcohol _____	_____
In a car, while stopped for a few minutes in the traffic _____	_____

**THANK YOU FOR YOUR COOPERATION**

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# Adolescent Sleep Hygiene Scale

Directions: Using the choices below, circle *how often* the following things have happened *during the past month*.

- Never** – has not happened  
**Once in Awhile** – happened 20% of the time  
**Sometimes** – happened 40% of the time  
**Quite Often** – happened 60% of the time  
**Frequently, if not always** – happened 80% of the time  
**Always** – happened 100% of the time

		Always (100%)					
		Frequently, if not Always (80%)				Always (100%)	
		Quite Often (60%)			Always (100%)		
		Sometimes (40%)		Always (100%)			
		Once in Awhile (20%)	Always (100%)				
		Never (0%)	Always (100%)				
<b>During the day...</b>							
1.	...I take a nap that lasts <i>more than</i> 1 hour.	N	O	S	Q	F	A
2.	...I play or exercise for <i>more than</i> 20 minutes.	N	O	S	Q	F	A
<b>After 6:00 in the evening...</b>							
3.	...I have drinks with caffeine (for example: cola, root beer, iced tea, coffee).	N	O	S	Q	F	A
4.	...I take a nap.	N	O	S	Q	F	A
5.	...I do some kind of physical activity (for example: exercise, play sports).	N	O	S	Q	F	A
6.	...I smoke or chew tobacco.	N	O	S	Q	F	A
7.	...I drink beer (or some other drinks with alcohol).	N	O	S	Q	F	A
<b>During the 1 hour before bedtime...</b>							
8.	...I do things that make me feel <i>calm or relaxed</i> (for example: taking a hot bath/shower, listening to soft music, reading).	N	O	S	Q	F	A
9.	...things happen that make me feel <i>strong emotions</i> (sadness, anger, excitement).	N	O	S	Q	F	A
10.	...I am <i>very active</i> (for example: playing outside, running, wrestling).	N	O	S	Q	F	A
11.	...I do things that make me feel <i>very awake</i> (for example: playing video games, watching TV, talking on the telephone).	N	O	S	Q	F	A
12.	...I drink <i>more than</i> 4 glasses of water (or some other liquid).	N	O	S	Q	F	A

		Always (100%)					
		Frequently, if not Always (80%)					
		Quite Often (60%)					
		Sometimes (40%)					
		Once in Awhile (20%)					
		Never (0%)					
I go to bed...							
13.	...and do things in my bed that keep me awake (for example: watching TV, reading).	N	O	S	Q	F	A
14.	...and think about things I <i>need</i> to do.	N	O	S	Q	F	A
15.	...feeling upset.	N	O	S	Q	F	A
16.	...and replay the day's events over and over in my mind.	N	O	S	Q	F	A
17.	...and worry about things happening at home or at school.	N	O	S	Q	F	A
18.	...with a stomachache.	N	O	S	Q	F	A
19.	...feeling hungry.	N	O	S	Q	F	A
I fall asleep...							
20.	...while listening to loud music.	N	O	S	Q	F	A
21.	...while watching TV.	N	O	S	Q	F	A
22.	...in a <i>brightly</i> lit room (for example: the overhead light is on).	N	O	S	Q	F	A
23.	...in <i>one place</i> and then move to <i>another place</i> during the night.	N	O	S	Q	F	A
24.	...in a room that feels <i>too hot</i> or <i>too cold</i> .	N	O	S	Q	F	A
I sleep...							
25.	...in a home where someone smokes cigarettes, cigars, or a pipe.	N	O	S	Q	F	A
I...							
26.	...get <i>too little</i> sleep.	N	O	S	Q	F	A
27.	...use a bedtime routine (for example: bathing, brushing teeth, reading).	N	O	S	Q	F	A
28.	...use my bed for things <i>other than sleep</i> (for example: talking on the telephone, watching TV, playing video games, doing homework).	N	O	S	Q	F	A
29.	...check my clock several times during the night.	N	O	S	Q	F	A

		Always (100%)					
		Frequently, if not Always (80%)					
		Quite Often (60%)					
		Sometimes (40%)					
		Once in Awhile (20%)					
		Never (0%)					
During the school week, I...							
30.	...stay up <i>more than 1 hour</i> past my <i>usual bedtime</i> . My <i>usual school night</i> bedtime is ____:____ am pm	N	O	S	Q	F	A
31.	..."sleep in" <i>more than 1 hour</i> past my <i>usual wake time</i> . My <i>usual school day</i> wake time is ____:____ am pm	N	O	S	Q	F	A
On weekends, I...							
32.	...stay up <i>more than 1 hour</i> past my <i>usual bedtime</i> . My <i>usual weekend</i> bedtime is ____:____ am pm	N	O	S	Q	F	A
33.	..."sleep in" <i>more than 1 hour</i> past my <i>usual wake time</i> . My <i>usual weekend</i> wake time is ____:____ am pm	N	O	S	Q	F	A



**Site ID**

letters only   numbers only

**Client ID**

Therapist ID    numbers only (1)     numbers only (2)

**Sub codes**

D D / M M / Y Y Y Y   /   /

**Date form given**

**Age**

Male  Female

**Stage Completed**

S Screening  **Stage**

R Referral

A Assessment

F First Therapy Session

P Pre-therapy (unspecified)

D During Therapy

L Last Therapy Session

X Follow up 1

Y Follow up 2

**Episode**

**IMPORTANT - PLEASE READ THIS FIRST**

This form has 34 statements about how you have been OVER THE LAST WEEK.  
Please read each statement and think how often you felt that way last week.  
Then tick the box which is closest to this.  
*Please use a dark pen (not pencil) and tick clearly within the boxes.*

Over the last week						Not at all	Only Occasionally	Sometimes	Often	Most of all the time	OFFICE USE ONLY
	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/>					
1 I have felt terribly alone and isolated	<input type="checkbox"/>						F				
2 I have felt tense, anxious or nervous	<input type="checkbox"/>						P				
3 I have felt I have someone to turn to for support when needed	<input type="checkbox"/>						F				
4 I have felt OK about myself	<input type="checkbox"/>						W				
5 I have felt totally lacking in energy and enthusiasm	<input type="checkbox"/>						P				
6 I have been physically violent to others	<input type="checkbox"/>						R				
7 I have felt able to cope when things go wrong	<input type="checkbox"/>						F				
8 I have been troubled by aches, pains or other physical problems	<input type="checkbox"/>						P				
9 I have thought of hurting myself	<input type="checkbox"/>						R				
10 Talking to people has felt too much for me	<input type="checkbox"/>						F				
11 Tension and anxiety have prevented me doing important things	<input type="checkbox"/>						P				
12 I have been happy with the things I have done	<input type="checkbox"/>						F				
13 I have been disturbed by unwanted thoughts and feelings	<input type="checkbox"/>						P				
14 I have felt like crying	<input type="checkbox"/>						W				

**Please turn over**

## Over the last week

	Not at all	Only Occasionally	Sometimes	Often	Most or all the time	OFFICE USE ONLY
15 I have felt panic or terror	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> P
16 I made plans to end my life	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> R
17 I have felt overwhelmed by my problems	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> W
18 I have had difficulty getting to sleep or staying asleep	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> P
19 I have felt warmth or affection for someone	<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 0	<input type="checkbox"/> F
20 My problems have been impossible to put to one side	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> P
21 I have been able to do most things I needed to	<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 0	<input type="checkbox"/> F
22 I have threatened or intimidated another person	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> R
23 I have felt despairing or hopeless	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> P
24 I have thought it would be better if I were dead	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> R
25 I have felt criticised by other people	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> F
26 I have thought I have no friends	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> F
27 I have felt unhappy	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> P
28 Unwanted images or memories have been distressing me	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> P
29 I have been irritable when with other people	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> F
30 I have thought I am to blame for my problems and difficulties	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> P
31 I have felt optimistic about my future	<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 0	<input type="checkbox"/> W
32 I have achieved the things I wanted to	<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 0	<input type="checkbox"/> F
33 I have felt humiliated or shamed by other people	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> F
34 I have hurt myself physically or taken dangerous risks with my health	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> R

THANK YOU FOR YOUR TIME IN COMPLETING THIS QUESTIONNAIRE

Total Scores

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	→	<input type="text"/>	→	<input type="text"/>
----------------------	----------------------	----------------------	----------------------	---	----------------------	---	----------------------

Mean Scores

(Total score for each dimension divided by number of items completed in that dimension)

<input type="text"/>					
(W)	(P)	(F)	(R)	All items	All minus R

Appendix E  
National Sleep Foundation Sleep Diary

Sleep Diary: Morning



Sleep Diary: End of Day

Complete in Morning							
Start date: ___/___/___	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Day of week:							
I went to bed last night at:	7:00 / 8:00	7:00 / 8:00	7:00 / 8:00	7:00 / 8:00	7:00 / 8:00	7:00 / 8:00	7:00 / 8:00
I got out of bed this morning at:	6:00 / 7:00	6:00 / 7:00	6:00 / 7:00	6:00 / 7:00	6:00 / 7:00	6:00 / 7:00	6:00 / 7:00
Last night I fell asleep:							
<input type="checkbox"/> Easily <input type="checkbox"/> After some time <input type="checkbox"/> With difficulty	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I woke up during the night:							
# of times							
# of minutes							
Last night I slept a total of:	Hours	Hours	Hours	Hours	Hours	Hours	Hours
My sleep was disturbed by:	List mental or physical factors including noise, lights, pets, allergies, temperature, discomfort, stress, etc.						
When I wake up for the day, I felt:							
<input type="checkbox"/> Disturbed <input type="checkbox"/> Somewhat disturbed <input type="checkbox"/> Fully alert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Notes:	Record any other factors that may affect your sleep (i.e. hours of work shift, or monthly cycle for women).						

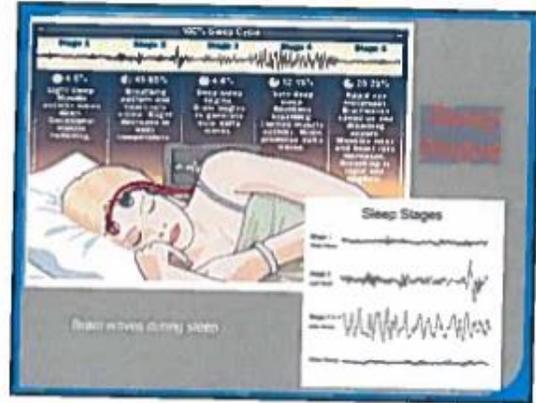
Complete at the End of Day							
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Day of week:							
I consumed caffeinated drinks in the Morning, Afternoon, Evening (N/A)							
W/A/E/T/W How many?							
I exercised at least 20 minutes in the Morning, Afternoon, Evening (N/A)							
Medications I took today:							
Took a nap? (Each one)	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
If Yes, for how long?							
During the day, how likely was I to doze off while performing daily activities? No chance, Slight chance, Moderate chance, High chance							
Throughout the day, my mood was.... Very pleasant, Pleasant, Unpleasant, Very unpleasant							
Approximately 2-3 hours before going to bed, I consumed:							
<input type="checkbox"/> Alcohol <input type="checkbox"/> A heavy meal <input type="checkbox"/> Caffeine <input type="checkbox"/> Not applicable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
In the hour before going to sleep, my bedtime routine included:	List activities including reading a book, using electronics, taking a bath, doing relaxation exercises, etc.						

## Appendix F Sleep Hygiene Lecture

**What and Why? What a Difference One Hour Can Make**

Lauren David  
Auburn University

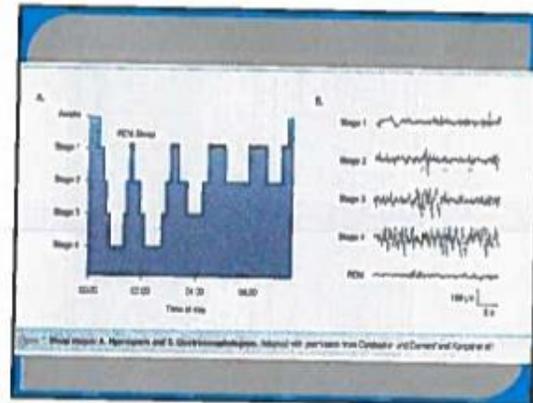
FIGURE 10.10. Joseph Rutenfranz, Ph.D.



**What is Sleep?**

**Dictionary definition:**

- A condition of body and mind such as that which typically recurs for several hours every night, in which the nervous system is relatively inactive, the eyes closed, the postural muscles relaxed, and consciousness practically suspended



**What is Sleep?**

The architecture of sleep is composed of different stages of sleep

- Non-REM sleep (75% of the night, stages 1-4)
- REM sleep or Rapid Eye Movement sleep (25% of the night)
- Begin after about 90 mins of sleep, re-occurring every 90 mins, and lengthening as the night goes on

**Sleep Stages: Non-REM sleep**

**Stage 1**

- Between being awake and falling asleep
- Light sleep

**Stage 2**

- Onset of sleep
- Becoming disengaged from surroundings
- Breathing and heart rate are regular
- Body temperature drops (so sleeping in a cool room is helpful)

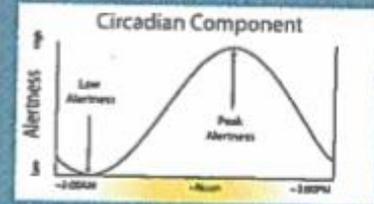
## Sleep Stages: Non-REM sleep

### Stages 3 and 4

- Deepest and most restorative sleep
- Blood pressure drops
- Breathing becomes slower
- Muscles are relaxed
- Blood supply to muscles increases
- Tissue growth and repair occurs
- Energy is restored
- Hormones are released, such as the Growth hormone, essential for growth and development, including muscle development

## Sleep 101

The circadian component operates in a 24 hour cycle and affects biological processes throughout the day, e.g. body temperature, blood pressure, metabolism and sleepiness (some individual differences exist)



## Sleep Stages: REM sleep

- Provides energy to brain and body
- Supports daytime performance
- Brain is active and dreams occur
- Eyes dart back and forth
- Body becomes immobile and relaxed, as muscles are turned off

## Sleep 101

Melatonin - a hormone secreted by the pineal gland

Is absent from our systems in the daylight

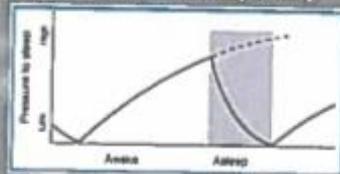
It is triggered by dim light

Release of melatonin triggers feelings of sleepiness: prepares body for sleep - 9:00 PM on average

Exposure to bright lights of screens (i.e. phones, tablets, computers, televisions, game systems) delays this melatonin release and delays sleepiness

## Sleep 101

The homeostatic component: the accumulated pressure to fall asleep the longer that you are awake. When you are sleep deprived, the body compensates by increased need to fall asleep and increased amount and intensity of deep sleep.



## How Much Sleep is Enough?

Adults need about 7-9 hours of sleep per night

Some individual variability (e.g., 6.5 hours may be enough for some, 8.5 may be optimal for others)

A third of adults report getting less than 7 hours of sleep a night

## Why are so Many Adolescents Depressed?

### Social/Environmental influences

- Shift work, prolonged working hours, jet lag, maintaining irregular sleep schedules

### Social & Biological influences

Screen time = TV, computer, tablets, smart phone

Caffeine

Alcohol

### Take home

- Some of us feel that sleep is somewhat voluntary sleep restriction and can therefore be fixed

## Sleep and Emotional Health

- Poor sleepers have an impaired ability to regulate emotions

As sleep quality goes down, perception of stress goes up

- Poor sleep related to strained family relationships

High quality sleep related to supportive family relationships

## Sleep and Physical Fitness

Sleep plays a crucial role for optimal physical performance. Individuals who miss out on sleep put themselves at a disadvantage for performance.

- Even with only slight disruptions in sleep (e.g., 1 less hour)

In contrast, optimal sleep may improve physical performance.

Poor sleepers 29% less likely to have a healthy BMI

## Sleep and Academic Performance

Sleep quality found to significantly affect cognitive performance.

- Missing out on even an hour of sleep decreases students' ability to learn, resulting in lower academic performance, than students getting full nights' sleep.
- Decreased sleep is related to a lessened ability to pay attention and remain focused.

## Sleep and Nutrition

Poor sleepers less likely to:

Eat breakfast (associated with enhanced attention and cognitive performance compared to not eating breakfast)

Engage in healthy eating habits

Eat at regular meal times

Poor sleepers more likely to:

Drink more sugar sodas

Eat more snacks than regular meals

Eat less fruits and vegetables

Eat more sweets



## Best Sleep Habits for Success

Go to sleep and wake up at the same time every day of the week

Exercise earlier than 3-5 hours before bedtime

Use any substances (i.e., alcohol, caffeine, nicotine) earlier than 3-5 hours before bedtime

Limit daytime napping unless you are consistently getting short night time sleep



### Good Sleep Habits for Success

- Put away your electronics 30-60 minutes before bedtime. Listen to soothing music or read instead (not on a tablet or reader)
- Limit time spent in bed not sleeping (i.e., lying awake thinking, worrying, etc.)
- Limit mentally and physiologically arousing activities prior to bedtime, including (but not limited to) school work, paying bills, or having an argument
- Use your bed only for sleep and sex

### Sleep Disorders to Watch Out For

#### Obstructive Sleep Apnea

Medical condition, usually evidenced with numerous nocturnal breathing disturbances

#### Circadian Rhythm Sleep-Wake disorders

Pattern of misalignment between circadian system and sleep-wake schedule required by the environment, usually leading to insomnia or excessive sleepiness

*If you're experiencing any of the sleep problems, consult with a psychologist or medical doctor*



### Good Sleep Habits for Success

- Empty your bladder just before lights out so the need to urinate won't interrupt your sleep
- Sleep in a dark, quiet, comfortable environment. If needed, use soft foam earplugs or a fan to block sounds and a sleep mask to block light. Create a comfortable bed environment (mattress, pillows, sheets, free from allergens) and keep bedroom at a cooler temperature

### Sleep Disorders to Watch Out For

#### Insomnia

Difficulty initiating or maintaining sleep, or early morning awakenings with inability to fall back asleep

#### Hypersomnolence

Excessive sleepiness despite adequate sleep length; usually non-restorative sleep

#### Narcolepsy

Irrepressible need to sleep, lapsing into sleep, or napping occurring within the same day