

Alicia M. Moran, A BRIEF MOTIVATIONAL INTERVIEWING INTERVENTION (SIESTA) FOR ADOLESCENT SLEEP: EFFECTS ON NEUROCOGNITION AND SLEEP-RELATED BEHAVIOR (Under the direction of Dr. D. Erik Everhart) Department of Psychology, March 2013.

Several studies have described sleep characteristics of adolescents, concluding that adolescent sleep lacks duration, quality, and consistency. Due to behavioral, environmental and biological changes, adolescents tend to prefer to stay up late and demonstrate considerable difficulty awakening in the morning for school. Study 1 of this dissertation examined sleep characteristics, demographics, and egocentrism in a large sample ( $N = 521$ ) of adolescents from a middle and high school in a low-SES ethnically diverse school district. Minorities and individuals of low SES are particularly vulnerable to health disparities, with limited research efforts focused towards exploration of sleep habits in youth that are linked to overall health and mortality as adults

Due to the wide range of negative consequences, including poor academic performance, increased risk of accidents, and increased risk of mental and physical health concerns, associated with inadequate sleep among adolescents, intervention has been an important focus of psychologists. Study 2 of this dissertation focused on the development of a 4-week, small group intervention (School-based Intervention to Establish Sleep Skills Tailored to Adolescents (SIESTA) incorporating principles of cognitive behavioral therapy and motivational interviewing. Additionally, this approach targeted volunteers to participate rather than making the intervention mandatory, in contrast to prior interventions. Overall, very few of the eligible participants volunteered to participate ( $N = 12$ ). However, these intervention participants showed a significant improvement in daytime sleepiness and increase in school-night sleep duration. They also demonstrated a significant improvement in reaction time and processing speed after the intervention. There was a large, positive correlation between estimated intelligence and

increase in sleep duration across the intervention. While the findings of these studies are promising, future research involving randomized controlled trials (RCTs) that examine academic and health outcomes are vital before the feasibility of dissemination across schools is examined.

A BRIEF MOTIVATIONAL INTERVIEWING INTERVENTION (SIESTA) FOR  
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BEHAVIOR

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## CHAPTER 1: INTRODUCTION

### Characteristics of Adolescent Sleep

Researchers believe that adolescent sleep generally lacks duration, quality and consistency, with particular subgroups of adolescents, including minority and low SES, being more vulnerable to these shortcomings (Moore & Kirchner, 2011). Of note, minority and low SES adults are more likely to sleep less and report worse quality sleep than their Caucasian counterparts (Stamatakis, Kaplan, & Roberts, 2007). Thus, long standing sleep patterns that result in chronic sleep deprivation may contribute to the ethnic and socioeconomic health disparities evident in the US. This makes it is important to further define sleep characteristics of minority populations and capitalize on adolescence as an avenue for intervention and prevention of further sleep problems and other chronic health conditions linked to poor sleep.

There is a general consensus among sleep researchers that adolescents require approximately 9 to 10 hours of sleep per night for optimal functioning in a number of domains, including school performance, mood regulation, cognitive processes such as reaction speed and attention, and overall health (Anderson, Storfer-Isser, Taylor, Rosen, & Redline, 2009; Carskadon et al., 1980; Crowley, Acebo, & Carskadon, 2007; Mercer, Merritt, & Cowell, 1998; Millman, 2005; Wolfson & Carskadon, 1998). According to a national survey on sleep patterns in U.S. adolescents between ages 11 and 17, only 20% get the recommended nine hours of sleep on school nights and 45% get less than eight hours on school nights (Carskadon, Mindell, & Drake, 2006). While only 14% of Caucasian adolescents indicated that they got less than 8 hours of sleep on non-school nights, twice as many African American adolescents (28%) reported the same. Interestingly, 90% of parents believe their adolescent is getting enough sleep “most nights” (Carskadon et al., 2006; Foundation, 2006).

Although parents may be unaware of their adolescent's poor sleep, adolescents themselves acknowledge inadequate sleep. In one survey, over 60% of high school students reported that they were "too sleepy to get out of bed in the morning," consistent with findings that 63% of adolescents aged 15-17 were very tired upon waking in the morning (Crowley et al., 2007; Wolfson et al., 2003). Over 70% of students require a parent to wake them up on school mornings and 15% had been late for school due to waking up late in the past two weeks, additional indicators that sleep duration was not adequate (Foundation, 2006). Another study reported that 85% of high school students needed their parent or an alarm to wake up on school days (Carskadon & Acebo, 2002).

Subjectively, it is not uncommon for adolescents to report symptoms of insomnia or poor sleep quality. A large-scale epidemiological study published in 2000 examined older adolescents aged 15-18 in four western European countries, and found that over 30% had at least one sleep complaint. Nearly 20% complained of daytime sleepiness, while 13.8% reported nonrestorative sleep, 12.4% reported difficulty falling asleep, and 9.2% reported difficulty maintaining sleep (Ohayon, Roberts, Zulley, Smirne, & Priest, 2000). Despite acknowledging these complaints, 60% of adolescents reported that they "enjoy staying up late" (Carskadon et al., 1988). Perhaps this is because adolescents (and adults) commonly assume that sleep loss has little or no effect on waking brain function. Rather, they believe, that sleep loss primarily affects motivation, and they can overcome this barrier and work as effectively as if they achieved adequate rest (Van Dongen, Maislin, Mullington, & Dinges, 2003).

Adolescents often attempt to compensate for missed sleep during the week by sleeping in on weekends. The difference between weekend and school-night bedtimes averages between 1 and 2 hours, and is usually greater in older than younger adolescents (Carskadon et al., 2006;

Wolfson & Carskadon, 1998). Even more drastic of a difference is the 3-4 hour discrepancy between weekday and weekend rise time in 13-19 year old adolescents, with girls rising earlier than boys (T. Roenneberg, Wirz-Justice, & Mellow, 2003).

Due to developmental changes related to puberty and environmental influences, many adolescents find it progressively more difficult to fall asleep early and awake as early as they had when they were younger. Researchers argue that the number of hours of sleep needed does not change from ages 10 to 17, but rather there is a shift in sleep, or phase delay, linked to melatonin levels that peak later in the evening for adolescents in comparison to younger children and adults (Buckhalt, Wolfson, & El-Sheikh, 2009; Carskadon & Acebo, 2002).

### **Correlates and Consequences of poor sleep in adolescents**

**Behavioral influences.** Adolescence is a time period of increased independence and responsibility involving a number of environmental pressures that interfere with adequate sleep. These environmental pressures range from decreased parental control to part time jobs. As high school students age, parental influence on a bed time greatly decreases (72% of 9<sup>th</sup> graders have a bed time and 39% of 12<sup>th</sup> graders), and adolescents are progressively allowed more independence in determining when to go to bed (Foundation, 2006). However, according to this poll, over 70% of the set bedtimes are for 10:00 PM or later, which typically is not sufficient for the recommended 9-10 hours of sleep due to the time it takes to fall asleep (74% of adolescents take > 30 minutes to fall asleep) and average wake times between 6:23 and 6:42. Furthermore, adolescents reported getting into bed on average 30 minutes after their set bedtime.

Additionally, student responsibilities and opportunities increase as independence increases. High school students often have more homework than they did in middle school, more opportunities for extracurricular activities, and part time jobs with late hours (Carskadon et al.,

1980; Carskadon et al., 2006; Foundation, 2006). In a recent study surveying 384 high school students, students identified homework (46%), too much time hanging out with friends (30%), too much TV (39%), and stress (42%) as the four main reasons why they got inadequate sleep (Noland, Price, Dake, & Telljohann, 2009). Part time jobs (21%) and extra curricular activities (24%) also fell among the top reasons for inadequate sleep.

Wolfson and colleagues examined the sleep schedules of over 3000 high school students, and found significant differences among those students who held a part time job and those that did not. Students who worked 20 or more hours per week reported going to bed later at night, sleeping fewer hours per night, oversleeping more in the morning, and falling asleep more in class than those who did not work or worked less than 20 hours per week (Wolfson & Carskadon, 1998). In this particular sample, high school students in rural, urban, and suburban communities of Rhode Island, 60% of the students held a job, and 30% of those employed worked more than 20 hours each week. In terms of extracurricular activities, those students who engaged in 5 or more hours per day of activities obtained significantly less sleep than those students that did not participate in extracurricular activities or work (Dorofaeff & Denny, 2006).

The Sleep in America poll also revealed that many high school students play video games, instant message, surf the web, exercise or talk on the phone the hour prior to going to bed. Due to the light that disrupts melatonin production, and the physical and emotional intensity of these activities, delayed sleep onset is expected. Furthermore, it is speculated that some adolescents experience frequent waking from text messaging and instant messaging noises and lights. Many of these environmental factors can be changed with relatively simple behaviors, such as turning off a phone before going to bed and rearranging the after school schedule. Despite sleep hygiene interventions improving knowledge regarding good sleep behavior, as

indicated by sleep hygiene quizzes, education does not translate to behavior change. Many students indicated that they *did not want* to change their current habits (Moseley & Gradisar, 2009).

**Cultural influences, gender and environmental factors.** There are other less controllable environmental factors that contribute to poor sleep in adolescents and children, and provide context for ethnic and income based health disparities. For example, there are environmental variables that are often, but not always, linked to SES that are related to shortened sleep time. In a sample of almost 400 adolescents, 29% identified the temperature of their sleeping environment as problematic, 25% stated there was too much outside noise, 23% indicated they had too many chores to do before sleep, and 15% reported that their care of siblings interfered with obtaining enough sleep (Noland et al., 2009).

In an Australian study of 133 adolescents aged 13-17, those adolescents who had no telephone, moved two or more times, and held a part time job were less likely to obtain adequate sleep (Dorofaeff & Denny, 2006). The authors operationalized these findings as indicators of low socioeconomic status (SES), but discussed the limitations of that application. Surprisingly, there was no significant relationship between overcrowding and sleep duration. Crabtree and colleagues examined sleep in 2-7 year olds of differing socioeconomic status (SES). Not only did children from low SES families obtain significantly less sleep than their middle class counterparts, they also were significantly more likely to display negative bedtime behavior and report excessive daytime sleepiness (Crabtree et al., 2005). After controlling for SES, African American children were less likely to obtain adequate sleep than Caucasian children, although naps were not measured for total sleep time. Similar results were found when comparing Caucasian and minority 8 to 11 year olds on duration of sleep (Spilsbury et al., 2004). Minority

males slept significantly less than nonminority boys and all girls. These authors emphasized the need for further understanding of the social and emotional influences that may differ among ethnicities. Among a diverse sample of adolescents aged 13-16, minority participants slept approximately 20 minutes less per night than non-minority adolescents (Moore & Kirchner., 2011). Minority children are much more likely to have a bedtime that is later than necessary to achieve nine hours of sleep per night compared to nonminority children (Spilsbury et al., 2004). Much of the data suggesting a relationship between SES, ethnicity, and poor sleep is limited to research on younger children. The relationship between SES and ethnicity on sleep in older adolescents may benefit from additional research.

There is also some evidence to suggest education is an important predictor of sleep behavior. For example, greater education has been associated with better sleep quality and with higher income in adults (P. Moore, Adler, Williams, & Jackson, 2002). Also, the importance of the role of parent intervention in adolescence was identified as one of the most important findings of the Sleep in America Poll (2006).

Gender discrepancies in adolescent sleep have been identified, but findings have been variable. For example, one study found that girls obtained less sleep than boys and reported greater sleep disturbances (Giannotti, Cortesi, Sebastiani, & Ottaviano, 2002). Similarly, another study showed that boys woke up later than girls on weekdays, but not weekends (Lee, Mcenany, & Weekes, 1999). Tonetti and colleagues found that girls reported a longer preferred sleep duration and suggested that there are gender-related circadian preferences for morningness and eveningness in adolescents (Tonetti, Fabbri, & Natale, 2008). However, at least one other study has found that boys obtain less sleep than girls (Till Roenneberg et al., 2007). Finally, the largest of these studies, across the broadest age range, suggested that there is no difference in sleep

duration between boys and girls (Foundation, 2006). However, it is possible that sex differences are variable based upon age groups, and thus, possible sex differences should be assessed during different developmental periods.

**Developmental considerations.** In addition to the environmental and behavioral factors influencing sleep patterns in adolescents, there are significant developmental and biological changes that take place in adolescence. Due to these changes, sleep problems typically peak in late adolescence, during the high school years (Dorofaeff & Denny, 2006). Circadian mechanisms are thought to slowly change across adolescent development, including a change toward evening circadian phase preference and later circadian phase. Also, a slower accumulation of homeostatic sleep pressure during puberty delays the sleep/wake cycle (Crowley et al., 2007). In other words, adolescents' sleep/wake schedules naturally becomes delayed as adolescents become tired and go to sleep later, but are not able to obtain enough sleep due to early awakening for school. As mentioned previously, these individuals often compensate for missed sleep by sleeping later on weekends and vacation days. African American adolescents appear to experience the most dramatic shift, where Hispanic children seem to be least affected by this change towards evening circadian preference (S. Kim, Dueker, Hasher, & Goldstein, 2002).

When this inconsistent and restricted pattern of sleep causes distress or impairs social, occupational, or other areas of functioning, a diagnosis of delayed sleep phase syndrome (DSPS) may be appropriate. The 2005 International Classification of Sleep Disorders (ICSD-Revised) lists DSPS within the set of Circadian Rhythm Sleep Disorders and states that it must be due to a persistent or recurrent pattern of sleep disturbances resulting from a misalignment of endogenous rhythm and external factors that affect timing/duration of sleep, and that there must be sleep

disruption that leads to insomnia and/or excessive daytime sleepiness. The incidence of DSPS is somewhat unclear, but estimates of adolescent DSPS are as low as 1.6% in Japan to 7% or more in the US, while only an estimated 0.7% of adults suffer from this same disorder (Ando, Kripke, & Ancoli-Israel, 2002; Hazama, Inoue, Kojima, Ueta, & Nakagome, 2008; LeBlanc et al., 1999).

DSPS is not the only sleep disorder of concern among adolescents. In a sample of 330 adolescents (15-18 years old), 4% met criteria for insomnia (Ohayon et al., 2000). There is evidence that low income youth are at increased risk of developing insomnia (Robert E Roberts, Roberts, & Chan, 2006). Adolescent girls are at increased risk of developing insomnia after menses onset (Eric O Johnson, Roth, Schultz, & Breslau, 2006). An additional 2% of adolescents are thought to suffer from sleep disordered breathing, and somewhere between 13 and 66% of overweight adolescents have obstructive sleep apnea (Verhulst et al., 2007). It is important to note that African American adolescents are at a much high risk of obesity and development of sleep disorder breathing (Heath, Eaves, Kirk, & Martin, 1998). Although rare, narcolepsy, periodic limb movement, and restless leg syndrome are all disorders that can affect children and adolescents (Millman, 2005). Diagnosable sleep disorders and subclinical sleep patterns that resemble DSPS and insomnia are a serious public health concern due to the serious consequences of chronic sleep restriction and poor quality of sleep.

**Neurocognitive consequences of poor sleep.** Consequences of inadequate and poor sleep range from subjective sleepiness to increased risk of accidents and poor school performance. Excessive daytime sleepiness, which involves deficits in alertness and vigilance, is a primary complaint of reduced duration and/or quality of sleep. In addition to subjective difficulty in focusing and sustaining attention, laboratory findings suggest slowed cognitive capabilities, especially in complex tasks. Individuals often begin tasks well, but neglect details,

make mental mistakes, and have slowed reaction time across time (Dinges et al., 1997; Doran, Van Dongen, & Dinges, 2001). Complex mental tasks, involving abstract reasoning, problem solving, and cognitive flexibility seem to be impaired as a result of sleepiness, although most studies utilized school-aged children and young adolescents (Fallone, Owens, & Deane, 2002). In a recent study that was carefully controlled for extraneous variables, deficits in executive functioning were related to higher levels of subjective sleepiness in adolescents, but not to duration of sleep (Anderson et al., 2009). This relationship was strongest among those with caregivers who had lower levels of education.

Other basic aspects of neurocognitive performance, including fine motor skills, attention and response inhibition, and memory have yielded inconsistent evidence of impairment as a direct consequence of sleepiness in adolescents (Fallone et al., 2002). When examining school-aged children there is some evidence that there is a relationship between poor sleep (sleep deprivation, sleep restriction, sleepiness) and these neurocognitive domains (Randazzo, Muehlbach, Schweitzer, & Walsh, 1998; Sadeh, Gruber, & Raviv, 2002). However, there are few studies utilizing older adolescent samples. One challenge when conducting this type of research is the issue of confounding demographic variables, such as race, ethnicity, education, and SES when examining cognitive functioning, as performance on neurocognitive measures can differ regardless of sleep. Furthermore, many of these studies measure executive functioning only after acute sleep restriction rather than chronic sleep loss (Fallone et al., 2002). Those researchers that have failed to find a strong relationship between sleep deprivation and cognitive performance in adolescents have offered the explanation of interindividual difference in tolerance for sleep deprivation (Anderson et al., 2009; Mercer et al., 1998). Rather, measures of subjective sleepiness may be a better predictor of cognitive deficits.

Although the evidence utilizing standardized measures to examine executive functioning secondary to excessive daytime sleepiness is relatively weak, there is ample evidence that everyday activities involving executive functioning skills suffer. One such activity that involves sustained and reliable attention and vigilance is operating a motor vehicle. Motor vehicle crashes are the leading cause of death in adolescents, and people between the age of 16 and 29 years of age are the most likely to be involved in crashes caused by the driver falling asleep (Horne & Reyner, 1995; Pack, Pack, Rodgman, & Cucchiara, 1995). When alcohol is not involved a majority of sleep related accidents are caused by two age groups, 16-25 years old and 65 and older. Young males appear to be at a slightly higher risk than young females, and those young persons who get only 6-7 hours of sleep per night are 1.8 times more likely to be involved in a sleep-related crash while those sleeping 5 hours or less per night are 4.5 times more likely to crash after falling asleep at the wheel than those getting more than 7 hours of sleep per night (Stutts & Wilkins, 1999; Stutts, Wilkins, Osberg, & Vaughn, 2003). Stutz and colleagues interviewed drivers from North Carolina who were classified in their police reports as having a sleep or fatigue related crash. They found that 40% of drivers had been awake for 15 hours or more and 20% had been awake for 20 hours or more before falling asleep at the wheel (Stutts & Wilkins, 1999).

**Academic consequences of poor sleep.** School performance is another vital component of an adolescent's life that is threatened by poor sleep quality and duration. Wolfson and Carskadon carefully reviewed the large body of literature pertaining to adolescent sleep patterns and school performance (Wolfson & Carskadon, 2003). In summary they concluded shortened total sleep time, irregular sleep schedules, and poor sleep quality are highly associated with poor school performance for adolescents. Those adolescents with self-reported higher grades reported

significantly longer sleep times. Those students that slept greater than nine hours were more likely to earn B's or better, while those with less than 8 hours of sleep were more likely to earn C's or worse. Those students with better grades also reported a more regular sleep/wake schedule with fewer weekends sleep delays. However, Wolfson and Carskadon discuss the weakness in utilizing grade point averages, as schools differ on difficulty, classes offered, and rating systems.

Meijer and colleagues examined the relationships between time in bed, sleep quality, and various measures of school functioning among younger adolescents. They found that adolescents who reported having difficulty getting up were less motivated to do their best at school, while adolescents with high quality sleep were more receptive to teacher influence, had more positive images of themselves as students, and reported more motivation to do their best in school (Meijer, Habekothé, & van den Wittenboer, 2000). In summary, adolescents who obtained adequate sleep were more likely to earn higher grades and have a more positive attitude towards school than those adolescents with inadequate sleep.

**Mental health outcomes of poor sleep.** The positive attitude and feelings associated with restorative sleep are not limited to the school environment. According to a large scale longitudinal study utilizing the Diagnostic Interview Schedule for Children (DISC-C), those adolescents with no sleep complaints had lower anxiety, depression, conduct disorder, and attention deficit disorder scores than those with sleep problems (Morrison, McGee, & Stanton, 1992). In a sample of over 4,500 adolescents, those who had reported sleeping issues were 22.7 times more likely to report anxiety and depression, 10.9 times more likely to report attention problems, and 6.2 times more likely to report social problems (E. O. Johnson, Breslau, Roth, Roehrs, & Rosenthal, 1999). Despite the strength of the relationship between psychosocial

problems and sleep problems, it is unclear if the relationship is bidirectional due to the correlational research design of these studies.

There are two longitudinal studies that explore poor sleep as a predictor for later mental health issues. Utilizing a sample of 257 boys from high-risk families, those who had reported difficulties sleeping at ages 3-5 were significantly more likely to have attention problems, anxiety, and depression at ages 12-14 (Wong, Brower, Fitzgerald, & Zucker, 2004). In a 1-year study of 11-17 year old adolescents, sleep disturbances predicted development of poor self esteem and depression one year later (R. E. Roberts, Roberts, & Chen, 2002),

There is substantial research that suggests adolescents with clinical mood disorders report high rates of sleep disturbances, while there are also data indicating that adolescents with sleep problems report increased negative mood and difficulty regulating their mood (Birmaher, Ryan, Williamson, Brent, & Kaufman, 1996; Morrison et al., 1992). In one of the first studies examining the effects of poor sleep in adolescents, participants who were classified as poor sleepers were more likely to report feeling “tired,” “tense,” “grumpy,” and “down in the dumps” most of the time (Price, Coates, Thoresen, & Grinstead, 1978). Interestingly, clinicians often report irritability and mood lability as an indicator of adolescent depression. Although the relationship between sleep and mood is not clear, it is obvious there is a strong connection between the two. In summary, problematic sleep is a marker for psychopathology in children and adolescents, and poor sleep puts one at risk for developing a psychiatric disorder.

**Substance abuse and poor sleep.** There is a similarly complex bidirectional relationship between sleep parameters and substance use and abuse in adolescents. Poor sleep or sleep disturbance may create a pathway for substance abuse as excessive daytime sleepiness and the resulting poor academic and social outcomes can lead to self medication (Bootzin & Stevens,

2005). For example, an adolescent may believe alcohol will facilitate sleep, but does not consider the impact of alcohol on sleep architecture and the rebound affect that leads to acute rebound insomnia (Millman, 2005). The result is likely increased daytime sleepiness and negative outcomes, which sets the stage for a perpetuating cycle of sleep disturbance, daytime sleepiness, and self-medication with alcohol.

Findings pertaining to an increased risk of substance use in poor adolescent sleepers are not limited to alcohol use. According to the 1996 National Household Survey on Drug Abuse, adolescents who had trouble sleeping often were more likely than those who had no trouble sleeping to report past-year use of inhalants (odds ratio 6.5), and more than twice as likely to use marijuana and cigarettes (E. O. Johnson et al., 1999). This was the same sample that identified strong associations between psychopathology and poor sleep. It appears that psychopathology, predominantly anxiety and depression, poor sleep and sleepiness, and substance use are interconnected, and can contribute to a cycle of maladaptive feelings and behavior in adolescents.

**Health outcomes of poor sleep.** The impact of chronic sleep deprivation is evident when examining physical health in addition to mental health. One consequence of inadequate sleep is a greater risk of obesity in adolescents. Being overweight is significantly associated with shorter sleep duration, and for each hour of lost sleep an adolescent's odds of developing obesity increases by 80% (Gupta, Mueller, Chan, & Meininger, 2002). Longitudinal studies have strengthened the support for a causal relationship between poor sleep and development of obesity. In a study of 785 children, shorter sleep duration in 3<sup>rd</sup> grade was associated with a greater likelihood of being overweight in 6<sup>th</sup> grade. The analysis adjusted for sex, race, maternal education, and child's BMI score in 3<sup>rd</sup> grade (Lumeng et al., 2007). A prospective study

examined 150 children from birth until 9.5 years of age and identified shortened sleep time at ages 2 to 5 as a significant predictor for being overweight at the end of the study when children were 9.5 years old (Agras, Hammer, McNicholas, & Kraemer, 2004). There is no evidence quality of sleep or daytime sleepiness is related to child or adolescent weight. However, researchers have hypothesized that excessive daytime sleepiness from shortened sleep duration leads to caffeine consumption. However, many drinks preferred by adolescents with high caffeine content, such as soft drinks and coffee drinks, are loaded with sugar and high in calories and sometimes fat (Noland et al., 2009).

Weight gain and obesity can be partially explained by the hormonal changes associated with greater caloric intake that result from inadequate sleep. The production of leptin, a hormone that reduces hunger and peaks during sleep, is decreased when sleep is decreased (Kalra, Bagnasco, Otukonyong, Dube, & Kalra, 2003). While leptin decreases hunger, a hormone called ghrelin increases hunger. Sleep time reduction increases ghrelin release, and is linked to cravings of sweet, salty, and typically calorically dense foods (K. Spiegel, Tasali, Penev, & Van Cauter, 2004; Taheri, Lin, Austin, Young, & Mignot, 2004).

Chronic sleep loss has also been associated with higher cortisol levels and poorer glucose tolerance, which results in poorer insulin responses to hyperglycemia. This hormone profile is characteristic of one who is prediabetic, and eventually leads to insulin resistance and diabetes (VanHelder, Symons, & Radomski, 1993). Furthermore, as summarized above, those adolescents who have sleep problems are more likely to struggle with cognitive deficits, mental health issues, poor school performance, and other stressors that are likely to increase cortisol levels even more.

Sleep disturbances may impact physical activity levels as well. Shorter sleep time results in less energy, resulting in lower interest in exercise and lower caloric expenditures (Noland et

al., 2009). In a large group of 11-16 year olds, for every hour that a sleep disturbance was experienced, the adolescent's physical activity decreased by 3% (Gupta et al., 2002). The physical and mental health outcomes of inadequate sleep examined as a whole is alarming. From short-term moodiness and cognitive slowing to serious health risks associated with chronic poor sleep in childhood and adolescence, researchers regard this problem as a major public health concern that is in need of intervention.

Although researchers acknowledge the need for assessment of sleep problems and interventions for adolescents, screening for sleep problems is very rare in the primary care setting, and not typical in schools either (Wassel, Soueidan, Al Etat, & Fahmy, 2006).

### **Review of Current Interventions to Improve Sleep in Adolescents**

Adolescent oriented interventions are costly, time consuming, and require trained professionals to deliver evidenced-based interventions. As an alternative approach to solve the problem of poor adolescent sleep, a study conducted over 10 years ago in the Minneapolis Public School System examined the effect of delaying high school start times (Wahistrom, 2002). Before the delay, high school classes began at 7:15 AM, and were dismissed at 1:45 PM. The new schedule had a start time of 8:40 AM and dismissal time of 3:20. Surprisingly, students did not stay up later, thus were much more likely to obtain an hour of additional sleep each night. Furthermore, statistically significant improvements were noted in attendance rates, decreased rates of sleeping in class, and less student-reported depression. In the past decade, at least 80 school districts have delayed their high school start times (Lamberg, 2009). Of note, the most recent data suggests that still only 16% of high schools start between 8:15 and 8:55 AM (Millman, 2005). Researchers acknowledge the positive outcomes of delaying the beginning of school. However, changing school schedules involves not only students and teachers but also

several aspects of social life associated with school, such as transportation and parent work schedules (de Sousa, Araujo, & de Azevedo, 2007). Furthermore, changing school schedules is more difficult and more expensive than most school-based interventions (Brown & Buboltz, 2002). In sum, it is unlikely that many schools will adopt such a schedule, and therefore targeting interventions to improve sleep related behavior should be the focus of researchers.

Researchers have developed a small variety of interventions, many focused on a combination of cognitive and behavioral strategies, and many have been modeled after successful adult sleep interventions (Bootzin & Stevens, 2005; de Sousa et al., 2007). Although cognitive behavioral therapy for insomnia is effective in 70-80% of adults, including young adults, support for the application to adolescent sleep problems is limited (Jacobs, Pace-Schott, Stickgold, & Otto, 2004; Morin et al., 2006). There are only two studies that utilized a predominantly cognitive-behavioral framework as an intervention. A randomized controlled trial conducted with 81 Australian high school aged adolescents found that a school-based cognitive-behavioral intervention reduced the discrepancy between school week and weekend bedtimes in those adolescents with delayed sleep timing, and increased sleep hygiene knowledge (Moseley & Gradisar, 2009). However, there were no significant changes in sleep or daytime parameters, such as total sleep time, daytime sleepiness, and depressed mood. Furthermore, the behavior changes seen after the intervention disappeared after 6 weeks. Strengths of this study were the short duration of 4 weeks at 50 minutes per week, and a high retention rate (83%) in the program.

The other study to date that utilized CBT framework was an outpatient based intervention rather than school-based, and had a poor retention rate (42%) (Bootzin & Stevens, 2005). However, it must be noted that this study recruited a high-risk population, 55 adolescents with a

history of substance abuse who were completing a substance abuse treatment program. Noncompleters of this program dropped out due to incarceration, work commitments, unwillingness to complete the assessments necessary for research, and travel burdens. The criteria for participating were having a “sleep disturbance” or “daytime sleepiness”. Those who did complete the program showed a significant increase in total sleep time and also reported significant improvement in reductions of sleepiness, worry, and mental health distress. Completion was defined as attending 4 out of the 6 weekly sessions, and no long-term follow-up was collected.

Despite both working within a cognitive behavioral framework, these two programs differed on sample population, content, delivery, and design. The sleep related components of the randomized school based intervention included sleep hygiene, stimulus control, cognitive strategies for sleep, consequences of poor sleep practices, and education of sleep needs of adolescents. The outpatient group also utilized stimulus control, sleep hygiene education, and cognitive strategies for sleep. In addition, Bootzin and colleagues added a bright light component to change circadian rhythms, as well as a mindfulness-based stress reduction component. The school-based intervention identified only those students who had delayed sleep phase and imbedded the sleep content into a well-being program to reduce selection bias and demand effects (Moseley & Gradisar, 2009). In contrast, the outpatient participants had just subjective complaints of sleep, and were aware that the intervention was specifically targeting sleep, which can create demand effects (Bootzin & Stevens, 2005). Finally, this was a smaller study that lacked a control group. Given the vast differences in these studies, it is difficult to summarize the overall utility of cognitive-behavioral approaches for adolescents with sleep problems.

The research examining less complex education based programs in the adolescent population is almost as scarce as the cognitive-behavioral focused programs (Tobler, 2000). Sleep-hygiene education programs have been applied to both middle school and high school students. Knowledge of sleep hygiene was weakly associated with good sleep hygiene practices in university students (Brown, Bulbaltz, & Soper, 2002). Researchers in other fields have also noted that acquisition of knowledge is rarely enough in itself to change behavior (Tobler, 2000). These programs are also subject to low response rate, lack of controls, small sample sizes, compliance issues, and lack of follow-up data (Noland et al., 2009). One such program was a sleep hygiene education program that was developed and implemented in four classes of adolescents in Brazil (de Sousa et al., 2007). The objectives taught in this program included sleep physiology, causes and consequences of short sleep and sleep hygiene procedures. Sessions were 50 minutes and took place across 5 days in the same school week. After the program, the adolescents' irregularity index of sleep onset decreased, they napped earlier in the day, and sleep latency diminished. There was no impact on daytime sleepiness or measures of sleep quality. All students were eligible to participate, regardless of delayed sleep phase behaviors or subjective sleep quality. This study was limited due to selection bias, self report data, limited time after follow up, and demand characteristics.

A more recent randomized controlled sleep hygiene intervention study in adolescents utilized high school students as sleep educators for their peers (Prince, Schauer, LeBourgeois, & Schauer, 2010). Researchers identified 125 students who met criteria for being an "evening type" on the Morning & Eveningness Questionnaire (MEQ). Peer educators used baseline data to create individual sleep improvement plans. Mean bedtimes were earlier and sleep quality was significantly improved in the experimental group. Researchers attribute the success of this study

to the unique peer component as well as the individualized treatment. It is unclear if this was a school-based intervention, or took place on an outpatient basis.

In summary, interventions for adolescent sleep problems are limited and have widely varied on content and quality. Due to vast differences in sample selection (all students, students with excessive daytime sleepiness, delayed sleep phase individuals, and evening type individuals) it is difficult to make comparisons among varying treatment programs and approaches. For a variety of reasons, these intervention studies have not examined outcomes in the context of cultural and demographic factors. While some of these interventions have been conducted in countries or areas with little ethnic diversity, other researchers did not collect the necessary demographic data to examine differences among groups.

Despite the many limitations, all interventions identified desire to participate and/or motivation as factors limiting effectiveness of treatment. Although behavior-focused programs and cognitive behavioral programs have been implemented, no intervention has integrated aspects of motivational interviewing into treatment. Motivational interviewing has been found to be effective in both altering adolescent health behaviors and areas of behavioral sleep medicine (Aloia, Arnedt, Riggs, Hecht, & Borrelli, 2004; Martins & McNeil, 2009).

It is evident from the early research in sleep and other health-related behavior that providing school-based intervention strengthens the effectiveness of interventions (Noland et al., 2009; Pospel, Baldus, Horn, Groen, & Hautzinger, 2005). School-based interventions can not only do mass screening for sleep problems, but treatment through school can also eliminate many of the barriers to receiving treatment – time constraints, transportation, cost, and social stigma. Alternatively, there are limitations to school-based interventions. In a review of implementing school-based substance abuse intervention, Wagner and colleagues emphasize the

concept that no school is the same as another, which creates for a daunting task in recruiting schools to participate. Schools vary in procedures to approve intervention work, and willingness to collaborate. They also noted several methodological challenges of working with school populations. For example, it is often impossible to “randomize” students into groups based on school structure (e.g., classrooms) and ethical considerations (e.g., waitlist control) (Wagner, Tubman, & Gil, 2004)

Despite the widespread application of motivational interviewing (MI) as a tool for change in behavior among adolescents, MI has not been implicated in sleep interventions in adolescents. Motivational interviewing is a client-centered, directive method for enhancing intrinsic motivation to change by exploring and resolving ambivalence, originally developed to treat substance abuse by Miller and Rollnick (Miller & Rollnick, 1991). In the past 20 years, empirical support for MI has begun to accumulate across problem behaviors, including health behaviors, and treatment adherence, far beyond its origins in the treatment of addictive behavior (Martins & McNeil, 2009). An underlying theory that explains the mechanism of action in MI treatment is currently still under development (Miller & Rose, 2009). Miller proposed the following theory that emphasizes two specific active components – a relational component focused on empathy and the interpersonal spirit of MI, and a technical component involving the differential evocation and reinforcement of client change talk. The spirit of MI has three components: 1) is collaborative rather than authoritarian, and 2) evokes the client’s own motivation rather than trying to install it, and 3) honors the client’s autonomy (Rollnick & Miller, 1995). The “technical hypothesis” suggests that proficient use of the techniques of MI will increase clients’ in-session change talk and decrease their sustain talk, which in turn will predict behavior change. He also emphasizes the importance of training in MI and treatment fidelity as process variables that

determine outcomes. According to Miller, the resulting causal chain model links therapist training, therapist and client responses during treatment sessions, and posttreatment outcomes.

Adolescents have benefitted from MI for improving diet, decreasing substance abuse, quitting smoking, preventing pregnancy and sexually transmitted infections (STIs) and increasing exercise (Erol & Erdogan, 2008; Macgowan & Engle, 2010; Olson, Gaffney, Lee, & Starr, 2008; Rofey et al., 2010; Rojas et al., 2009; Stephens & B., 2001). Using MI with adolescents with diabetes and obesity has also improved adherence and health outcomes (Mehlenbeck, Wember, Jelalian, & Steele, 2008). Within the sleep literature, a successful MI intervention was developed to improve Continuous Positive Airway Pressure (CPAP) adherence in adults (Aloia et al., 2004). The success of MI trials related to improving health behaviors has been variable. In a review article of MI applied to diet, exercise, diabetes, and dental care, researchers identified a wide range of effect sizes across studies, ranging from small ( $d = .23$  to large ( $d = .77$ ). Most effect sizes were in the moderate range (.35 to .56) (Martins & McNeil, 2009). The efficacy of MI appears to vary across populations as well. A meta-analysis found that the effect size of MI was doubled when the patients were from minority populations (Hettema, Steele, & Miller, 2005). Investigation of MI as an intervention to improve sleep among predominantly minority adolescents could expand the vast array of implications for adolescent health behaviors.

### **Correlates of Motivation and Intervention Adherence**

There is significant room for improvement in designing and implementing these school-based interventions. Perhaps the first step to improve these interventions is to understand the associated challenges. A school-based intervention eliminates some practical barriers to obtaining treatment, such as initial screening, transportation, and cost, but it is clear that many

adolescents are not motivated to make changes in sleep habits even after being educated about the potential negative consequences in many domains of life. Authors have noted that adolescents lack motivation to make sleep habit changes, and simply “don’t want to” due to their desire to maintain independence and responsibility (Moseley & Gradisar, 2009).

In the area of sleep intervention in adolescents, no researchers have attempted to pinpoint the factors that affect “motivation” and desire to prevent negative consequences. However, Taddeo and colleagues reviewed adherence to medical treatments in adolescents, such as diabetes mellitus, and identified the main predictors of nonadherence (Taddeo, Egedy, & Frappier, 2008). Examining over 40 publications on adherence to various health conditions they identified the following factors as the best predictors of poor adherence: being an older adolescent, having a care giver with mental health issues, family conflict, thinking that treatment is complex and demanding, severity of illness, and denial of illness. Many adolescents do not regard poor sleep as “severe” or may not even believe inadequate sleep is a real problem, which is predictive of poor adherence. Furthermore, students may find sleep hygiene and stimulus control to be complex and demanding.

A review of the literature produced only one study specifically examining adherence to a school-based intervention that targeted health behavior. This study focused on improving muscle fitness in 9<sup>th</sup> and 10<sup>th</sup> graders, and researchers found that adherence was better among those students who were in an elastic tubing group than free-weight groups (Lubans, Sheaman, & Callister, 2010). This suggests that interventions that was easier to follow and less strenuous are easier to stick with, despite the fact that the free-weight group outperformed the tubing group in terms of strength. However, one limitation of this study was the lack of long-term follow-up. Researchers discussed the need for identifying interventions that adolescents will be motivated to

continue beyond the treatment period. Still, this study supported the relationship between complexity and demand highlighted in the review by Taddeo et al (2008).

Another critical factor to consider when discussing adherence in adolescence is developmental stage. Adolescence is not only a time for puberty and changes in independence as discussed above, but also a significant time period for cognitive maturation, identity formation, and development of social relationships. In terms of cognitive development, it is believed that adolescents have reached the stage of formal operations, and are able to engage in abstract and hypothetical thinking. This would suggest that most have the ability to analyze the potential consequences, such as poor grades and weight gain, and to assess one's personal risk related to being chronically sleep deprived. Taddeo offers an explanation for poor adherence despite cognitive capabilities. "The ability to engage in formal thinking is inconsistent at first, and at times of stress, adolescents may regress to more simple ways of problem solving. Despite their maturing skills, they may remain self-centered and feel invulnerable to consequences – negative things happen only to others" (2008).

Taddeo described a construct well known among psychologists, adolescent egocentrism. Adolescent egocentrism, characterized by risk taking behavior and the belief by adolescents that they are unique, special and invincible, was a term coined by David Elkind in 1967. He proposed two components of his theory – adolescents construct an "imaginary audience" or the belief that those around them are as concerned and focused on their appearance as they themselves are, and the "personal fable", the belief that the individual is special and invulnerable to harm (Elkind, 1967). Elkind originally thought that egocentrism emerged in early adolescence, around age 11, and declined in middle adolescence, around age 16. However, follow up research suggests that adolescent egocentrism may peak in middle adolescence and persist well into late adolescence

and sometimes adulthood (Peterson & Roscoe, 1991; Rycek, Stuhr, McDermott, Benker, & Swartz, 1998; Schwartz, Maynard, & Uzelac, 2008).

Adolescent egocentrism has a number of social and academic implications addressed in past research, but the application to adherence is limited to one small sample study. Intuitively, egocentrism can contribute to our understanding of motivation in this adolescent age group. Perhaps resistance to treatment is explained by the “personal fable,” and possible stigma related to the “imaginary audience.” In other words, what if students are less willing to participate because their peers will see them as weak for needing help with sleep problems, or will tease them for going to bed early? Perhaps some adolescents are not motivated to make changes because they deny the possibility of falling asleep behind the wheel or becoming overweight due to sleep habits. Regardless, this theory would suggest adolescents would be more likely to engage in risk-taking behaviors, such as driving when sleepy. There has been one study examining egocentrism and treatment adherence. Researchers identified low adolescent egocentrism as a significant factor for predicting adherence to Acute lymphoblastic leukemia (ALL) treatment in six 16-23 year old women (Malbasa, Kodish, & Santacroce, 2007).

Related to adherence to treatment regimens is the small body of literature highlighting the associations between health related behavior and aspects of adolescent egocentrism. A study of high school seniors measured invincibility, a construct closely associated with invulnerability and the personal fable. There was a negative correlation between perceived risk and two risky behaviors, using alcohol and engaging in sexual activity (Wetherill & Fromme, 2007). When teens were asked to judge the probability that they and several target others, such as a friend, acquaintance, or parent, would experience various risks (e.g. unplanned pregnancy, auto accident, alcohol dependency), they saw themselves as facing somewhat less risk than the target

others. There were no significant differences among teens who were considered “at high risk” (from a group home) and average risk teens, although the high risk group showed a general trend for higher invulnerability (Quadrel, Fischhoff, & Davis, 1993). In summary, adolescents tend to underestimate their risk of negative consequences from health behavior choices.

In addition, people tend to overestimate their ability to alter health related behaviors. Although many intend to make health behavior changes, execution is problematic. In a series of studies, Hall and colleagues examined the relationship between neurocognitive abilities and the ability to implement health behavior changes. Executive functioning, characterized by top-down cognitive processes that serve the purpose of regulating behavior in line with a goal, is hypothesized to play a role in self-regulating health behavior (e.g. making healthy food choices, going to bed early enough to get adequate sleep) (Hall, Elias, et al., 2008). There is preliminary data to suggest individual differences in cognitive ability are associated with health behavior performance in both physical activity and dietary behaviors (Hall, Elias, & Crossley, 2006; Hall, Fong, Epp, & Elias, 2008). More recently, Hall and colleagues examined the relationship between intelligence and health behavior change, and found evidence that intelligence and increases in physical activity were positive associated (Hall, Elias, et al., 2008). However, cognitive ability and executive functioning capabilities have yet to be explored in relation to regulation of sleep schedules. Furthermore, these studies utilized adults from the community and college students. The prefrontal cortex, which is strongly associated with executive function, is not fully mature within adolescents (Blakemore & Choudhury, 2006). Furthermore, there is evidence that inadequate sleep impairs cognitive abilities, especially executive functioning, as reviewed above. For these reasons, it would be of interest to examine self-regulation of sleep behavior and cognitive abilities in adolescents who report motivation to alter sleep behavior.

Beyond individual characteristics as predictors of adherence are elements of the treatment process that are important to understanding treatment outcomes. Often, within the context of psychotherapy, the concept of therapeutic alliance within individual therapy and group cohesion among group therapy participants are valued as predictors of effective treatment (Glass & Benschhoff, 2002). There have been several published studies that highlight the benefits of group cohesion, including improved behavioral change, improved self-esteem, and reduced symptomology (Budman et al., 1989; C. R. Evans & Dion, 1991; N. J. Evans & Jarvis, 1980). At least one study has identified positive aspects of group cohesion, including increased self disclosure and productivity on a task, among adolescents (Glass & Benschhoff, 2002) A group therapy approach is not only more practical in a school setting, but perhaps may provide a benefit of group cohesion as an important change factor.

### **Summary and Hypotheses of Current Study**

Inadequate sleep is a significant problem that lacks assessment and intervention in adolescents, with worse outcomes across ethnic minorities and those of low SES (Moore & Kirchner, 2011). Environmental influences (e.g., part time jobs, extracurricular activities), behavioral factors (e.g. watching TV or exercising before bed), and pubertal dependent delays in sleep/wake schedules all contribute to decreased sleep time and poor quality of sleep. Although not an exhaustive list, consequences of poor sleep include varying cognitive deficits, poor academic outcomes, and increased risk of becoming obese or being involved in a sleep related motor vehicle accident. While it is clear that adolescents, in general, suffer from these negative consequences of inadequate sleep, less attention has been given to low SES, rural, minority populations of adolescents. While health disparities with regard to medical conditions, and other health behaviors, such as physical activity and diet, have been clearly illustrated in low SES

rural, and minority samples, sleep behavior has been neglected. There is ample evidence to suggest that low SES, minority adolescents are more vulnerable when it comes to engaging in adverse health-related behaviors (e.g., poor diet, drug use, unprotected sex) (Elster, Jarosik, VanGeest, & Fleming, 2003). Additionally, personality characteristics may play a role in sleep behaviors among this population. For this reason, the first goal of this study is to screen a large sample of adolescents in a low SES, diverse, rural community to examine sleep characteristics, demographic information, and personality characteristics of interest (egocentrism). Specifically, it was hypothesized that levels of adolescent egocentrism may differentiate those adolescents who obtain adequate sleep from those who do not.

The focus of Study 2 was to implement an intervention to improve sleep in need based participants of this ethnically diverse, low SES, rural sample. Historically, few interventions have been developed and implemented, and those that have vary in content, length of intervention, means of delivering intervention, and target sample. Demographic data of these participants is largely unknown or irrelevant in studies outside of the United States. These interventions have had encouraging results, although past outcome variables are limited to self reported daytime sleepiness and change in sleep duration. Studies have failed to evaluate any potential neurocognitive improvements that accompany increased sleep duration. Researchers of past interventions were also concerned with retention and motivation to adhere to treatment programs. They point future work towards developing interventions that are perceived as engaging and motivating in this challenging age group. Those individual differences that predict adherence to treatment and motivation to participate also remain unexplored.

While adherence and success of treatment is complex, and a number of variables need to be considered when attempting to explain motivation in an adolescent, there are developmental

considerations unique to this population and therapeutic factors that can contribute to our understanding of adolescents and improve development of interventions. Currently, interventions in adolescent behavioral sleep medicine have used cognitive-behavioral or basic behavioral frameworks, and have lacked motivational components and individually focused, goal-based interventions. For these reasons, Study 2 evaluates the efficacy of an innovative school-based intervention named SIESTA (School-based Intervention to Establish Sleep Skills Tailored to Adolescents), and potential correlates of success in treatment (Moran & Everhart, 2011).

SIESTA is a 4-week group school-based intervention to improve sleep habits, sleep duration, and daytime sleepiness among adolescents. SIESTA blends elements of motivational interviewing and cognitive-behavioral therapy, individually tailored for autonomy. In addition to perceived daytime sleepiness and self-reported sleep duration, neurocognitive and mood related outcomes were evaluated. The role of intellectual functioning on behavioral health changes was explored among individuals, due to the body of literature that suggests those individuals with stronger neurocognitive capabilities better succeed at health behavior interventions (Hall et al., 2006).

Specifically, the following hypotheses were made Study 2: 1) Of those adolescents who are screened for inadequate sleep those who are high on adolescent egocentrism will be less likely to volunteer for the sleep intervention, 2) A school based intervention (SIESTA) utilizing motivational interviewing will be effective in increasing total sleep time and improving quality of sleep among those adolescents that report sleep problems, 3) The intervention will improve neurocognitive measures sensitive to sleep deprivation and improve mood/mental health related measures, 4) Those participants who report lower adolescent egocentrism, perceive a higher level of group cohesion, and have a higher IQ estimate will have more positive outcomes.

## CHAPTER II: METHODS AND RESULTS

The current project included two studies, a large descriptive population based study (Study 1) and a pilot study of the school-based intervention (Study 2). Figure 1, below, summarizes participation across the two studies. The studies were reviewed and approved by the University and Medical Center Institutional Review Board Behavioral and Social Sciences at East Carolina University.

### **Study 1**

Participants were 521 6<sup>th</sup> thru 12<sup>th</sup> grade students from Greene Central High School and Greene County Middle School. Greene County is considered an ethnically diverse (51% Caucasian, 41% African American, 8% Hispanic/Latino), low-wealth, rural district in Eastern North Carolina. According to the 2000 census, the median income for males was \$27,048 and the median income for females was \$21,345. Of those individuals under 18 years of age, 28.3% were below the poverty line.

For Study 1, teachers were recruited to volunteer 30-45 minutes of class time for brief classroom screening for inadequate sleep (< 7 hrs/night and/or clinical level of excessive daytime sleepiness) and also complete measures of adolescent egocentrism. Demographic information (e.g., age, sex, ethnicity, grade, participation in extracurricular activities) was also collected. The researcher asked students to complete a few brief sleep related measures to improve understanding of sleep habits of adolescents. One week prior to screening, students were sent home with opt-out consent document that allowed parents to decline participation. The focus of this study was to provide descriptive data with regard to prevalence of inadequate sleep and level of egocentrism within a broad sample population reflecting Greene County adolescents.

Measures of adolescent egocentrism were also collected, and examined in the context of adequate and inadequate sleep.

## **Study 2**

Of those 521 students who participated in Study 1, a sample of 30 students from the middle and high schools who were identified as inadequate sleepers were invited to participate in SIESTA. These participants were in large part determined by teacher participation, researcher availability and permission to invite students to participate in 4-week intervention. Specifically, those teachers whose availability was consistent with researcher availability were asked if they would be willing to allow students to miss four classes (one per week for four sequential weeks) to participate in the study. Students were collectively called to the school office at the end of the school day and offered the opportunity to participate in a 4-week program during their elective class period once per week. Students were provided with information that their sleep was inadequate and provided with a short list of risks associated with sleep deprivation. The assent document was verbally outlined by the researcher in the middle school and a parental permission form was given to those students who stated they were interested. At the high school this information was provided by the secretary and students were asked to check a box to indicate they were interested in participating in the study. High school students were also provided with a parental permission document. Students were reminded weekly for 4 weeks to return the permission document if they wished to participate. Individuals who indicated that they would like to participate in the intervention and returned a permission document were compared on measures of adolescent egocentrism to individuals who declined the invitation.

The 12 middle school students who assented and returned permission documents were included in the SIESTA trial. Study 2 included two groups (Group A,  $n = 5$ ; Group B,  $n = 7$ ) of

students who were examined collectively with a repeated measures design examining pre and post change on a number of domains, including sleep quality and duration, mental health measures, vigilance, and processing speed. Explained in detail below, the participants underwent a baseline assessment, completed the 4-session (one session per week) SIESTA program and post-treatment assessment. Changes in sleep quality, duration, and daytime sleepiness were compared pre and post treatment. All participants received a \$10 gift card for iTunes, Aeropostale, or Walmart.

Prior to the intervention, the participants underwent a 45-minute baseline assessment, including completion of a brief cognitive assessment (estimate of general intellectual processing, processing speed, vigilance), were screened for mental health problems, completed a measure of morningness/eveningness, and were instructed on how to use a sleep log. The sleep log was completed the following two weeks.

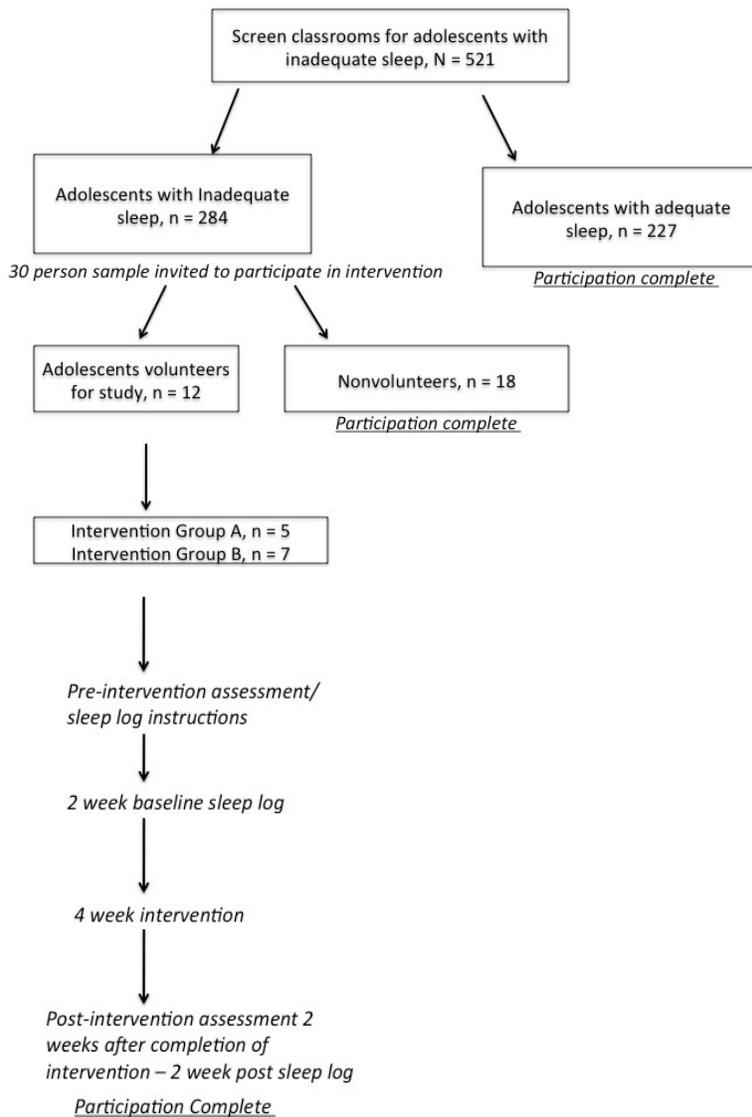
Treatment began after completion of baseline data collection. The participants attended four 75-minute group sessions on a weekly basis for four weeks from start of treatment (SIESTA). Students were divided into a Wednesday group and a Thursday group. The intervention utilized techniques from CBT-I and motivational interviewing and aimed to integrate a number of “hands on” interactive activities. The content of the intervention sessions will be described in detail below. Throughout the intervention, participants continued to complete sleep logs and set goals that were tracked in a workbook.

Post treatment data were collected two weeks after treatment ended, with the purpose of allowing adequate time to implement the final set of skills addressed in the final treatment session. The data collected from these logs was used to calculate post intervention sleep duration. During the post assessment, participants repeated several of the baseline measures, including

assessments of processing speed, psychomotor vigilance, mental health, and daytime sleepiness. Additionally, they completed a group cohesion scale.

A secondary aim was to identify predictors of success in treatment. The relationship between success of treatment and a number of variables were examined, such as adolescent egocentrism, group cohesion, and neurocognitive measures.

Figure 1  
*Participant Flow chart*



## Measures

**Demographic inventory.** A demographic inventory was developed to collect basic information (sex, race/ethnicity, age, grade, participation in extracurricular activities, employment, and estimate of current sleep duration) and was administered during the initial screening process.

**Adolescent Sleep Wake Scale (ASWS).** The ASWS is a 28-item self-report research instrument that assesses sleep quality in 12 to 18-year-old adolescents (LeBourgeois et al., 2004). Participants were asked to indicate how often sleep behaviors have occurred during the past month using a 6-point self-report scale (*6 always, 5 frequently-if not always, 4 quite often, 3 sometimes, 2 once in a while, and 1 never*). Adolescents' sleep is measured along 5 behavioral dimensions including going to bed (5 items), falling asleep (6 items), maintaining sleep (6 items), reinitiating sleep (6 items), and returning to wakefulness (5 items). Mean subscale scores for each dimension and a full-scale sleep-quality score (ASWS total; mean of 5 subscales) can be obtained. Scores range from 1 to 6, with higher scores indicating better sleep quality. The full scale (ASWS total) has showed good reliability across Americans (Chronbach's  $\alpha = .86$ ) and Italians (Chronbach's  $\alpha = .80$ ) (LeBourgeois et al., 2004). The ASWS was administered during the screening process.

**Pediatric Daytime Sleepiness Scale (PDSS).** The PDSS is 8-item measure developed for use in adolescents to examine the relationship between daytime sleepiness and school-related outcomes. Internal consistency, as measured by Chronbach's  $\alpha$ , for the 8-item scale was .80 (Drake et al., 2003). Kim and colleagues suggested the measure has good validity due to consistency with other validated sleepiness measures (H. Kim & Young, 2005). Individuals respond to each item on a 5-point self-report scale, indicating to what degree the statement

applies to themselves (*0 Never, 1 Seldom, 2 Sometimes, 3 Often, and 4 Very Often*). The PDSS was administered during the initial screening process and at the follow up assessment.

**Imaginary Audience Scale (IAS).** The IAS is a 12-item scale that was developed to measure the concept of the imaginary audience, a component of adolescent egocentrism (Elkind & Bowen, 1979). Elkind defined the imaginary audience as the belief that others in our immediate vicinity are as concerned with our thoughts and behavior as we ourselves are. Each item is composed of short stories in which the participant is asked to imagine he or she the subject of the story. The participant has three choices that are potential responses or behaviors to the situation, from which they must choose one. Internal consistency, as measured by Chronbach's alpha, was .63 for the IAS scale and .52 and .54 for the two subscales, Transient Self and Abiding Self, respectively. The IAS was administered during the screening process.

**The New Personal Fable Scale (new PF scale).** The new PF scale is a 12-item self-report scale, with five dimensions per item (*never, rarely, sometimes, often, always.... True for me*). The new scale is shorter than the original PF scale developed in the late 1970s. The personal fable yields a sense of invulnerability and speciality commonly associated with behavioral risk-taking in adolescents, and compliments the construct of the imaginary audience, together the two composing the theory of adolescent egocentrism. Each item presents a belief statement and participants must indicate using the 5-point scale the degree to which they regard the statement "true for me." There are two subscales, invulnerability and speciality, each comprised of six items. The internal reliability was .60 (Cronbach's alpha) when this measure was initially validated (Alberts, Elkind, & Ginsberg, 2007).

**Sleep log.** Participants were asked to keep daily sleep logs for two weeks prior to the first session of the intervention to obtain baseline data, and for two weeks immediately after treatment

was completed to obtain change in sleep duration and sleep patterns. The sleep log was developed to assess sleep duration, quality of sleep, and monitor napping duration.

**Morningness-Eveningness Scale – Children (Children’s M/E scale).** The children’s M/E scale is a 10-item about preferred timing of such activities as recess, tests, bedtime, rising time, etc. M/E is a construct developed to estimate phase tendencies from self-descriptions. The items were modified from similar questionnaires constructed for use in adults that are valid and reliable for this children’s M/E scale (Carskadon, Vieira, & Acebo, 1993). Scores range from 10 (eveningness) to 42 (morningness). The M/E scale was administered during the individual intakes prior to collection of baseline data. The reliability of this instrument has been validated cross-culturally (Cronbach’s alpha = .82) (Diaz-Morales, 2008).

**Depression Anxiety Stress Scale – 21 item (DASS-21).** The DASS-21 is a self-report measure of one-week state negative affect, developed with the specific aim of achieving maximal differentiation between the affective syndromes of depression, anxiety and tension/stress. Participants indicate the extent to which they experienced each of the symptoms depicted in the items during the previous week on a 4-point self-report scale between 0 (Did not apply to me at all) and 3 (Applied to me very much, or most of the time). The 21-item version was developed by selecting the highest loading items from each scale of the original 42-item version of the DASS, while also aiming to retain coverage of the full symptom content of each of the three affective states. The DASS-21 possesses a stable factor structure and has demonstrated high internal consistency in both adolescents and adults (Lovibond & Lovibond, 1995; Szabo, 2010). Scores on each of the subscales (depression, anxiety, and stress) correspond to descriptive ranges. For example, depression is defined as normal (0-4), mild (5-6), moderate (7-10), severe (11-13), and extremely severe (14+). Anxiety was defined as normal (0-3), mild (4-5), moderate

(6-7), severe (8-9), and extremely severe (10+). Stress was defined as normal (0-7), mild (8-9). Moderate (10-12), severe (13-16), and extremely severe (17+). The DASS-21 was administered during the initial intake session and at the individual follow-up session.

**Group Cohesion Questionnaire.** A group cohesion questionnaire was developed to assess individuals' perception of group cohesion. Each item presents a belief statement and participants must indicate using the 7-point scale the degree to which they agree with the statement (*1 Do not agree, 2 Slightly agree, 3 Somewhat agree, 4 fairly agree, 5 Quite agree, 6 Very much agree, 7 Definitely agree*). Example items include, "The group members were excited to be a part of the group" and "The group members were able to relate to one another". The group cohesion inventory was administered at the post assessment.

**The Wechsler Abbreviated Scale for Intelligence (WASI) – (two-subtest form).** The WASI (two-subtest form) provides an estimate of general intellectual ability (FSIQ), which takes approximately 15 minutes to administer. The two-subtest form is composed of two subtests, Block Design and Vocabulary. The assessment is validated for ages 6 to 89, and estimates are comparable to the four-subtest version. Correlations between a full-length intelligence scale (WAIS-III) and the WASI ranged from .71 to .82 in a large sample of adult males (Axelrod, 2002). The WASI was administered during the baseline assessment.

**Symbol Digit Modalities Test (SDMT).** The SDMT requires individuals to identify nine different symbols corresponding to the numbers 1 through 9, and to practice writing the correct number under the corresponding symbol. Then they manually fill the blank space under each symbol with the corresponding number. A second oral administration is then completed. The participant is given a blank copy of the test and asked to state the correct number for each corresponding symbol. A written and oral score is calculated by totaling the number of correct

answers for each section. Oral and written administrations provide two different indices of functioning, which assess attention, scanning abilities, and motor skills. SDMT is validated for ages 8 and older and takes less than 5 minutes to administer (Lezak, 2004). For the purpose of this study only the written portion was administered. Participants completed the SDMT during the baseline assessment and during the post intervention assessment.

**Psychomotor Vigilance Test (PVT).** A psychomotor vigilance test (PVT) is a sustained-attention, reaction-timed task that measures the speed with which participants respond to a visual stimulus. It is a device that is widely used in sleep deprivation, shift work, fatigue, and stimulant drug research. This study used the Walter Reed palm-held PVT, called the “PalmPVT.” The PalmPVT software was administered to participants on a Palm Tungsten E2 device using their dominant hand, and took about 5 minutes to complete. The Palm PVT has been shown to be highly reliable, with correlations for key metrics such as lapses measuring test-retest reliability above 0.8 (Dorrian J, Rogers NL, Dinges DF, Kushida CA. New York, NY: Marcel Dekker, Inc.; 2005. Psychomotor vigilance performance: Neurocognitive assay sensitive to sleep loss. *Sleep deprivation: clinical issues, pharmacology and sleep loss effects*; pp. 39–70). Participants are asked to press a specified button immediately after visual stimuli are presented. Participants were provided response time feedback during each trial and posttask feedback of their mean response time. Data on response time, lapses, and errors was also collected. Participants were instructed that speed and accuracy performance were equally important on all tasks. In this study, the duration of a single Palm PVT session lasted 5 min or until 100 stimuli were presented. Inter-stimulus intervals varied randomly from 1 to 5 s. Lapses were defined as any reaction time >500 ms. Participants completed the PVT during the pre and post assessments. PVT performance is sensitive to sex in adolescents (Beijamini, Silva, Peixoto,

& Louzada, 2008). Although nonsignificant differences have been shown for time of day, data were collected in a short time window, between 10:40 and 11:55 AM EST, for all participants, both pre and post intervention.

**SIESTA Treatment Manual.** The treatment manual is approximately 20 pages long and includes four sessions of material to support psychoeducation during session, guide activities, prompt reflection on educational topics and personal feelings, and includes space for directed self monitoring and goal setting. Much of the information is supported by visual presentation, such as visual mood and sleepiness ratings, and includes attractive illustrations appropriate for adolescents. All sessions begin with a check-in box to help students track sleep from the prior evening, the average sleep obtained across the week, mood rating, and level of current alertness. All sessions end with a goal-setting page that emphasizes setting a SMART goal (specific, measurable, attainable, realistic, and timely). There is space to plan how a goal will be accomplished and to measure confidence of goal completion. Throughout the program students are prompted to be creative and guide their treatment independently with no prescribed behaviors weekly. Specific content of each session is described below.

***Session 1.*** The purpose of session 1 is to build rapport among group leaders and group members, and provide basic education about sleep deprivation and the importance of sleep. Upon completion of introductions, an icebreaker activity prompts group members to share personal experiences and the associated consequences of episodes in which they have been sleep deprived in the past. They complete a true and false quiz designed to elicit adolescent relevant concerns about the detriments of inadequate sleep, including health consequences, physical appearance, school performance, and safety. Group members are assisted by the group leader in establishing baseline averages for sleep on weekdays and weekends by utilizing the sleep logs that were

completed across the past two weeks. Group members will also work together to develop a list of “pros” and “cons” of staying up late and not getting enough sleep. A cost benefit analysis is an important component of motivational interviewing. Group members will be educated on the purpose of sleep, and appropriateness of naps. Group members are asked to reflect on personal feelings and behavior associated with sleep deprivation, and are asked to imagine the consequences of inadequate sleep across several years, to highlight incompatibility with current behavior and future goals.

***Session 2.*** The purpose of session 2 is to provide psychoeducation on the bidirectional relationship between stress and sleep, and the consequences of stress on physical and emotional health. Group members are educated on the long term health consequences of stress and signs of stress. They are asked to identify and discuss personal stressors, and share strategies (both healthy and unhealthy) that they have used to deal or cope with stress. The goal of the session is to guide group members to link the close relationship between stress and sleep and to gain skills to cope with stress response. Group members also participate in a guided imagery exercise to help with stress reduction at the end of the session.

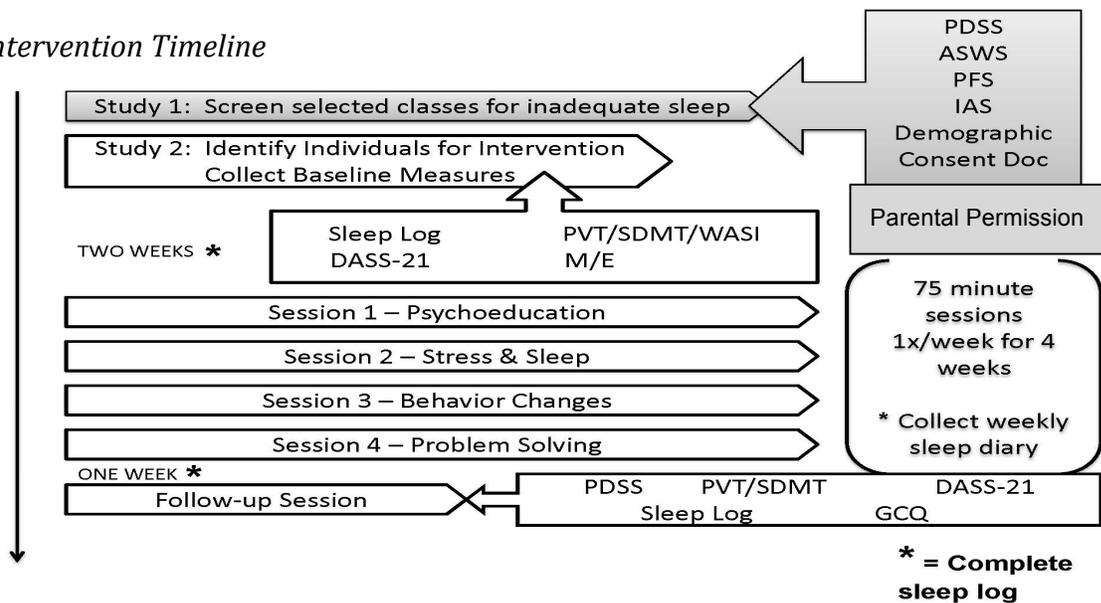
***Session 3.*** Session 3 is designed to provide basic education on positive sleep hygiene and stimulus control, two established strategies important to improving sleep. Sleep hygiene strategies were adapted to be relevant to adolescents (e.g., limiting cell phones and video games prior to sleep, turning off computer and cell phone lights). Stimulus control is explained with examples that are adolescent appropriate. Traditional classical conditioning examples, including dog salivation and dental anxiety, will be introduced first. Group members are provided several possible strategies that may be helpful in improving sleep and emphasis is on personal choice and autonomy in identifying strategies best suited for them as individuals. Group members are

also encouraged to discuss those strategies that have been useful to them in the past and problem solve those strategies that will be difficult to implement.

**Session 4.** The purpose of session 4 is to help group members develop problem-solving skills and provide time for reflection on individual impact of the program. After three weeks of psychoeducation and new strategies that were reportedly attempted, group members are expected to encounter struggles or difficulties with implementing change. The session also includes a fun activity called “Trade-off” in which group members will be asked if they would trade activities or qualities for potential positive correlates of sleep (e.g., Would you trade one hour of video game playing for a better grade on your test tomorrow?), to emphasize the change in attitude towards sleep importance across the treatment program. Students will be asked to generate a list of barriers that have been present when trying to reach goals. Problem-solving steps are introduced and examples are practiced with the group. Pros and Cons for possible solutions are emphasized, as well as choice and control in solving problems. Time management tips are introduced near the end of the session.

Figure 2

*Intervention Timeline*



## Statistical Analysis

All quantitative data analyses were conducted using Statistical Packaging for the Social Sciences (IBM SPSS Statistics 20.0 – August 2011, USA). Descriptive statistics and correlational matrices were computed on the large screening sample. Missing data were dealt with by replacing the missing data point with the mean of the respondent's other scores for the same subscale, only if the respondent had two or fewer missing items. Remaining missing data were coded as missing and not included in analyses. For the Study 1 hypothesis, an independent samples *t*-test was employed to compare scores of adolescent egocentrism between adolescents who obtain adequate sleep and those who do not. The first hypothesis of Study 2 was also tested using an independent samples *t*-test to compare egocentrism scores for treatment volunteers and nonvolunteers.

For the remaining analyses, missing data were coded as missing and not included in the analyses. To examine Hypothesis 2 of Study 2, a repeated measures ANOVA was conducted to examine the differences within subjects across time on sleep duration. Changes in sleep quality, duration, and daytime sleepiness were compared pre and post treatment with paired samples *t*-tests. To evaluate improvement in neurocognitive measures and changes in mood- based measures, Hypothesis 3 of Study 2, required paired samples *t*-tests.

The final analyses employed were multiple regressions with predictors of adolescent egocentrism, group cohesion, and cognitive measures (Hypothesis 4, Study 2). The first regression examined these predictors relative to change in sleep duration. Additional regressions used these predictors to examine relative change in sleep quality and daytime sleepiness. These analyses addressed the final three hypotheses related to identifying the most relevant variables to the success of treatment.

## Results: Study 1

Data from 521 middle and high school students, 215 boys and 293 girls, were collected across a 2-month period. It took, on average, 45 minutes for participants to complete the questionnaires for Study 1, with a range of 25 minutes to an hour. Means, standard deviations, and ranges for descriptive statistics are presented in Table 1. Grades 6-12 were sampled, Participants ranged from 11 to 19 years old with a mean of 15.20 years, and 67% were minority adolescents. Self-reported sleep on non-school nights was significantly inversely correlated with age ( $r = -.19, p < .001$ ) and grade ( $r = -.18, p < .001$ ), indicating that as age increases, sleep on the weekends and holidays tends to decrease. There were not significant correlations for school night sleep duration. A majority of the sample, 78.6%, reported that they did not work, while 4.7% of students reported working 5 hours or less, 5.8% reported working 5-10 hours, 5.1% reported working 10-20 hours, 3.9% reported working 20-30 hours, and 1.9% reported working more than 30 hours per week. Work was defined as employment within the community as well as structured work/labor completed for the family business (e.g., working in the fields, caring for animals). Interestingly, hours worked was significantly correlated with several subscales of the ASWS, including going to bed ( $r = .17, p < .001$ ), falling asleep ( $r = .11, p = .02$ ), and reinitiating sleep ( $r = .09, p = .04$ ), indicating that better sleep practices were related to greater number of hours worked. A majority of students, 55.7% indicated they do not participate in sports, while 29.3% reported participating in one sport, and 15% in two or more sports. Sports participation was also linked to better sleep practices as indicated by the following ASWS subscales: going to bed ( $r = .10, p = .03$ ), falling asleep ( $r = .14, p = .001$ ), reinitiating sleep ( $r = .18, p < .001$ ), and total sleep ( $r = .16, p < .001$ ). Several students, 38.4%, reported participating in one club/extracurricular activity, 18.9% in two or more activities, and 42.8% did not participate in

any clubs/extracurricular activities. Similarly, participation in clubs/extracurricular activities was linked to positive sleep behaviors, including going to bed ( $r = .10, p = .03$ ) and falling asleep ( $r = .12, p < .01$ ).

Table 1

*Participant Characteristics for Study 1*

	<i>M</i>	<i>SD</i>	Range of values
Age ( $N = 517$ )	15.20	2.16	11.16-19.83
Grade ( $N = 516$ )	9.37	2.12	6-12
Sleep duration school nights ( $N = 517$ )	7.30	1.46	2-14 hours
Sleep duration non-school nights ( $N = 509$ )	7.63	2.85	0-16 hours
<b>Adolescent Sleep Wake Scale</b>			
Go to bed ( $N = 503$ )	3.74	1.03	1-6
Fall asleep ( $N = 511$ )	4.05	.95	1.20-6
Maintain sleep ( $N = 518$ )	4.18	1.07	1-6
Reinitiate sleep ( $N = 517$ )	4.76	.90	1-6
Return to wake ( $N = 511$ )	2.96	1.17	1-6
Total ( $N = 487$ )	3.94	.71	1.70-5.80
Pediatric Daytime Sleepiness Scale ( $N = 521$ )	17.09	5.88	0-32
<b>Personal Fable Scale</b>			
Invulnerability ( $N = 519$ )	18.36	3.67	0-30
Speciality ( $N = 518$ )	19.00	4.32	0-30
Total ( $N = 518$ )	37.35	6.90	0-60
<b>Imaginary Audience Scale</b>			

Abiding Self ( $N = 516$ )	4.94	2.32	0-12
Transient Self ( $N = 515$ )	6.14	2.88	0-12
Total ( $N = 515$ )	11.07	4.47	0-22

Self-reported average sleep duration was 7.30 hours for school nights ( $SD = 1.46$ ) and 7.63 hours for non-school nights ( $SD = 2.85$ ). Minority adolescents ( $M = 7.28$ ,  $SD = 2.10$ ), reported significant less sleep on nonschool nights than did Caucasian adolescents ( $M = 8.33$ ,  $SD = 2.60$ ),  $t(376.71) = 4.51$ ,  $p < .001$ . Girls ( $M = 7.88$ ) reported significantly more sleep on nonschool nights than boys ( $M = 7.29$ ),  $t(494) = -2.27$ ,  $p = .02$ . However, boys consistently reported better quality sleep, with girls reporting significantly lower quality sleep across the total ASWS, and 4 subscales, including maintaining sleep, reinitiating sleep, and returning to wake the following day (see Table 2). There were no other significant differences among demographic groups.

Table 2

*Sex differences for Study 1*

Scale/Subscale	Boys	Girls	$T$	$p$
ASWS ( $N = 476$ )	4.05	3.86	2.83	.005*
Go to bed ( $N = 490$ )	3.77	3.74	.40	.69
Fall Asleep ( $N = 498$ )	4.10	4.01	1.01	.31
Maintain Sleep ( $N = 505$ )	4.36	4.06	3.14	.002*
Reinitiate Sleep ( $N = 504$ )	4.92	4.64	3.42	.001*
Return to Wake ( $N = 500$ )	3.11	2.83	2.73	.007*
PDSS ( $N = 505$ )	16.59	17.58	-1.90	.06

PFS ( $N = 506$ )	38.03	36.72	2.11	.05
IAS ( $N = 502$ )	10.35	11.50	-2.86	.004*

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*Note:* paired samples, two tailed  $t$ -tests conducted;

\* differences significant at  $p < .05$ ; \*\* pre-post change significant at  $p < .001$

Although there is considerable variability in the amount of sleep necessary to achieve optimal functioning and promote health in adolescents, 7 hours of sleep and less was considered inadequate for the purpose of this study. About half (50.8%) of the sample reported getting less than 7 hours of sleep on school nights. The mean score on the PDSS was 17.09, which falls in the subclinical range. A large portion of the sample, 30.1% of participants, reported a PDSS score greater than 19, which is considered a cutoff for clinically excessive levels of daytime sleepiness (Drake et al., 2003). Of all the sleep-wake domains assessed by the ASWS, participants reported the most problems rising from bed in the morning ( $M = 2.96$ ) and going to bed ( $M = 3.74$ ), with lower scores indicating more problems on a 6-point scale. They reported fewer problems maintaining sleep ( $M = 4.18$ ) and reinitiating sleep ( $M = 4.76$ ) after waking during the night.

Participants also completed the Personal Fable Scale (PFS) and Imaginary Audience Scale (IAS). Interestingly, boys' scores were significantly higher on the PFS, but significantly lower on the IAS (see Table 2). Hypothesis 1 stated that those participants with inadequate sleep would have higher levels of adolescent egocentrism than those with adequate sleep, as measured by self-report measures. Inadequate sleep was defined as 7 hrs or less per night and/or clinical level of excessive daytime sleepiness (PDSS >19). Those participants with adequate sleep ( $M = 10.85$ ,  $SD = 4.57$ ) did not significantly differ on the IAS from participants with inadequate sleep ( $M = 11.21$ ,  $SD = 4.40$ ),  $t(509) = .20$ ,  $p = .65$ , consistent on both subscales, the Abiding Self scale,  $t(509) = 2.21$ ,  $p = .14$ , and Transient Self scale,  $t(509) = .06$ ,  $p = .81$ . Similarly, the groups

did not significantly differ on the Personal Fable scale,  $t(511) = .77, p = .45$ , or either of the subscales, Invulnerability,  $t(512) = .34, p = .44$ , and Speciality,  $t(511) = .97, p = .31$ .

## **Results: Study 2**

Hypothesis 1 of Study 2 predicted that those participants who volunteered for the intervention portion of the study would have significantly lower scores of adolescent egocentrism than those who declined participation in Study 2. The twelve volunteers ( $M = 11.92, SD = 3.06$ ) did not significantly differ from the eighteen nonvolunteers ( $M = 10.59, SD = 5.31$ ),  $t(27.6) = -.87, p = .39$ , on the IAS. Additionally, the volunteers ( $M = 39.92, SD = 6.23$ ) did not significantly differ from the nonvolunteers ( $M = 42.56, SD = 8.56$ ),  $t(27.7) = .98, p = .33$ , on the PFS. However, girls were much more likely to volunteer,  $t(28) = -3.65, p < .001$ . Furthermore, volunteers ( $M = 13.86, SD = .25$ ) were significantly younger than nonvolunteers ( $M = 15.83, SD = 1.86$ ),  $t(28) = 4.45, p < .001$ . Interestingly, nonvolunteers ( $M = 24.44, SD = 5.02$ ) reported more daytime sleepiness than volunteers ( $M = 18.58, SD = 5.02$ ),  $t(28) = 5.86, p < .01$ .

The twelve volunteers who assented and returned parental permission forms were included in Study 2, and participated in (SIESTA). Ten of the twelve participants attended all four group sessions. One participant completed 3 of 4 sessions and one completed 2 of 4 sessions. Brief, individual makeup sessions were provided for those three missed sessions, and focused on content of the missed session. Groups were closed, with one group containing 5 participants and the other 7 participants. The two groups were examined for differences in baseline data, outcome data, and demographic variables. Group A ( $M = 102.80, SD = 9.07$ ) had a significantly higher IQ estimate than Group B, ( $M = 87.43, SD = 9.22$ ),  $t(8.8) = 2.87, p = .02, d = 1.99$ . No other differences were found between groups, and the groups were examined as a single sample. All participants were in 8<sup>th</sup> grade and were 13-14 years of age. There were 11 girls and 1

boy in the sample. Five of the participants were African American, five Caucasian, and two identified as multiracial. Approximately 42% of the subjects indicated they did not participate in any sports, while the remaining 58% indicated they participated in one sport. No one in the sample participated in more than one sport. Approximately 33% of the sample indicated they did not participate in clubs/extracurricular activities, while 42% indicated they participated in one club/extracurricular activity, and the remaining 25% reportedly participated in 2 or more clubs/extracurricular activities.

Participants completed a sleep log between 7 and 14 days ( $M = 10.27$  days,  $SD = 3.32$ ) to determine mean sleep duration across school nights and non-school nights as a baseline. School night sleep ranged from an average of 5.30 to 8.30 ( $M = 7.10$ ,  $SD = .78$ ) hours per night. Non-school night sleep was much more variable within and among participants, and ranged from 4 to 14 ( $M = 8.90$ ,  $SD = 2.79$ ) hours per night. Overall, average sleep duration across baseline ranged from 6.20 to 9.00 ( $M = 7.5$ ,  $SD = .79$ ) hours among participants. Overall, few naps (measured in naps/wk) ( $M = .80$ ,  $SD = .82$ ) were reported. Participants also indicated how alert they felt upon awakening in the morning. Only 3% of the responses indicated the participant felt “wide awake”. About 31% of the time participants felt “awake”, about 44% of the time participants felt “tired”, and about 20% of the time they felt “very tired”. Scores on the PDSS ranged from 12-26 ( $M = 18.60$ ,  $SD = 5.02$ ), indicating variability in daytime sleepiness. Exactly 50% of participants reported a daytime sleepiness at or above the clinical cutoff. Scores ranged from 23 to 31 ( $M = 27.30$ ,  $SD = 2.70$ ) on the M/E children’s scale, consistently indicating neither a strong morning or evening preference across participants in the intervention sample.

IQ estimates ranged from 75 to 111 ( $M = 93.80$ ,  $SD = 11.79$ ). Baseline mean response times, as measured by the PalmPVT, ranged from 282.39 to 601.89 ms, ( $M = 381.20$ ,  $SD =$

315.63). Mean response time was positively correlated with daytime sleepiness ( $r = .63, p = .04$ ), suggesting response time increased as sleepiness increased. All participants committed at least one minor lapse and some as many as 15 ( $M = 6.17, SD = 5.18$ ), and four participants each had one major lapse. A minor lapse is defined as reaction time greater than 500 ms, while a major lapse is defined as a reaction time greater than 1 second. On the baseline SDMT z-scores ranged from -1.47 to +.80 ( $M = -.35, SD = .79$ ). Finally, participants completed the DASS-21, which provided baseline scores for depression ( $M = 10.08, SD = 8.72$ ), anxiety ( $M = 9.08, SD = 7.20$ ), and stress ( $M = 14.33, SD = 8.25$ ). At baseline, 67% of participants reported clinically significant depression (mild = 8%, moderate = 17%, extremely severe = 42%) and 100% reported clinically significant anxiety (mild = 25%, moderate = 33%. Severe = 8%, extremely severe = 33%). Furthermore, 75% of the participants reported clinically significant stress (moderate = 17%, severe = 17%, extremely severe = 42%).

Repeated measures ANOVAs were employed to examine weekly changes in sleep duration across the intervention. Only 5 participants completed sleep logs for all 5 data collection time points, leading to very limited power. There was not a significant weekly change in sleep duration for school nights,  $F(1, 4) = .57, p = .69$ , or non-school nights,  $F(1, 4) = .44, p = .78$ , for this small sample. However, a one-tailed, paired samples t-test found a significant increase in sleep duration for school nights from baseline ( $M = 7.08, SD = .78$ ) to post-intervention (or data from last available sleep log) ( $M = 7.70, SD = .88$ ),  $t(10) = -2.34, p = .02, d = 1.48$ . Participants also demonstrated significant reduction in daytime sleepiness as indicated by the PDSS pre-intervention ( $M = 18.58, SD = 5.02$ ) and post-intervention ( $M = 15.42, SD = 4.48$ ),  $t(11) = -2.30, p = .02, d = 1.39$ . Upon completion of the intervention, 77% of participants reported scores below the clinical cutoff for excessive daytime sleepiness. Participants demonstrated

improvements on measures of processing speed and psychomotor vigilance. Participants' mean response time improved when comparing pre-intervention PVT ( $M = 381.21, SD = 111.60$ ) to post-intervention PVT ( $M = 336.66, SD = 58.06$ ),  $t(11) = 1.93, p = .04, d = 1.17$ . There were no changes in major lapses,  $t(11) = .43, p = .67$ , minor lapses,  $t(11) = .00, p = 1.00$ , or accuracy,  $t(11) = .05, p = .97$ . Improved processing speed was demonstrated after correcting for expected practice effects (Hinton-Bayre & Geffen, 2005) when comparing pre-intervention SDMT scores ( $M = 45.25, SD = 7.01$ ) to post-intervention SDMT scores ( $M = 50.17, SD = 7.48$ ),  $t(11) = -2.20, p = .05, d = 1.33$ .

There were no changes from pre to post intervention for depression,  $t(11) = .50, p = .63$ , anxiety,  $t(11) = 1.02, p = .33$ , or stress  $t(11) = .21, p = .94$ . Pre and post intervention measures are summarized in Table 2. However, 33% of the sample was in the normal range on the anxiety subscale after the intervention, in contrast to 100% of participants reporting clinically significant anxiety at baseline. After the intervention there was no change in the percentage of participants who reported clinically significant depression (77%), and stress worsened (only 8% subclinical post-intervention compared to 25% subclinical levels at baseline).

Table 3

*Pre and Post-Intervention Sleep Characteristics and Measures*

	Pre-Intervention	Post-Intervention
	<i>M (SD)</i>	<i>M (SD)</i>
<hr/>		
Sleep Measures		
School night (duration)	7.08 (.78)	7.70 (.88)*
Nonschool night (duration)	8.86 (2.79)	9.06 (1.68)
PDSS	18.58 (5.02)	15.42 (4.48)*

## Cognitive Measures

### PVT

Major Lapses	.33 (.49)	.25 (.45)
Minor Lapses	6.17 (5.20)	6.17 (4.30)
% Correct	97.28 (3.02)	97.24 (3.08)
Mean Response Time	381.21 (111.59)	336.67 (58.06)*
SDMT	45.25 (7.01)	50.17 <sup>^</sup> (7.48)*

### Mood

Depression	10.08 (8.72)	9.33 (8.15)
Anxiety	9.08 (7.20)	6.83 (5.75)
Stress	14.33 (8.25)	14.50 (7.04)

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*Note:* paired samples, one tailed *t*-tests conducted pre and post intervention;  
\* pre-post change significant at  $p < .05$ ; \*\* pre-post change significant at  $p < .001$   
<sup>^</sup> score was corrected for practice effects

Finally, multiple regressions were employed to examine the correlates of success in increasing sleep duration and reducing daytime sleepiness. The first multiple regression analysis was used to examine if demographic variables, group cohesion scores, IQ estimate, and scores on the IAS significantly predicted participants' change in school night sleep duration. Ethnicity was collapsed into two groups, minority (coded as 1) and Caucasian (coded as 2). The results of the regression indicated that the full model was not significant,  $F(6, 4) = 28.78$ ,  $p = .14$ . The zero-order Pearson correlation between IQ estimate and increase in sleep duration was significant ( $r = .87$ ,  $p = .001$ ), indicating a large effect size.

The second multiple regression analysis used the same predictors in the context of change in daytime sleepiness pre and post intervention. The results of the regression indicated that the

full model was not significant,  $F(6, 5) = .46, p = .82$ . Results are summarized in Table 4 and Table 5. It is important to note that the power for these analyses was extremely low, secondary to a small sample size in addition to missing data. There was a significant negative correlation between age and the IAS.

Table 4

*Correlation Matrix of age, GCQ, IQ estimate, IAS, MEQ*

<i>Variables</i>	<i>IQ Est.</i>	<i>GCQ</i>	<i>IAS</i>	<i>MEQ</i>
IQ Estimate				
GCQ	-.49			
IAS	-.32	.20		
MEQ	.22	-.20	.00	
Age	.28	-.03	-.90**	.05

*Notes: \*  $p < .01$ ; \*\*  $p < .001$*

Table 5

*Demographic variables, GCQ, IQ estimate, IAS, and MEQ predicting increase in sleep duration*

	<i>B</i>	<i>SE B</i>	$\beta$
IQ Estimate	.06	.01	.66
GCQ	.10	.02	1.14
IAS	.07	.14	.24
MEQ	.09	.04	.26
Age	-.61	1.53	-.20

Ethnicity	1.12	.36	.59
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Notes:  $R^2 = .99$ ,  $p = .14$

Table 6

*Demographic variables, GCQ, IQ estimate, IAS, and MEQ predicting change in daytime sleepiness*

	<i>B</i>	<i>SE B</i>	$\beta$
IQ Estimate	.11	.17	.27
GCQ	-.18	.30	-.34
IAS	.74	2.1	.47
MEQ	-.59	.68	-.33
Age	8.7	20.26	.52
Ethnicity	1.27	5.45	.14

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Notes:  $R^2 = .35$ ,  $p = .82$

## CHAPTER III: DISCUSSION

### Discussion of Hypotheses

The present study first screened a large sample ( $N = 521$ ) of middle and high school students from a low income, predominantly minority school district in rural North Carolina for a broad range of sleep problems, including inadequate duration, inconsistency, poor quality sleep, and daytime sleepiness (Study 1). Additionally, demographic variables and measures of egocentrism were collected, as adolescent egocentrism is a well-established phenomenon that affects mood and behavior across domains, perhaps including health behaviors.

Means and standard deviations on measures of sleep behaviors and daytime sleepiness, the ASWS and PDSS, were extremely consistent with the current literature base (LeBourgeois, Giannotti, Cortesi, Wolfson, & Harsh, 2005; Moseley & Gradisar, 2009). The current sample and a sample of 88 Australian adolescents both averaged a score of 17.1 on the PDSS, prior to any intervention. Similarly, all subscales of the ASWS demonstrated the same pattern as a large sample of American children, and suggested students have the most difficulty waking up in the morning, followed by going to bed. Interestingly, girls in the current study reported worse quality sleep across several subscales of the ASWS.

However, sleep duration was slightly less than other samples from other studies. According to the large scale, national Sleep in America Poll, about 45% of adolescents get less than 8 hours of sleep per night, in contrast to about 53% of adolescents in the current sample. Similarly, about 20% of adolescents reported greater than or equal to 9 hours of sleep, while only 17% of the current sample got that amount (Carskadon et al., 2006). These findings are consistent with findings that suggest minority children, 67% of the current sample of participants, get less sleep than Caucasian children (Spilsbury et al., 2004). Similarly, minority

adolescents reported that, on average, they received an hour and three minutes less on nonschool nights, consistent with past research (Foundation, 2006). Overall, self reported school night sleep duration of 7.301 (1.460) hours was slightly less than Moseley and colleagues' Australian sample ( $M = 7.60$  hours,  $SD = 1.0$ ), essentially a difference of about 18 minutes per night (2009). Similarly, a Brazilian study that utilized actigraphy, also indicated participants received 7.6 hours of sleep on school nights. Nonschool night sleep was slightly greater than school night sleep for the current sample ( $M = 7.60$  hours) although the standard deviation ( $SD = 2.85$ ) and range of scores was much larger, with some students reporting that they do not typically sleep on weekends, while others report sleeping as many as 16 hours on weekends. It appeared that two patterns emerged – students tended to compensate for weekday sleep debt by sleeping in on weekends, or students tended to sleep much less on weekends. Girls appeared to compensate more on the weekends and reported sleeping significantly more on nonschool nights than boys. A number of previous studies have noted a pattern of sleep compensation on the weekends (Carskadon & Acebo, 2002; Warner, Murray, & Meyer, 2008). Overall, the sleep duration reported is less than self-report and actigraphy (8.2-8.8 hours) measures in other studies (Beijamini et al., 2008).

A number of demographic variables were collected in addition to questions related to everyday activities. In contrast to previous studies, this current study revealed a positive relationship between sleep behaviors/quality and scheduling demands, including employment and participation in sports and clubs. Past research suggested adolescents indicated that part time jobs and extracurricular activities interfered with sleep (Carskadon et al., 1980; Noland et al., 2009). While the present study asked participants about participation in activities separately from sleep behaviors, Noland and colleagues asked adolescents to identify which factors they

perceived to interfere with sleep, which could be subject to report bias and demand characteristics. An additional study found that five or more hours of extracurricular activities per day led to reduced sleep (Dorofaeff & Denny, 2006). However, the current study was limited in that students could indicate in they participated in 2 or more activities. It may be that a few extracurricular activities may be beneficial to sleep, but several hours may begin to interfere with sleep. Similarly, Wolfson and Carskadon found that impaired sleep was found in high school students who worked more than 20 hours per week (1998). Only 5.8% of the current sample reported worked 20 or more hours per week. Similarly, perhaps working less than 20 hours a week is beneficial for sleep behavior, where as greater than 20 interferes with sleep behavior. Because many students report maladaptive sleeping patterns, including napping several hours after school and staying up late at night, it may be that students who work or participate in extracurricular activities are unable to take naps and fail to develop maladaptive napping schedules while becoming more tired from exerting energy at work or participating in activities and sports. It should be noted that the effect sizes of these correlations are small and further research is needed to evaluate these hypotheses.

It was hypothesized that those participants who received adequate sleep would score lower on adolescent egocentrism, and those participants with inadequate sleep would be higher on measures of adolescent egocentrism, as they would have increased beliefs that they were invincible and special, or not subject to any of the negative health consequences related to inadequate sleep. These groups did not differ on any measures of adolescent egocentrism, suggesting that this construct may not be related to sleep or health behaviors in general. It may also be possible that this sample of adolescents had little baseline knowledge related to the detriments of inadequate sleep, which would make it difficult to find such a difference. Baseline

knowledge was not measured, and anecdotally, participants in the intervention group indicated that they did not know much about the importance of sleep during the first sessions. Girls were significantly higher on the imaginary audience scale, while boys were higher on personal fable scale. This would suggest that girls are more vulnerable to perceiving others' interests and awareness in their own thoughts and feelings, while boys are more likely to report feeling invulnerable and special, or perhaps, not susceptible to negative consequences of risk-taking behavior.

A sample of students who described short sleep duration (< 7 hours) and/or excessive daytime sleepiness (PDSS score > 19) were invited to participate in an intervention to improve sleep (SIESTA), Study 2. It was hypothesized that those participants who volunteered ( $n=12$ ) for the intervention portion of the study (SIESTA) would have significantly lower scores of adolescent egocentrism than those who declined ( $n=18$ ) participation in the intervention portion of the study. The rationale behind this hypothesis was that those who believed they were more vulnerable to the detriments of poor sleep and were less concerned with peers' opinions were more likely to be interested in participating in an intervention that could help improve their sleep. However, there were no differences on any of the measures of adolescent egocentrism between volunteers and nonvolunteers. This was a small sample of only 30 participants, and perhaps there are other variables that more strongly predicted participation or interfered with this analysis, such as simply remembering to return their informed consent document or desiring to miss an elective class in favor for the intervention. Interestingly, those that declined participation in Study 2 reported higher levels of daytime sleepiness. This may be related to higher levels of stress and perhaps increased burden by participating in the intervention perceived by more sleepy adolescents, or simply may be secondary to the younger age of the volunteers compared to

nonvolunteers. Typically, sleepiness worsens as adolescence progresses, and this finding may suggest that the earlier the intervention, the more likely it is to be successful, as adolescents are more willing to participate and may have more mild problems.

Study 2 was the first to use a targeted small group, school-based intervention utilizing a cognitive behavioral framework and aspects of motivational interviewing to improve adolescents' sleep problems. Participants self monitored sleep duration, naps, and subjective morning alertness throughout the 8 week duration of the study. Unique to this study, correlates of success in treatment were also evaluated, and hands-on, interactive activities were incorporated into the intervention protocol. The accompanying manual is described in detail under the materials section. This study was also distinctive in that baseline measures of neurocognitive functioning, including psychomotor vigilance, processing speed, and an estimate of general intellectual functioning were collected in addition to levels of depression, anxiety, and stress.

Baseline assessment revealed that participants from the intervention sample presented with considerable variance in cognitive capabilities. There is a small literature base that suggests intellectual functioning and executive functioning skills are linked to success in changing health related behaviors in adults of community and college samples (Hall et al., 2006; Hall, Elias, et al., 2008; Hall, Fong, et al., 2008). This relationship has not been examined in the context of adolescents who are still developing these cognitive skills, nor in the ability to change sleep related behavior. Estimates of general intellectual ability in the current sample ranged from 75 to 111, with 10 of 12 participants falling within one standard deviation from the mean, or within the average range. The other two participants fell within the borderline range of functioning, although neither reported being enrolled in special education or required an individualized education plan. Intelligence was the only significant predictor of overall increased sleep duration

across the study and improvement in daytime sleepiness. The Pearson correlation between increased sleep duration and IQ estimate was of a large effect size,  $r = .87$ . It should be noted that this excluded the participant with the lowest IQ estimate, as data were missing. This suggests that intelligence or general intellectual abilities likely play a significant role in the ability to self regulate health behaviors in adolescents as well as adults. Furthermore, despite any temporary neurocognitive deficits that existed due to sleep deprivation, participants with strong cognitive capabilities were able to self regulate behavior. Specifically, further research is needed to identify the mechanism, whether it is the ability to monitor behavior or grasp educational information, for example.

In addition to the WASI to estimate IQ, participants completed a number of measures during baseline that were readministered after the intervention to measure change, including the Symbol Digit Modalities Test, the PalmPVT, and the depression, anxiety, and stress scale (short form). Several participants demonstrated impaired processing speed on the baseline SDMT, with two students who performed well below one standard deviation from the mean (-1.29 and -1.47). Based on the age equivalent standardization sample, the average raw score would be expected to be approximately four points higher (Smith & Services, 2002). These findings are consistent with the literature base demonstrating impaired processing speed in adults, and the weaker evidence in adolescents, who report chronic sleep deprivation (Dummer & Dinges, 2005).

Psychomotor Vigilance is widely used with adults in sleep research as an objective measure for the assessment of sustained attention and alertness. However, few studies have evaluated PVT performance in children, and even fewer in adolescents (Beijamini et al., 2008; Venker et al., 2007). Beijamini and colleagues examined a healthy group of adolescents just slightly younger ( $M = 13.76$  years) than the sample in this study ( $M = 14.07$  years at start of

study). Beijamini's sample of girls averaged 7.6 hours of sleep on school nights and 8.2 hours of sleep on non-school nights, considerably more than the baseline averages of the current study. The devices used and procedure, including number of stimuli and length of PVT trial, were equivalent. It is unclear if the participants in Beijamini's study received feedback on their performance as they did in the current study. The participants in the current sample demonstrated a faster average response time (381.21 MS at 11 AM,  $SD = 111.59$ ) compared to the Beijamini samples, 402.96 MS at 8 AM and 415.70 at 11 AM (no SD reported), despite reporting less sleep. However, norms created for 6-11 year old children (PSG and survey ruling out sleep disorders) suggest that response time of 11 year old girls has a mean of 393.45 ms ( $SD = 107.71$ ), close to the current baseline measure of sleepy 14 year olds who took part in the present study (Venker et al., 2007). Response times continued to decrease as age increased in this sample, and it is suggested response times would continue to improve. Although norms for adolescents are not well established, this study sample performed considerably slower than well-rested adults and sleep-deprived adults, who typically perform in the 210-250 MS range, dependent on age and gender (Blatter et al., 2006).

On baseline testing participants' scores ranged widely and all participants demonstrated minor lapses, consistent with sleepiness. Four participants experienced major lapses. Due to the relatively small samples of these two comparable studies and lack of a large standardization sample, it is difficult to explain the demonstrated differences. Perhaps there are cultural influences in response style or adolescents are motivated to perform better on the task when they receive feedback (i.e., trying to get a faster time than the last trial).

In this unique sample of only adolescents with inadequate sleep duration or quality, depression (pre intervention = 10.08, post intervention = 9.33), stress (pre intervention = 9.08,

post intervention = 6.83), and anxiety (pre intervention =14.33, post intervention = 14.50) were much higher than in healthy, nonclinical samples of adolescents of the same age group. In a Australian (Szabo, 2010) sample of girls ( $N = 119$ ) with a mean age of 14.46, mean scores were as follows: Depression =4.54, Anxiety = 4.02, and Stress = 4.3. Similarly, in a large sample adolescent sample ( $N = 1,090$  girls, ages 12-14), scores were similar: Depression = 4.0, Anxiety = 3.5, Stress = 5.1 (Tully, Zajac, & Venning, 2009). In a large, predominantly adult sample that included adolescents in the UK, mean scores were somewhat higher: Depression = 5.55, Anxiety 3.56, Stress = 9.27, but still clearly lower than scores from the current sample (Crawford & Henry, 2003). Stress, in particular was much higher in the current sample. This may, in part, reflect the increased stress experienced by individuals who experience sleep deprivation. Heightened stress scores may also be attributed to environmental factors specific to this sample (e.g., living in poverty). It should also be noted that results of a Confirmatory Factor Analysis suggest that the stress construct in the 12-14 year old age group may not be consistent with the adult construct of stress (Szabo, 2010). Additionally, none of the studies providing norms for adolescents were conducted in the US, so there may be cultural differences in response style and symptom report.

All but one participant arrived to the first group session with 7-14 days of baseline sleep log data. Their average school night sleep, just a little over 7 hours per night on average, was slightly less than the large screening sample, which reported 7.3 hours. Interestingly, their non-school night sleep average duration of 8.85 hours was much greater than the 7.63 hours reported in the large sample. Again, this highlights the weekend compensatory strategy common in adolescents with sleep deprivation that is known to deregulate sleep patterns and create sleep problems, such as impaired daytime sleepiness and insomnia. However, it is of importance to

note that those adolescents who are compensating on the weekends may be less likely to become obese than those who are chronically sleep deprived on the weekends as well (Wing, Li, Li, Zhang, & Kong, 2009). Laboratory results suggest improved endocrine and metabolic functioning after compensating for sleep debt (Karine Spiegel, Leproult, & Van Cauter, 1999). Therefore, while compensation may be beneficial for some aspects of health, it is well established very inconsistent sleep often interferes with daytime sleepiness, alertness, and can lead to more chronic sleep problems.

Another factor to consider is the accuracy of the self-report survey used to collect this data. While adolescent self report has been established as relatively reliable for school night sleep, survey reports of weekend total sleep time were significantly greater than diary and actigraphy estimates by an hour (Wolfson et al., 2003). Students may actually be getting less sleep than they estimated on the weekends.

Overall, the average score on the measure of daytime sleepiness of participants who volunteered for the intervention was slightly greater than the large sample in the current study (18.58 compared to 17.09), which was near the clinical cut off of 19. This pattern was expected, based on those who were invited to participate in the intervention. Data from baseline sleep logs indicated that over half of the time (64% of responses) the participants indicated on their sleep log that they felt “tired” or “very tired.” It was clear that participants enrolled in the intervention had a high need for intervention based on duration of sleep and daytime sleepiness.

Participant attendance to the four weekly sessions was good. One participant missed one session, while another missed two. Brief, 15 minute, individual make up sessions were provided the following school day the participant was present at school. Therefore, there were no dropouts across the intervention, from baseline to post data intervention data collection, and all

participants received the content of each session. High attendance is attributed to the advantage of school-based intervention, in contrast to high drop out rates in outpatient programs. The program was provided at no cost and did not require parental transportation, which would have been extremely common challenges in reaching rural, low-income populations. Participants appeared invested in the intervention, and attention and participation appeared good.

There were several positive outcomes to the current study, including increased sleep duration during school nights. On average, participants increased sleep duration by about 37 minutes per night, which was significant and of a large effect size. This increase should be considered clinically significant as well, as previous research has shown that an increase in 30-45 minutes of sleep per night significantly decreases daytime sleepiness, reduces depression, increases motivation to participate in a variety of activities, and lowers the rate of students seeking medical attention for fatigue related concerns in high school students (Owens, Belon, & Moss, 2010). Similarly, another study demonstrated a 16.7% reduction in car crashes among students by delaying school start times by 1 hour (Danner & Phillips, 2008). Several studies have demonstrated similar findings by examining change in these factors after a school's start time has been delayed or moved up just a modest amount of time (Carskadon, Wolfson, Acebo, Tzischinsky, & Seifer, 1998; Wolfson & Carskadon, 1998).

These data are believed to be subject to minimal demand characteristics, as participants did not have access to previous sleep logs or workbooks with sleep duration averages across the previous week. Although students may have remembered their prior week average, they may have remembered an inaccurate number. This sample of 8<sup>th</sup> graders had considerable difficulty counting the numbers of hours nightly to determine averages. How to calculate average sleep duration was reviewed weekly, but participants continued to miscount. Averages were

recalculated by researcher to assure accuracy. Furthermore, students only calculated averages across all nights, not examining school nights and non-school nights separately. For these reasons, and prior supportive research, it is believed that sleep logs were relatively accurate and reliable, and subject to minimal demand characteristics (Wolfson et al., 2003).

After the intervention, non-school night sleep remained inconsistent within and across participants. There were no significant changes in time, although the average amount of time increased to an equivalent of about 12 minutes per night. Interestingly, the standard deviation did decrease slightly, perhaps suggesting slightly more consistent sleep. As noted above, prior research suggests that non-school night sleep is often overestimated and overall less accurate than school night reports, although data from a daily sleep log are preferred to a survey question (used in Study 2 of the current study) (Wolfson et al., 2003). It has continually been demonstrated that it is quite difficult to motivate adolescents to maintain a consistent sleep schedule, especially when there is no pressure to get out of bed early the following morning. These data and biological pressures of delayed sleep phase, in addition to qualitative data collected in this study and others, suggests adolescents strongly prefer to stay up late and sleep in on the weekends and holidays. Although prior data suggest inconsistent sleep can lead to problems, compensating may be beneficial in some aspects, such as weight management and improved endocrine and metabolic functioning (Wing et al., 2009). Despite night-to-night variability, it should be noted that on average on non-school nights this sample received the 9 hours of sleep recommended for their age group, which may be advantageous over early awakening to maintain a consistent rise time. Due to the unrealistic goal of having adolescents maintain a consistent sleep schedule across school and non-school nights, further research is

needed to determine the costs and benefits of altering non-school night sleep patterns and compensating on the weekends.

In addition to changes in sleep duration, daytime sleepiness improved and the effect size was large. At the beginning of the study, the average daytime sleepiness score was about a half point below the clinical cutoff for significant daytime sleepiness. At the end of the intervention, participants average score decreased to well below the cutoff score, which is also seen as a clinically significant change. This is also consistent with Bootzin and colleagues targeted, small group intervention, and is in contrast to prior interventions where daytime sleepiness did not significantly change (de Sousa et al., 2007; Moseley & Gradisar, 2009). Both of these interventions were classroom based and did not specifically target adolescents with sleep deficits, which may hide any real change among those participants who did benefit from intervention.

Improvements in psychomotor vigilance and processing speed were also demonstrated post intervention. Unlike self-report measures, these measures are not subject to demand characteristics and response bias, and suggest significant improvements in processing speed and reaction time. After correcting for practice effects, participants processing speed improved and the effect size was large. Participants had 7-8 weeks between trials, which was a duration of time vulnerable to practice effects, but also adequate for sleep debt to reduce by consistently increased sleep, enabling participants to perform better. Interestingly, prior to the study, this sample's average score ( $M = 45.25$   $SD = 7.01$ ) was below the expected averages for 14-year-old girls. After the intervention, the mean score of this sample ( $M = 50.17$ ,  $SD = 7.48$ ) had almost improved to the equivalent of the mean for the standardization sample ( $M = 50.93$ ,  $SD = 9.97$ ) (Smith & Services, 2002). Of concern, is any improvement of processing speed that is due to

natural development across a two-month span, which is not accounted for. Because of the strength of the effect size, any improvement in this task secondary to development is likely negligible.

Improvement in vigilance was evidenced in mean response time post intervention, demonstrating an average change of about .08 ms. Perhaps just as interesting is the reduced standard deviation, from .11 ms to .58 ms, suggesting more consistent responses, which may be related to improved vigilance. There were no changes in accuracy, or measures of lapses. The small sample size perhaps did not provide enough power to find such differences. Still, the limited findings support the relationship between increased sleep duration, reduced daytime sleepiness, and improved vigilance and processing speed, which have many real world applications. For example, many studies have concluded that increases in processing speed and vigilance are linked to improved driving using simulators (George, 2003; Lim & Dinges, 2010).

Within our knowledge, there are no other studies that examined change in psychomotor vigilance in adolescents pre and post sleep intervention. Much of the literature examining neurocognitive changes relies on sleep depriving healthy, adult volunteers, as this model has several advantages to increasing internal validity compared to the current study. Additionally, many of these studies examine neurocognitive deficits after acute sleep deprivation of several hours rather than modest nightly sleep loss that occurs more frequently in the real world of adolescents and adults (Lim & Dinges, 2010). In a unique study, Sadeh and colleagues examined the neurocognitive effects of minor increases and decreases in sleep of 9-12 year olds across multiple nights. Participants who reduced sleep time by 37 minutes on average across 3 nights decreased reaction time from 431.4 ms to 458.2 ms (Sadeh, Gruber, & Raviv, 2003). Participants in the current study increased sleep time by about the same amount of time across several weeks

and demonstrated a greater improvement than Sadeh and colleagues' study. Despite the limited conclusions that can be drawn by this comparison, these studies suggest that a modest increase in sleep duration can have a significant impact of reaction time in children.

There were no changes in measures of depression, anxiety, and stress pre and post intervention. These findings are consistent with one study that also utilized the depression scale of the DASS-21 to measure depressed mood. In Moseley and colleagues' study, which collected data at three time points, depressed mood scores ranged from 7.7 to 10.2 in the intervention group. In the current study scores were 9.3 and 10.1. Interestingly, these scores were higher than the standardization sample, and it remains unclear how much sleep deprivation influences scores on an instrument, such as the DASS-21. Similarly, anxiety and stress scores did not significantly change pre and post intervention. Although there are well-established links between improved sleep and improved mental health measures, it is likely that the short duration of the study was inadequate to identify any potential changes in mood. Furthermore, it would be naïve to discount the various environmental factors that contribute to these scores, which may be significant in the case of this sample drawn from a population with several low-SES related stressors. Unfortunately, stress management was targeted in session 2 of the intervention, but perceived stress scores remained constant pre and post SIESTA.

### **Strengths of Current Study**

Several improvements in sleep were present in the current study that prior studies failed to find. In general, these improvements were large in effect size and clinically relevant, despite having limited power. These findings are attributed to the unique characteristics of the intervention, including a targeted group rather than classroom, group therapy strategies, self monitoring with cognitive behavioral therapy structure, and motivational interviewing allowing

adolescents to have autonomy in determining sleep goals they would like to make. Specifically, participants identified individual weekly goals, in contrast to prior interventions that have prescribed specific weekly goals. Self-selected goals have been shown to improve success for dietary change (Cullen, Baranowski, & Smith, 2001) The small group environment and interactive activities allowed students to stay engaged and participate. Education was tailored to adolescent interests and delivered in an adolescent friendly manner. Although sleep stages and biological aspects of stage were briefly touched on, education was focused on information that adolescents would easily grasp and would be relevant to an adolescent “here and now” (e.g., explaining how inadequate sleep can affect physical appearance or moods/attitudes with friends and parents).

This study also contributed to the inconsistent literature base related to inadequate sleep and deficits in basic neurocognitive abilities (e.g., reaction time, processing speed) in adolescents. Although this research remains difficult to interpret do to a number of confounding demographic variables and interindividual variation in sleep deprivation, this study demonstrated that basic neurocognitive processes can be improved by increasing sleep duration and reducing daytime sleepiness. Furthermore, compared to the standardization samples, there were minor deficits in these domains prior to the intervention.

Finally, this study was one of the few to investigate potential ethnic and sex disparities in a unique, rural, low SES sample of adolescents. In short, Study 1 replicated findings of smaller samples (e.g., ethnic minority students get less sleep on the weekends) or provided additional data for conflicting findings (e.g., discrepancies in boys and girls sleep time). These findings are extremely important to identifying adolescents who are at most at risk, and can lead the development for interventions.

## **Challenges**

Although preliminary data suggest there may be utility in a school-based intervention to improve sleep, there remain many challenges in implementing such a program. The advantage of providing services in a school setting has many challenges that accompany the accessibility. Provided the current state of funding for such programs, it would likely be difficult to convince school officials that such a program has utility without evidence of school specific positive outcomes, such as improved grades. These studies are challenging based on the time investment and authorization to collect such data. Furthermore, a major limitation is lack of long-term follow-up with the current program, as without booster sessions, adolescents may be more likely to lapse into old sleep habits after the intervention is over, far before a significant improvement in grades could be detected.

When working within the confines of the school environment, time, space, and scheduling are concerns. While school or even class-wide programs are easy to implement, it becomes more challenging when only particular students are to attend a program, such as SIESTA. It is challenging for teachers to determine what accommodations should be made for missed class time, in contrast to class-wide programs in which no one is participating in class. It is sometimes possible to hold such programs during free time or study periods, although schools widely vary with structure. An additional challenge is scheduling weekly sessions around possible conflicts, such as awards ceremonies, assemblies, standardized testing, or important review sessions for testing. Finding space for a small group may be difficult, depending on school resources. Furthermore, space provided is not always quiet, which is ideal for groups and imperative for neurocognitive testing.

Participation and interest was clear in the group members who participated, although this was a small minority of eligible participants. Motivating students who are at risk for negative consequences of inadequate sleep proved challenging, and sharing potential consequences was not effective for a large number of students. It took several weeks of reminders for students who indicated they wished to participate to return permission slips. Many students declined participation due to various reasons, on which data were not formally collected. While some students indicated that they did not want to participate because they did not want to miss their favorite elective class, others appeared to be motivated by missing class. As many other studies have cited a possible reason for poor outcomes, adolescents “can’t be bothered by sleep” or simply “don’t want to change” because they enjoy staying up. This was a unique sample in that participation was completely voluntary and based on interest, which is important in understanding the effectiveness of the intervention. Other studies have not screened for adolescents most in need of an intervention and have selected classes with students who may have not been truly interested in participating despite providing the necessary consent.

Although MI is intended to move participants towards change and it has utility in every stage of change, there is evidence that individuals who are in the precontemplation stage show the highest dropout and least behavioral change in behavioral interventions (Beitman et al., 1994; Scott & Wolfe, 2003; Terence & Schlam, 2004). Although not formally measured in the current study, it is hypothesized that the group who volunteered to participate in the intervention were for the most part beyond precontemplation, as indicated by qualitative statements made during SIESTA groups, which was believed to facilitate motivation interviewing. This intervention may not be beneficial to adolescents who are resistant contemplators for sleep change.

As was demonstrated in this study, there may be very few adolescents for whom this intervention may have utility. This study revealed that 60% of students invited to participate in a sleep intervention that would allow them to miss an elective class for 4 weeks and be eligible to win gift cards declined interest in participating, despite being told they were receiving inadequate sleep and the long term consequences of inadequate sleep were outlined. A major limitation of the current study is the very small sample size ( $N=12$ ) in Study 2. Only 30 students were invited to participate in the study, making it difficult draw conclusions. Future research should be focused on understanding why students are uninterested in participation (e.g., don't want to miss class, don't believe they have a problem, don't want to participate in a group, etc.). While it is often difficult to intervene with adolescents, it may be more difficult to conduct interventions with high risk, low SES minority adolescents, due to the numerous challenges discussed throughout (e.g., high stress levels/mental health concerns, limited resources). While this group is needy and gaps in the literature exist, this is also a very challenging group with whom to conduct research.

### **Limitations**

Although the study design allowed for a unique sample of participants, likely vital to the positive outcomes, it also created numerous limitations. Several of these limitations are quite common to school-based interventions. The small number of participants prevented the possibility of a control group, which is the gold standard for health behavior intervention research. Large, randomized, controlled trials would be necessary in establishing SIESTA as an effective intervention that would be valuable to schools. There was lack of long-term follow up, based on time requirements of collecting such data and the interfering school schedule (e.g., end of year standardized testing).

Additionally, 11 of 12 participants were girls. Girls from Study 1 reported poorer sleep quality compared to boys, perhaps motivating them to participate in an intervention. Although little is known about voluntary participation in health behavior interventions among adolescents, the adult literature does suggest that women are more likely to participate in interventions for weight loss and increasing physical activity, for example (Waters, Galichet, Owen, & Eakin, 2011). In mental health interventions, adolescent girls are known to participate at a significantly higher rate than male adolescents (Hoek, Aarts, Schuurmans, & Cuijpers, 2012). Alternatively, this discrepancy may lie in personality factors related to sex and development. In the current study (Study 1), boys' scores on the personal fable scale were significantly higher than girls, suggesting that boys may feel invulnerable to the consequences of inadequate sleep, driving the disinterest in participation. Although more girls were invited to participate than boys, this discrepancy is out of proportion. The findings of this study are limited in that they may not be applicable to boys.

This study also failed to identify strong predictors of success in treatment. The only variable that was consistently linked to success in treatment was IQ estimate, as discussed above. Egocentrism was not linked to decision to participate in an intervention, nor was it helpful in determining treatment success, as hypothesized. Perhaps the ability to grasp knowledge and utilize skills learned, in combination with the appropriate stage of change, is truly of uttermost importance in the current treatment program.

## **Summary**

Several studies have described sleep characteristics of adolescents, concluding that adolescent sleep lacks duration, quality, and consistency. Due to environmental and biological changes, adolescents tend to prefer to stay up late and demonstrate considerable difficulty

awakening in the morning for school. Although in its infancy, there is growing literature base suggesting minority and socioeconomic sleep disparities across the lifespan, and these at-risk adolescents may be more susceptible to the consequences of inadequate sleep. The first of the two current studies examined a large sample of adolescents from a middle and high school in a low-income, predominantly minority school district. Although measures of sleep behavior and daytime sleepiness were very consistent with national samples, these adolescents self reported shorter sleep duration across weekends and weekdays. It also demonstrated that minority students in this sample reported less sleep on nonschool nights than their Caucasian counterparts. Overall, two weekend sleep patterns emerged - students tended to compensate for weekday sleep debt by sleeping in on the weekends, or students did not sleep much on weekends at all. Girls reported poorer sleep quality than boys, and compensated for loss sleep on nonschool nights. While past research has suggested that part time jobs and extracurricular activities can interfere with sleep when absorbing several hours of the day, this study suggested a positive relationship between a modest amount of time spent working and participating in extracurricular activities, and positive sleep quality and duration.

Adolescent egocentrism was not related to sleep quality or quantity, and also did not predict individuals who would volunteer for a group intervention focused on improving sleep. This 4-week, small group intervention (School-based Intervention to Establish Sleep Skills Tailored to Adolescents (SIESTA)) utilized principles of cognitive behavioral therapy and motivational interviewing, and targeted volunteers to participate rather than making the intervention mandatory, in contrast to prior interventions. Overall, very few of the eligible participants volunteered to participate (N=12). Participants were mostly girls (11/12), perhaps related to lower reported sleep quality. Alternatively, boys reported higher levels of risk taking

invulnerability and speciality, perhaps leading them to conclude that an intervention is not necessary for them. Overall, these participants increased their sleep duration on school nights and had reduced their daytime sleepiness significantly. Improvements in psychomotor vigilance and processing speed were also evident. There were no changes in self reported depression, anxiety, or stress, and these scores were much higher than national samples of this age group, hypothesized to be related to sleep deprivation and environmental stressors. Finally, an estimate of general intellectual functioning was strongly related to success in treatment among participants.

There are several strengths in the current study, including large effect sizes among positive outcomes, despite limited power, as well as the development of a unique, adolescent-friendly, program that participants were very receptive to. Still, these findings are limited to a relatively small sample of mostly adolescent, 8<sup>th</sup> grade girls, with no control group for comparison. It is unclear for what age groups and sex the intervention may be suitable for, which required additional, large scale research. Additionally, it is unclear if participation would be adequate and practical to promote such an intervention in the school setting, as a majority of the eligible participants were not interested in participating. There are also several logistical and practical challenges of implementing a school-based intervention, including scheduling and space to hold group interventions.

### **Future Directions**

Due to the promising outcomes evident in the current pilot data collected on 12 SIESTA participants, future research in adolescent sleep interventions would benefit from a randomized controlled trial (RCT) to further explore the efficacy of this school based group intervention. While several challenges were noted with intervention implementation, such a project may be

more feasible in school districts with more resources and collaboration with parents. While this intervention certainly targeted adolescents who were in need of such an intervention, it remains unclear how outcomes would look in adolescents of varying age, socioeconomic status, race, and location (e.g., urban, rural). Additionally, this intervention targeted those adolescents who were motivated to engage in the intervention, and future SIESTA trials may benefit on examining efficacy in adolescents with varying levels of motivation by measuring stage of change prior to intervention.

While outcomes pertaining to sleep characteristics, mental health, and neurocognitive outcomes are valuable, long term outcomes for these domains in addition to health and academic outcomes would be important to support the value of this intervention. Academic (e.g., improved grades or behavior) and physical health outcomes are outcome variables of particular interest to school personnel, and could certainly promote the desirability of such an intervention, if SIESTA is deemed efficacious in future trials. Height and weight data was not collected to evaluate change in weight status pre and post intervention due to a variable sample of adolescents that may or may not benefit from weight loss, in the context of a short duration study. Perhaps more broadly applicable health-related determinants, such as cortisol levels, should be collected in future studies.

One major finding of the current study was the relationship between IQ and success in the intervention. In the future it may be useful to administer more comprehensive assessments of intellectual abilities, perhaps pre and post intervention. Like other cognitive domains, which are vulnerable to sleep deprivation, inadequate sleep may have slightly impacted performance on general intellectual functioning. Although crystalized intelligence is largely unaffected by sleep deprivation, abstract reasoning may have been affected (Lim & Dinges, 2010). Additionally, the

mechanism supporting this relationship requires further investigation to determine if there are means of compensation for adolescents whose intellectual abilities are inadequate for positive outcomes.

Researchers and healthcare providers have long recommended consistency in bedtime and rise times as it promotes good sleep hygiene and reduces the risk of insomnia and daytime sleepiness. However, adolescent sleep is very inconsistent, with frequent compensation for lost sleep on the weekends (Mosely & Gradisar, 2009; de Sousa et al., 2007). However, this often leads to oversleeping and daytime sleepiness, and difficulty with sleep onset the following day. While past studies have focused on encouraging consistency in bed time and rise time, this practice is questionable in lieu of the research suggesting reduced risk of obesity and harmful metabolic changes in those adolescents who do not compensate for lost sleep on the weekend (Wing et al., 2009). Additionally, the current pilot data suggested that adolescents were able to increase school night sleep duration, but weekend sleep duration did not significantly change. Provided these recent research findings, future research should focus on increased weekday sleep and earlier bedtime on weekends, with less emphasis on consistent rise times.

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# Welcome to SIESTA

## Session 1:

Today's Topic: What's Sleep for Anyway?... Do I really need it?

### Introductions & Group Rules

- ☾ Real life – Sleep problems
  - What has happened to YOU when you were very sleepy (we call this “sleep deprived”)?
  - Do you know anyone else who has had something bad happen after sleep deprivation?

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### Let's test your sleep knowledge!

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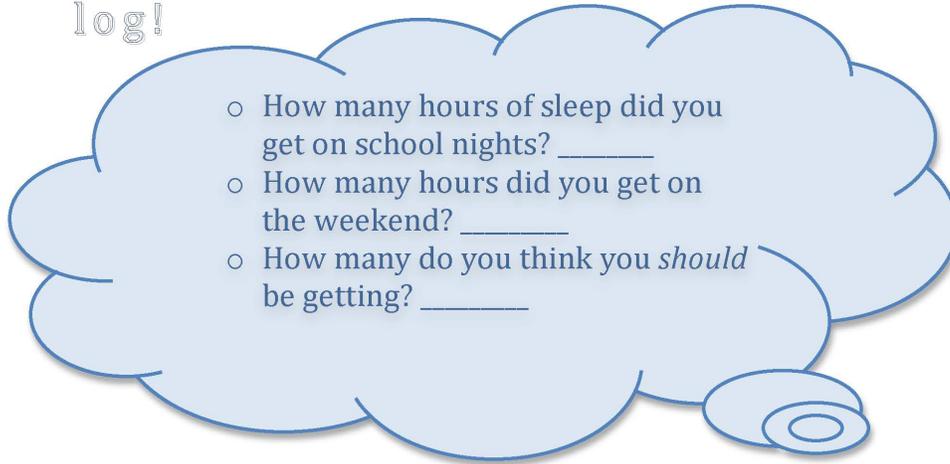
#### ☾ TRUE or FALSE quiz

- T F** Studying all night for a test will help you remember more than studying a couple hours and getting a full night of sleep.
- T F** Going to bed after midnight makes you 50% more likely to become depressed.
- T F** Not getting enough sleep can lead to acne breakouts and can make acne even worse.
- T F** Not getting enough sleep can lead to early development of wrinkles in your 20's.
- T F** Not getting enough sleep often leads a headache the next day for many people.

- T F** Not getting enough sleep can confuse your brain, and cause your body to store fat and crave unhealthy foods.
- T F** If you don't get enough sleep during the night, you can just make it up by taking a long nap during the day.
- T F** Getting enough sleep improves your memory during the school day, so you can remember more of what your teacher is saying for tests.
- T F** If you don't have a chance to get enough sleep during the school week, you can sleep in on the weekends to make up for the lost sleep.
- T F** If you don't get enough sleep you can slow your growth and make it difficult to develop muscle.
- T F** Getting only a couple of hours of sleep each night across one school year each can lead to development of diabetes in kids and teens.
- T F** You are most likely to feel your best if you go to sleep and wake up at the same time every day.
- T F** Alcohol and drugs make you sleep better.
- T F** Not getting enough sleep can lead to your hair falling out.
- T F** All teens need about the same amount of sleep, which is a lot more than adults.
- T F** Getting a full night of sleep can help you with your sports performance.
- T F** Having coffee or an energy drink will make your body feel like you had enough sleep.
- T F** You are more likely to make mistakes at work if you didn't get enough sleep.
- T F** Not getting enough sleep can make it more likely that you get a cold or the flu.
- 



## Sleep Habits- Get out your sleep log!



☞ Sometimes it is hard to get to bed early because we have homework to do. Sometimes we get caught up in a video game or texting.... Or watching TV...or...What are the good things (pros) about staying up late and what are the bad things (cons) about staying up late?

(+)PROS 😊	(-)CONS ☹

## ☾ So why do we need sleep & what is happening when we sleep?

- **Sleep** is important to your whole body – many of organs are working while you are sleeping
  - **Brain** → remember what you learn, help you concentrate, pay attention, and respond quickly – a well rested brain also keeps you feeling your best, keeping your mood positive!
  - **Muscles** → grow, develop, and repair any injury
  - **Bones** → grow and strengthen
  - **Skin** → grow new skin cells and recycle old skin cells
  - **Immune system (the system that protects against disease)** → your immune system does not work properly without enough sleep



Your brain goes through five stages while you sleep – For example, Stage 4 sleep is important for muscle growth, while Stage 5 (usually called REM sleep is important for memories! It is important to sleep through the night – *instead of taking naps* – so your brain has a chance to cycle through all five stages!

So what happens when you just don't get enough sleep?

I feel \_\_\_\_\_.

I act like \_\_\_\_\_.

If I don't get enough sleep for several days, I \_\_\_\_\_.

What are some things that can happen throughout the day when you are sleep deprived?

What if you still aren't sleeping enough 10 years from now?

Falling asleep at work is the 8<sup>th</sup> most common reason people get fired!



# Goal Setting

What was the most interesting thing you learned today?

\_\_\_\_\_.

We will set one *SMART* goal each week to help improve your sleep!

Specific (not vague!)

Measurable (something you can easily count)

Attainable (something not too hard!)

Realistic (something that fits with your schedule)

Timely (can be done by next week!)

My goal for this week (until our next meeting) is.....

\_\_\_\_\_.

How do you plan on accomplishing this goal (who, when, where)?

\_\_\_\_\_.

How *confident* (1-10) are you that you can accomplish your goal? (1= impossible to accomplish-----  
10 = 100% sure I can accomplish my goal)

\_\_\_\_\_.

Don't forget .... You need to complete your sleep logs to earn your gift card.

... Fill out your sleep log every morning – it will only take 30 seconds to do!

... If you forget, just fill it out as soon as you remember

... If you lose it, you can email me for a new one

**Session 2:**

**Today's Topic: Stress & Sleep**



CHECK-IN

Average hours (#) you slept this week \_\_\_\_\_

How many hours of sleep did you get last? \_\_\_\_\_

How alert do you feel?



How do you rate your mood?



Were you able to accomplish your goal? Why or why not?

\_\_\_\_\_.

If not, what can be done to help make your goal easier next week?

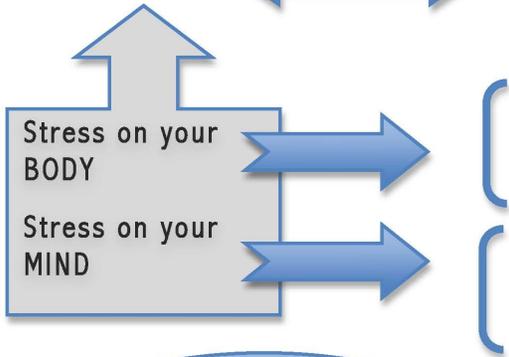
\_\_\_\_\_.

How are stress and sleep related?

Can stress cause sleep problems?

How can sleep deprivation affect your stress level?

Stress ↔ Sleep Problems



How do your mind and body feel without enough sleep?  
Fill in the space!

How do you know when you are really stressed out?

Stress Signs...

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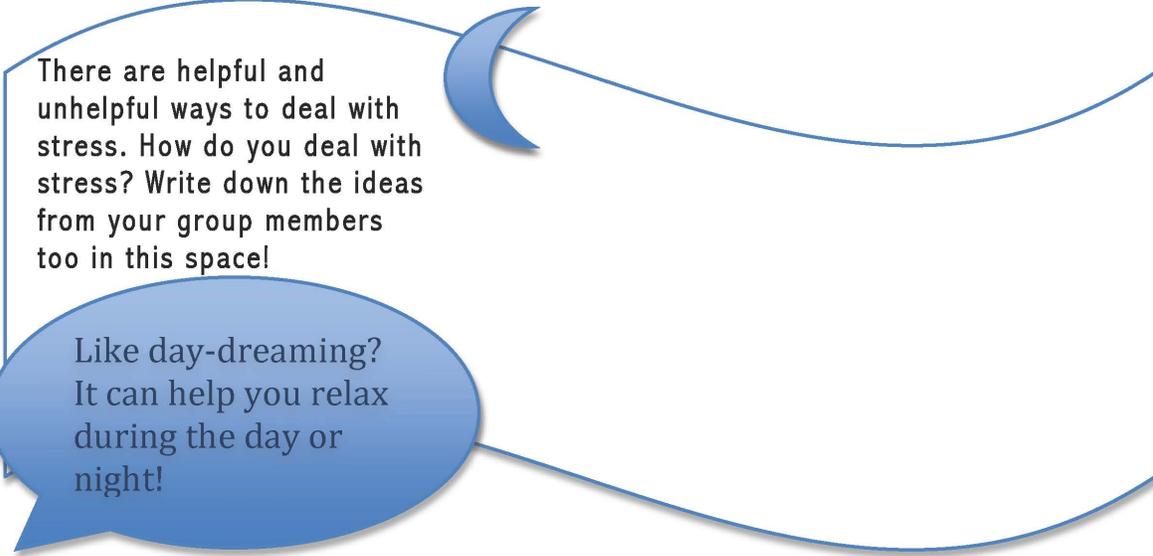
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How do these stressors impact sleep?

- Sure, stress can lead to a cold or the flu, but chronic stress can lead to serious medical problems!**
- Depression
  - Diabetes
  - Hair loss
  - Heart disease
  - Hyperthyroidism
  - Obesity
  - Obsessive-compulsive or anxiety disorder
  - Sexual dysfunction
  - Tooth and gum disease
  - Ulcers
  - Cancer

Why is this important to know?

What stresses *you* out?  
School? Home?  
Friends?



There are helpful and unhelpful ways to deal with stress. How do you deal with stress? Write down the ideas from your group members too in this space!

Like day-dreaming?  
It can help you relax  
during the day or  
night!

### **My Safe Place**

→ This is a special type of day-dream that is meant to help you relax... Like other day-dreams you should be so absorbed that you feel like nothing else is going on around you, and you have to “snap out of it” (think of a time you were sitting in class and a teacher called on you and you had no idea what was going on because you were lost in your thoughts!) While we do this exercise keep your eyes closed, focus 100% on the exercise, and push any intruding thoughts (for example, school or what you’re doing this weekend) out of your mind. Start by taking two to three deep breathes...

*Close your eyes while in a comfortable position... think of the most peaceful, relaxing place that you feel safe and comfortable – beach? Mountain top? Luxurious hotel bed? ....In a hot tub? This is your place, unique to you...be as creative as you wish. While closing your eyes think of **your** safe place...*

*To get to your safe place we will take a journey to get there... The journey to get there is long, but comfortable... How will you get there – walk? Row a boat? Ride in a car? The journey can be long and challenging, but comfortable...How does the journey feel? How does it smell...You are very tired but you continue on your journey to get to your safe place... you are dozing, trying to stay awake to get to your destination... You can see the beautiful destination ahead as you move closer... Now that you have the picture in your head how does your body feel? Imagine the smell... taste... texture of your safe place. Sit or lie down in your safe place... Spend three minutes realizing you are more relaxed than you ever have been before... chase away any intruding thoughts... visitors... and danger...*

*Memorize this place’s smells, tastes, sights, and sounds... You can come back and relax here whenever you want... Leave by the same path or entrance... notice the ground.. touch things near you... Look far away and appreciate the view. Remind yourself that this special place you created can be entered whenever you wish...*

# Goal Setting

---

We will set one *SMART* goal each week to help improve your sleep!

Specific (not vague!)

Measurable (something you can easily count)

Attainable (something not too hard!)

Realistic (something that fits with your schedule)

Timely (can be done by next week!)

My goal for this week (until our next meeting) is.....

---

How do you plan on accomplishing this goal (who, when, where)? \_\_\_\_\_.

How *confident* (1-10) are you that you can accomplish your goal? (1= impossible to accomplish-----10 = 100% sure I can accomplish my goal)

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Don't forget .... You need to complete your sleep logs to earn your gift card.  
... Fill out your sleep log every morning – it will only take 30 seconds to do!  
... If you forget, just fill it out as soon as you remember  
... If you lose it, you can email me for a new one

**Session 3:**

**Today's Topic: Sleep Strategies**



CHECK-IN

Average hours (#) you slept this week \_\_\_\_\_

How many hours of sleep did you get last night? \_\_\_\_\_

How alert do you feel?



How do you rate your mood?



Were you able to accomplish your goal? Why or why not?

\_\_\_\_\_

If not, what can be done to help make your goal easier next week?

\_\_\_\_\_

What are some strategies you've used to help you (or someone you know) sleep in the past?

☺ Take a hot bath, Have a warm beverage before sleep

☺ \_\_\_\_\_

☺ \_\_\_\_\_

☺ \_\_\_\_\_

**Sleep Hygiene** ← **Strategies that are proven to help you sleep!**

- Ⓒ Try to get up around the same time each day
  - Within 2 hours (if you get up at 6 AM on weekdays, rise no later than 8 on weekends)
- Ⓒ Exercise regularly, but more than 3 hours before bed
- Ⓒ Avoid your computer, TV, loud music, video games, etc. 30 minutes before bed
- Ⓒ Make sure your bedroom is comfortable and quiet
  - Turn off your cell and computer because noise and light can keep you up
  - Make sure your PJs match the weather
  - Consider a fan for background noise if your house is noisy
- Ⓒ Avoid greasy food before bed
  - Fried chicken, hush puppies, burgers, pizza, fries...etc.
- Ⓒ No caffeine after lunch
  - Soda, coffee, sweet tea, chocolate
- Ⓒ No alcohol before bed
- Ⓒ No smoking before bed
- Ⓒ Don't take your problems to bed
- Ⓒ Avoid naps that are more than 20 minutes
- Ⓒ Turn alarm clock around so you can't see the time
- Ⓒ Keep your blinds open so the sun can shine into your room

Which of these strategies could you add to your schedule?

-----  
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Which of these strategies are NOT for you? Why not?

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The primary purpose of your bed is sleep! What are some things you do in your bed OTHER than sleep?

Homework?  
TV?

### Stimulus Control

Being unable to sleep may be because an association has developed between being in your bed and not sleeping!

This means that if you always play videogames while you lie in bed, your body will start to think your bed is place for being very alert and aroused! Your body will think your bed is NOT somewhere to sleep.

This is similar to how you and animals learn things without even noticing. Think of your dog's automatic excited response to filling dog food bowl Or think about how your body feels when you hear the drill at the dentist's office... your body automatically responds, and you might feel excited, scared, or worked up!



This means, you should never do anything in bed except **SLEEP**...This means you **should not** talk on the phone, do homework, watch TV, play videogames, and so on if you want your **body to associate the bed with SLEEP and only SLEEP!**

This also means that if you lie in bed and cannot sleep more than 30 minutes, you should get out of bed and do something calming, like your relaxation exercise or imagery!

# Goal Setting

What was the most interesting thing you learned today?

\_\_\_\_\_.

We will set one *SMART* goal each week to help improve your sleep!

Specific (not vague!)

Measurable (something you can easily count)

Attainable (something not too hard!)

Realistic (something that fits with your schedule)

Timely (can be done by next week!)

My goal for this week (until our next meeting) is.....

\_\_\_\_\_.

How do you plan on accomplishing this goal (who, when, where)? \_\_\_\_\_.

How *confident* (1-10) are you that you can accomplish your goal? (1= impossible to accomplish-----10 = 100% sure I can accomplish my goal)

\_\_\_\_\_.

Don't forget .... You need to complete your sleep logs to earn your gift card.

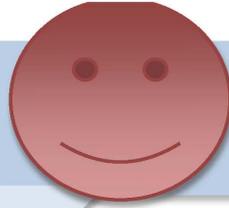
... Fill out your sleep log every morning – it will only take 30 seconds to do!

... If you forget, just fill it out as soon as you remember

... If you lose it, you can email me for a new one

**Session 4:**

**Today's Topic: Problem Solving**



CHECK-IN

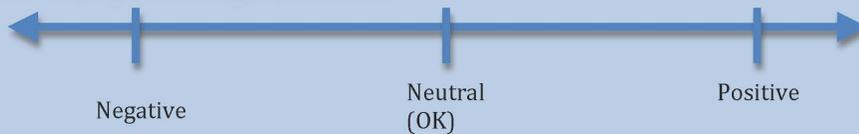
Average hours (#) you slept this week \_\_\_\_\_

How many hours of sleep did you get last night? \_\_\_\_\_

How alert do you feel?



How do you rate your mood?



Were you able to accomplish your goal? Why or why not?

\_\_\_\_\_.

If not, what can be done to help make your goal easier next week?

\_\_\_\_\_.

GAME TIME →

Trade-Off

You've learned a lot in the past few weeks! There are a lot of common problems that you may have run into by now... circle all the struggles you've run into so far...

My job is getting in the way

I have to do homework all night

I can't stop playing video games or watching TV at night

My sports practice is getting in the way

My friends get mad when I don't text back

It's too noisy or too much light in my house

The parties I go are too late on the weekend

I'm just not tired

I can't stop taking naps after school

I'm too stressed out

My extracurricular activities keep me up late

**I'm sure the list above forget some things!  
What are some other challenges you've face  
that have been interfering with your sleep?**

-----  
-----  
-----  
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## Problem Solving Steps

Step 1: Positive mindset (problems are bound to happen!)

Step 2: Define the problem (specific!)

Step 3: Find Solutions (think of as many options as possible)

Step 4: Make Decisions (weigh out the pros and cons)

Step 5: Put your plan into action

Let's try an example...

*STEP 1* → positive self talk and positive attitude “ \_\_\_\_\_ ”

*STEP 2* → \_\_\_\_\_

*STEP 3* → \_\_\_\_\_

*STEP 4* → \_\_\_\_\_

Solution	Pros (+s)	Cons (-s)

*STEP 5* → \_\_\_\_\_

## Time-Management Tips

- ★ **Prioritize** → You can't do *everything*... Do those things you *need to do* (homework, chores) first, and then those things you *want to do* (TV, talk on phone) afterwards
  - Make a to-do list to determine what you need to do first
  - Do not, I repeat, do not *multitask* – it is proven you get less done
- ★ **Create a Routine** → Set aside a specific time for your homework, favorite TV, exercise, etc. to save time
- ★ **Utilize your time to its fullest** → do your reading and studying while you are waiting for a ride, on the bus...during any downtime!
- ★ **Keep yourself organized** → how much time have you wasted because you couldn't find your homework or lost your house key? Have a special place where you can put everything that you need for school
- ★ **Get enough sleep** → you won't be as productive if you're tired! Remember –if you need a nap, take only a 20-30 minute power nap

# Goal Setting

What was the most interesting thing you learned today?

\_\_\_\_\_.

We will set one *SMART* goal each week to help improve your sleep!

Specific (not vague!)

Measurable (something you can easily count)

Attainable (something not too hard!)

Realistic (something that fits with your schedule)

Timely (can be done by next week!)

My goal for this week (until our LAST meeting) is.....

\_\_\_\_\_.

How do you plan on accomplishing this goal (who, when, where)? \_\_\_\_\_.

How *confident* (1-10) are you that you can accomplish your goal? (1= impossible to accomplish-----10 = 100% sure I can accomplish my goal)

\_\_\_\_\_.

Don't forget .... You need to complete your sleep logs to earn your gift card.

... Fill out your sleep log every morning – it will only take 30 seconds to do!

... If you forget, just fill it out as soon as you remember

... If you lose it, you can email me for a new one

... Get 3 more hours of sleep for one night for a B instead of a C on an important test the next day?

... Get 2 more hours of sleep the next two nights to stop a 4-day cold/flu?

... Get 1 more hour of sleep each night to stop a 2-pound weight gain across the next month?

... Get 2 more hours of sleep each night this week to prevent a bad acne breakout?

... Get 1 more hour of sleep to be in a good mood the next day (instead of being crabby!)

...Give up 2 hours of videogames before bed for a better sports performance?

...Give up an hour of texting before bed to prevent bags under your eyes the next day?

...Pretend like you have your license already. Would you get two more hours of sleep one night to prevent a car accident the next day?

...Would you take a 20-minute nap (only 20 minutes!) daily to prevent falling asleep during class?

SLEEP LOG ID# _____	I went to bed last night at...	This morning I woke up at...	Total number of <b>hours</b> I slept...	When I woke up for the day I felt... (check one)	Today I napped for...
Day 1: ____/____/____	_____ PM/AM	_____ PM/AM	_____ hours	<input type="checkbox"/> Wide Awake <input type="checkbox"/> Awake <input type="checkbox"/> A Little Tired <input type="checkbox"/> Very Tired	_____ minutes
Day 2: ____/____/____	_____ PM/AM	_____ PM/AM	_____ hours	<input type="checkbox"/> Wide Awake <input type="checkbox"/> Awake <input type="checkbox"/> A Little Tired <input type="checkbox"/> Very Tired	_____ minutes
Day 3: ____/____/____	_____ PM/AM	_____ PM/AM	_____ hours	<input type="checkbox"/> Wide Awake <input type="checkbox"/> Awake <input type="checkbox"/> A Little Tired <input type="checkbox"/> Very Tired	_____ minutes
Day 4: ____/____/____	_____ PM/AM	_____ PM/AM	_____ hours	<input type="checkbox"/> Wide Awake <input type="checkbox"/> Awake <input type="checkbox"/> A Little Tired <input type="checkbox"/> Very Tired	_____ minutes
Day 5: ____/____/____	_____ PM/AM	_____ PM/AM	_____ hours	<input type="checkbox"/> Wide Awake <input type="checkbox"/> Awake <input type="checkbox"/> A Little Tired <input type="checkbox"/> Very Tired	_____ minutes
Day 6: ____/____/____	_____ PM/AM	_____ PM/AM	_____ hours	<input type="checkbox"/> Wide Awake <input type="checkbox"/> Awake <input type="checkbox"/> A Little Tired <input type="checkbox"/> Very Tired	_____ minutes
Day 7: ____/____/____	_____ PM/AM	_____ PM/AM	_____ hours	<input type="checkbox"/> Wide Awake <input type="checkbox"/> Awake <input type="checkbox"/> A Little Tired <input type="checkbox"/> Very Tired	_____ minutes
<b>Weekly Averages</b>	Add the <b>hours</b> column above and divide by 7...for example... $(7+4.5+5+5+6+5+5)/7 = 5.36$ hours (____+____+____+____+____+____+____)/7 = ____			Add the minutes napped column and divide by 7... (remember that there are 60 minutes in one hour...so if you take a three hour nap that is 180 minutes) $30+0+0+45+70+30+30/7 = 29.3$ minutes (____+____+____+____+____+____+____)/7 = ____	



## EAST CAROLINA UNIVERSITY

University & Medical Center Institutional Review Board Office  
1L-09 Brody Medical Sciences Building • 600 Moye Boulevard • Greenville, NC 27834  
Office 252-744-2914 • Fax 252-744-2284 • www.ecu.edu/irb

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TO: Alicia Moran, MA student, Department of Psychology, ECU, 237 Rawl Building  
FROM: UMCIRB *JK*  
DATE: September 16, 2011  
RE: Expedited Category Research Study  
TITLE: "A brief motivational interviewing intervention for adolescent sleep"

### UMCIRB #11-0536

This research study has undergone review and approval using expedited review on 9/9/11. This research study is eligible for review under an expedited category number 7 where it is research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies. (NOTE: Some research in this category may be exempt from the HHS regulations for the protection of human subjects. 45 CFR 46.101(b)(2) and (b)(3). This listing refers only to research that is not exempt.) The Chairperson (or designee) deemed this **unfunded** study **no more than minimal risk** requiring a continuing review in **12 months**. Changes to this approved research may not be initiated without UMCIRB review except when necessary to eliminate an apparent immediate hazard to the participant. All unanticipated problems involving risks to participants and others must be promptly reported to the UMCIRB. The investigator must submit a continuing review/closure application to the UMCIRB prior to the date of study expiration. The investigator must adhere to all reporting requirements for this study.

The above referenced research study has been given approval for the period of 9/9/11 to 9/8/12. The approval includes the following items:

- Internal Processing Form (dated 8/7/11, received 9/1/11)
- Protocol summary
- Informed consent (revised, received 9/9/11)
- Parental permission (revised, received 9/9/11)
- Parental consent for using research data (revised, received 9/9/11)
- Minor assent (received 9/1/11)
- Teacher request for recruitment email
- Adolescent request letter
- Letter of support (dated 9/7/11)
- Demographic information inventory
- Pediatric daytime sleepiness scale (PDSS)
- Adolescent sleep wake scale (ASWS)
- Personal fable scale (PFS)
- Imaginary audience scale (IAS)
- Depression-anxiety-stress scale (DASS)

IRB00000705 East Carolina U IRB #1 (Biomedical) IORG0000418  
IRB00003781 East Carolina U IRB #2 (Behavioral/SS) IORG0000418  
IRB00004973 East Carolina U IRB #4 (Behavioral/SS Summer) IORG0000418  
Version 3-5-07

UMCIRB #11-0536  
Page 1 of 2

- Morningness-eveningness scale (MES-C)
- Group cohesion questionnaire (GCQ)
- Sleep log
- Siesta workbook

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

**The UMCIRB applies 45 CFR 46, Subparts A-D, to all research reviewed by the UMCIRB regardless of the funding source. 21 CFR 50 and 21 CFR 56 are applied to all research studies under the Food and Drug Administration regulation. The UMCIRB follows applicable International Conference on Harmonisation Good Clinical Practice guidelines.**



**Parental Permission**

Information to consider before permitting your teen to take part in research.

Title of Research Study: A Brief Motivational Interviewing Intervention for Adolescent Sleep

Principal Investigator: Alicia Moran  
Institution/Department or Division: Psychology  
Address: Rawl Building, East 5th Street, Greenville, NC  
Telephone #: (252) 328-1069

Researchers at East Carolina University (ECU) and Greene County Schools study problems in society, health problems, environmental problems, behavior problems and the human condition. Our goal is to try to find ways to improve the lives of your teen and others. To do this, we need the help of volunteers who are willing to take part in research.

**Why is this research being done?**

The purpose of this research is to develop a school-based intervention to improve sleep and overall wellbeing of teens. By doing this research, we hope to learn whether or not a school-based intervention to improve sleep is effective. We also hope to learn about factors that contribute to success of an intervention.

**Why is my teen being invited to take part in this research?**

Your son or daughter is being invited to take part in this research because he or she may not be getting enough sleep at night, which can lead to poor health, academic problems, and put him/her at risk for accidents and substance abuse. If you allow your son or daughter to volunteer to take part in this research, he/she will be one of about 64 people to do so in the Greene County Schools.

**Are there reasons my teen should not take part in this research?**

Teens who have cognitive disabilities, such as intellectual disability and severe learning disabilities, should not participate in this research study.

**Do I have a choice about whether or not my teen participates in this research?**

Yes, we are asking your permission. You have the option to not allow your teen to participate in this research.

**Where is the research going to take place and how long will it last?**

The research procedures will be conducted at Greene County Schools. Your teen has completed four brief surveys assessing their sleep habits and personality characteristics during an elective class period. Your teen has been identified as a student that may benefit from taking part in a group-based intervention that will be held at the school-based health center behind the high school. There will be four sessions that will be held during your child's elective class a week apart. Additionally, there will be a brief intake interview and assessment two weeks prior to the first group and one week after the last group meeting that will also be conducted at the school-based health center. The

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total amount of time your teen will be asked to volunteer for this study is approximately 8-9 hours during the school day over the next three months. Your adolescent will be expected to do a few things outside of the group meeting time – he or she will be asked to keep track of their sleep patterns, such as time he or she goes to bed. He or she will also set goals to work before bed, at home. He/she may be asked to participate at the beginning of the semester, or they may be assigned to a waitlist in which they will track their sleep patterns with a sleep log for two weeks and then start the intervention near the middle of the semester or the spring semester.

**What will my child be asked to do?**

You will not be directly required to do anything to participate in this study. Your teen has completed brief questionnaires examining sleep habits and personality characteristics during the school day that researchers would like to use for research purposes. Signing this consent document will indicate that you agree to allow researchers to use your teen’s responses as information in this research study. Your teen has also been invited to participate in a 4-week group based intervention. He/she may decline to participate or stop participating at any time. If you give permission for your teen to participate he/she will be asked to do the following:

- Come to the school-based health center or separate classroom for a baseline assessment that last approximately 30-45 minutes for further assessment of mood (for example, stress and anxiety questions) and cognitive abilities (for example, measure of reaction speed and comprehension of vocabulary words). These factors will be examined in the context treatment success and will be reassessed after intervention. Each teen will be educated on the purpose of the intervention and associated responsibilities, such as completing a sleep log (sheet of paper to record sleep bed time and wake time) daily.
- He/she will then be randomly assigned to a group intervention or be placed on a waitlist until later in the semester in which he/she will get the opportunity to participate in the intervention. The group intervention will include approximately 6-7 other students and will meet four times, once a week for four weeks during your teen’s elective class period (70-95 minutes). If your teen is on the waitlist, he/she will be asked to track sleep patterns with a sleep log for two weeks.
- After the four group sessions are completed your teen will be asked to return on individual basis to the school-based health center or empty classroom the following week for a post-treatment assessment that will last 15-30 minutes to complete measures of mood, sleep habits, and group cohesion. The purpose is to examine any changes in mood and sleep habits after the sleep intervention.
- Your teen will be asked to complete a sleep log daily from the baseline to post-treatment assessment. The log will take approximately 1-2 minutes to complete each day. Throughout the assessment your teen may also identify additional weekly individual goals related to improving sleep and reducing stress levels. There will be a weekly drawing for a \$10 gift certificate for those individuals who complete their sleep logs.

**What possible harms or discomforts might my teen experience if he/she takes part in the research?**

It has been determined that the risks associated with this research are no more than what he or she would experience in everyday life.

**What are the possible benefits he or she may experience from taking part in this research?**

We cannot guarantee that your teen will get any benefits by taking part in this study. This research might help us learn more about the impact of a school-based sleep intervention. Your teen may benefit from education about the importance of sleep, improve sleep habits, reduce health risks, and may learn how to use stress reduction strategies. There may be no personal benefit from his/her participation but the information gained by doing this research may help others in the future.

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**Will my teen be paid for taking part in this research?**

We will not be able to pay your teen for the time you volunteer while being in this study. However, weekly participation will make your teen eligible to win a \$10 gift certificate for Walmart, Subway, iTunes, or the Movie theatre.

**Will it cost anything to take part in this research?**

It will not cost you any money to be part of the research.

**Who will know that my son or daughter took part in this research and learn personal information about him/her?**

Any information we learn about your teen will be kept private. As a part of the research, these people may use the information about your teen.

- The researchers from the department of psychology at East Carolina University (ECU), including the principal investigator/group leader (Alicia Moran) and professor overseeing study the study, Dr. Everhart.
- The University & Medical Center Institutional Review Board (UMCIRB) and its staff, who have responsibility for overseeing your welfare during this research, and other ECU staff who oversee this research.

**How will you keep the information you collect about my teen secure? How long will you keep it?**

Information about your teen will be use a number rather than your teen's name. The only documents that will contain your teen's name are the consent and assent documents, which will be stored separately from other research paperwork. All electronic data will be password protected and stored on a laboratory drive in room 237. This information will be kept for 7 years before it will be destroyed.

**What if my teen wants to stop participating in the research?**

Your teen may stop participating in the research at any time. He or she will not be penalized or criticized for stopping. Dropping out of research will not affect his or her grades.

**Who should I contact if I have questions?**

The people conducting this study will be available to answer any questions concerning this research, now or in the future. You may contact the Alicia Moran at (252) 328-1069 (Tuesdays 4:00-5:00 pm and Fridays between 8:00 am and 10:00 am).

If you have questions about your child's rights as someone taking part in research, you may call the Office for Human Research Integrity (OHRI) at phone number 252-744-2914 (days, 8:00 am-5:00 pm). If you would like to report a complaint or concern about this research study, you may call the Director of the OHRI, at 252-744-1971.

**I have decided to allow my teen to take part in this research. What should I do now?**

Read the following and if you agree, you should sign this form:

- I have read (or had read to me) all of the above information.
- I may call Alicia Moran if I have any questions about things in this research.
- I know that my child can stop taking part in this study at any time.
- By signing this informed consent form, I am not giving up any of my teen's rights.
- I have been given a copy of this consent document, and it is mine to keep.

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Participant (Child) Name (PRINT) \_\_\_\_\_

Parent's Name (PRINT)

Signature

Date

7/16/24

9-8-16

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**Parental Consent for Using Research Data**

Dear Parent/Guardian,

I'm presently working on my Doctorate of Clinical Psychology at East Carolina University. As part of my degree requirements, I am planning an educational research project to take place in Greene County Schools that will help me to learn more about the sleep habits of adolescents. The fundamental goal of this research study is to examine the sleep patterns of the children in Greene County, and in the future offer them an opportunity to participate in an intervention.

As part of this research project, your child will be asked to complete a brief survey about his or her sleep and personality traits. As this study is for educational research purposes only, the results of the survey **will not** affect your child's grade. I am requesting permission from you to use your child's data (i.e. survey responses) in my research study. Please understand that your permission is entirely voluntary.

If you have any questions or concerns, please feel free to contact me at school at (252) 328-1069 or by emailing me at MoranA07@students.ecu.edu . If you have any questions about the rights of your child as a research participant, you may contact *The University and Medical Center Institutional Review Board* at 252-744-2914.

Please detach and return the form below by X date if you wish that your child does **not** participate in the research study. If this document is not completed and returned to school by X date your child's survey will be used in the study. Thank you for your interest in my research study.

**Alicia Moran, M.A.**  
**Researcher/Investigator**

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As the parent or guardian of \_\_\_\_\_,  
(write your child's name)

I do NOT grant my permission for Ms. Moran to use my child's data in her research project regarding sleep habits.

Signature of  
Parent/Guardian: \_\_\_\_\_ Date: \_\_\_\_\_

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East Carolina University



*Assent Form*

*Things You Should Know Before You Agree To Take Part in this Research*

IRB Study # \_\_\_\_\_

Title of Study: A Brief Motivational Interviewing Intervention for Adolescent Sleep

Person in charge of study: Alicia Moran

Where they work: East Carolina University

Other people who work on the study: Dr. Erik Everhart and Dr. Jeannie Golden

Study contact phone number: (252) 328-1069

Study contact E-mail Address: MORANA07@students.ecu.edu

People at ECU and Greene County Schools study ways to make people’s lives better. These studies are called research. This research is trying to find out if a school program can help improve your sleep and wellbeing.

Your parent(s) needs to give permission for you to be in this research. You do not have to be in this research if you don’t want to, even if your parent(s) has already given permission. You may stop being in the study at any time. If you decide to stop, no one will be angry or upset with you.

**Why are you doing this research study?**

The reason for doing this research is to see if participating at a program during school will improve your sleep and wellbeing. We will also see if this program can improve your grades and mood and affect your risk taking behaviors.

**Why am I being asked to be in this research study?**

We are asking you to take part in this research because you are a student in Greene County who may not get enough sleep.

**How many people will take part in this study?**

If you decide to be in this research, you will be one of about 62 people taking part in it.

**What will happen during this study?**

This study will take place at the health trailer and will last about 3 months total. You will be asked to answer some questions on surveys. Many questions will ask you about your sleep habits, such as “How long does it usually take you to fall asleep after “lights out”?” and “How long do you usually ‘put off’ or delay going to bed?”. You will also be asked about your mood and personality characteristics. For example, you will be asked how much you agree to statements, such as “Some kids don’t worry about

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getting injured when they play sports,” or “I found it difficult to relax.” You will be asked to complete brief testing, which will involve various tasks, such as providing definitions of words and solving visual puzzles.

You will also be asked to keep track of your sleeping patterns daily, such as what time you went to sleep and what time you woke up, while you participate in the study. Each week that you keep track of your sleeping patterns every day you will be entered to win a gift certificate for Walmart, Subway, iTunes, or the movie theatre. You will be asked to participate in a group of 6-8 students weekly during your elective class period for four weeks. You will receive a manual, and follow along weekly. You will also be asked to make weekly goals during this group meeting.

**Who will be told the things we learn about you in this study?**

Only the group leader, Alicia Moran, and her supervisor Dr. Everhart, will see everything you complete during the research study. Your teachers will know you are participating in the study, but will not be told any details about your participation. Your parents will not be told anything about your participation either. There are a few situations in which the group leader must tell your parents and other adults about something that you said. These situations include if you were to tell the group leader that you wanted to hurt yourself or someone else, or you know of a child or older adult being abused.

**What are the good things that might happen?**

Sometimes good things happen to people who take part in research. These are called “benefits.” The benefits to you of being in this study may be improved sleep habits, deal with stress, and improve wellbeing.

**What are the bad things that might happen?**

Sometimes things we may not like happen to people in research studies. These things may even make them feel bad. These are called “risks.” There are no known risks in this study. You may feel tired at the beginning of the study. Things may also happen that the researchers do not know about right now. You should report any problems to your parents and to the researcher

**Will you get any money or gifts for being in this research study?**

You will not receive any money or gifts for being in this research study. You will be eligible to win a gift card each week that you complete your sleep log (a piece of paper where you can track when you go to sleep and wake up).

**Who should you ask if you have any questions?**

If you have questions about the research, you should ask the people listed on the first page of this form. If you have other questions about your rights while you are in this research study you may call the Institutional Review Board at 252-744-2914.

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If you decide to take part in this research, you should sign your name below. It means that you agree to take part in this research study.

\_\_\_\_\_  
Sign your name here if you want to be in the study

\_\_\_\_\_  
Date

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\_\_\_\_\_  
Print your name here if you want to be in the study

\_\_\_\_\_  
Signature of Person Obtaining Assent

\_\_\_\_\_  
Date

\_\_\_\_\_  
Printed Name of Person Obtaining Assent

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