

ALLEVIATING CHRONIC SLEEP DEBT IN EARLY ADOLESCENCE:
CAN A SCHOOL BASED INTERVENTION MAKE A DIFFERENCE?

by

BARBARA B. RICHARDSON

A dissertation submitted in partial fulfillment of
the requirements for the degree of

DOCTOR OF PHILOSOPHY

WASHINGTON STATE UNIVERSITY
College of Nursing

MAY 2010

To the Faculty of Washington State University:

The members of the Committee appointed to examine the dissertation of
BARBARA B. RICHARDSON find it satisfactory and recommend that it be accepted.

Ruth Bindler, Ph.D., Chair

John Roll, Ph.D.

Robert Short, Ph.D.

ACKNOWLEDGEMENTS

I would like to thank the chair of my dissertation committee, Dr. Ruth Bindler, and committee members, Dr. John Roll and Dr. Robert Short for sharing their expertise and providing thoughtful guidance throughout the course of my dissertation research. I am grateful for their contributions to my doctoral education. I also wish to thank Linda, Gail, Vicki, Carrie, and Colleen, my peers in the first cohort of nursing doctoral students at Washington State University (WSU), for providing encouragement from start to finish.

The technology I used to collect sleep data was made possible with the assistance of Linda Tavolacci and Joan Pellegrini of Ambulatory Monitoring, Inc. (AMI), who worked out a lease agreement that enabled me to complete my project with a limited budget. AMI's willingness to help me obtain 25 actiwatches was invaluable. I am also grateful to Lindsey Thompkins of WSU's Sleep and Performance Research Center who served as a technical consultant, answering my endless questions pertaining to use of the AMI devices and software programs. Collecting and interpreting the data would have been much more difficult – if not impossible – without her help.

I also wish to acknowledge Dr. Nancy Stowell, Superintendent of Spokane Public Schools (SPS); Peter Ellis, SPS Fitness and Health Coordinator; Razak Garoui, SPS Director of Assessment and Program Evaluation; Travis Schulhauser, Principal; Pam Crowley, Fitness and Health teacher; Joe Crowley, Fitness and Health teacher; and Judith Rasmussen, Family and Consumer Science Education teacher, for their enthusiastic support of my research project.

ALLEVIATING CHRONIC SLEEP DEBT IN EARLY ADOLESCENCE:
CAN A SCHOOL BASED INTERVENTION MAKE A DIFFERENCE?

Abstract

By Barbara B. Richardson, Ph.D.
Washington State University
May, 2010

Chair: Ruth Bindler

In the past decade, researchers have gained a better understanding of adolescent sleep needs, and have developed a growing concern for the chronically insufficient quantity and quality of sleep experienced by up to 80% of today's youth (National Sleep Foundation, 2006). While tolerance for inadequate sleep varies among individuals, a growing body of scientific evidence demonstrates that inadequate sleep results in varying degrees of increased daytime sleepiness, and may negatively impact health, behavior, emotions, and academic achievement. The underlying causes of insufficient quantity and quality of sleep may be related to behavioral, environmental, and /or physiological factors. The purpose of this study was to investigate an educational program designed to increase nightly sleep time towards a target goal of the recommended 9 hours per night. The educational program, *Sleep For Your Health*, aimed to increase awareness of the importance of adequate sleep in 12-14 year old adolescents through implementation of a school-based curriculum. Two theories, Bruner's (1966) Discovery Learning model and Bronfenbrenner's (2005) bio-ecological theory, provided the framework for curriculum development. The pretest-posttest study with an intervention group and a control group included two classes of combined 7th and 8th grade students ($n=48$) attending an urban public middle school. Total sleep time (TST) was measured using wrist actigraphy. Daytime sleepiness (DS) was measured using the Cleveland Adolescent Sleepiness Questionnaire

(CASQ). Following the educational program, conducted weekly for six consecutive weeks, TST and DS were reassessed. No significant relationship existed between TST and DS, or sleep quality and DS. No significant changes in mean TST or DS scores occurred in the intervention group compared to the control group. Student and parent scores on a post-intervention quiz demonstrated a strong understanding of the concepts presented in the *Sleep for Your Health* curriculum. On the post-intervention survey, the majority of students indicated they were trying to get more nightly sleep, with 55% demonstrating an increase in sleep time by an average of 65 minutes a night. Based on post-intervention feedback from participants, the approach was acceptable, with only minor suggestions offered for improvement in the curriculum.

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS.....	iii
ABSTRACT	iv
LIST OF TABLES.....	vii
LIST OF FIGURES	viii
DEDICATION.....	ix
CHAPTER	
1. INTRODUCTION	1
2. REVIEW OF THE LITERATURE	5
3. RESEARCH DESIGN AND METHODOLOGY	25
4. RESULTS	40
5. DISCUSSION.....	58
REFERENCES	70
APPENDICES	
A. PROPOSED SLEEP FOR YOUR HEALTH CURRICULUM	84
B. SLEEP FOR YOUR HEALTH CURRICULUM ADAPTED FOR ENVIRONMENTS WITHOUT TECHNOLOGY	101
C. SLEEP DIARY.....	140
D. INSTITUTIONAL REVIEW BOARD PERMISSION AND ASSENT FORMS	141
E. CLEVELAND ADOLESCENT SLEEPINESS QUESTIONNIRE.....	180
F. SLEEP KNOWLEDGE ASSESSMENT AND PROGRAM EVALUATION FORM	182

LIST OF TABLES

1. Demographic Characteristics of Control and Experimental Groups	40
2. Descriptive Statistics for Total Sleep Time (TST) and Daytime Sleepiness as Measured by the Cleveland Adolescent Sleepiness Questionnaire (CASQ)	41
3. Sleep for Your Health Post-Intervention Quiz: Student Responses	45
4. Analysis of Student Responses to Post-Intervention Survey	46
5. Sleep for Your Health Post-Intervention Quiz: Parent Responses	47
6. Analysis of Parent Responses to Post-Intervention Survey Questions	48
7. Descriptive Statistics for Measures of Sleep Quality	51
8. Pearson Correlations Between Total Sleep Time, Measures of Sleep Quality, and Self- Reported Daytime Sleepiness (CASQ)	52

LIST OF FIGURES

1. Example of actigraph demonstrating consistent bed and wake times with few night awakenings	55
2. Example of actigraph demonstrating typical adolescent sleep pattern with extended sleep on weekend nights.....	55
3. Example of actigraph demonstrating fairly consistent bed and wake times on school nights, extended sleep on weekend nights, and a moderate number of brief awakenings after onset of sleep	56
4. Example of actigraph demonstrating fairly consistent bed and wake times with numerous brief and prolonged nighttime awakenings.....	56
5. Actigraph demonstrating variable times for sleep onset and frequent night awakenings	57
6. Actigraph demonstrating extremely variable times for sleep onset with numerous and prolonged night awakenings (insufficient amount and poor quality sleep	57

Dedication

This dissertation is dedicated to my husband Tom. With his unfailing love and support, I have been able to accomplish a long held dream of completing a doctorate in nursing.

CHAPTER ONE

INTRODUCTION

Statement of the problem. In the past decade, researchers have gained a better understanding of adolescent sleep needs and have developed a growing concern for the chronically insufficient quantity and quality of sleep experienced by many of today's youth. Mindell and Owens (2003) describe a number of reasons that parents, health care providers, and educators should be concerned about sleep in adolescents, including: (1) sleep problems are common in teens; (2) numerous adolescent sleep problems are chronic; (3) sleep problems are generally treatable and preventable; (4) sleep problems have a major impact on the adolescent *and* the family; (5) adequate sleep is necessary for optimal functioning; (6) sleep affects every aspect of a youth's physical, emotional, intellectual, and social development; (7) coexistence of sleep problems exacerbates nearly all health, psychiatric, developmental, and psychosocial problems in adolescence; and (8) chronic lack of sleep has become a public health issue. Research studies demonstrate that the biological need for sleep, approximately nine hours per night, changes little from ages ten through seventeen years (Iglowstein, Jenni, Molinari, & Largo, 2003; Mindell & Owens). Concurrently, sleep/wake patterns usually do change during adolescence, with teens often staying up later at night and sleeping later in the morning (Carskadon, Vieira, & Acebo, 1993; Iglowstein et al.). Numerous studies across a variety of geographic locations and cultural settings report that middle and high school students typically obtain fewer than seven hours of sleep on most school nights (Lebourgeois, Giannotti, Cortesi, Wolfson, & Harsh, 2005; Loessi et al., 2008; Mindell & Owens; Ng, Ng, & Chan, 2009; Paraskakis et al., 2008). Research indicates that between 54% and 92% of teens do not get enough sleep (Mercer, Merritt, & Cowell, 1998; National Sleep Foundation, 2006; Noland et al.,

2009; Strauch and Meier, 1988; Wolfson and Carskadon, 1998). While tolerance for inadequate sleep varies across individuals, a growing body of scientific evidence demonstrates that inadequate sleep results in increased daytime sleepiness, placing youth at risk for serious health, behavioral, emotional, and cognitive consequences (Anderson, Storfer-Isser, Taylor, Rosen, & Redline, 2009).

The underlying causes of insufficient amounts of sleep or poor sleep quality may be related to behavioral factors (e.g., increased demands on adolescent's time from school, work, activities, and socialization resulting in shortened sleep duration); environmental factors (e.g., culture, socio-economic conditions, stress); physiological factors (e.g., circadian rhythm changes, chronic illness, obesity, or sleep disorders causing frequent awakenings); or in some cases, a combination of all three factors (Lebourgeois et al., 2005, Mindell & Owens, 2003; Moore and Meltzer, 2008). Sleep habits in youth differ by race and socioeconomic status (SES), with black and Hispanic adolescents and youth of lower SES reporting less nightly sleep than their peers (Lumeng et al., 2007). While some studies have found no statistical sleep and sleepiness differences between genders (Roberts, Roberts, & Chen, 2001), others have found higher rates of daytime fatigue in young women (Vallido, Jackson, & O'Brien, 2009). Regardless of the etiology, insufficient and poor quality sleep may lead to increased daytime sleepiness and decreased daytime alertness, as well as numerous potential health related outcomes.

During the middle school years, early adolescents aged 12 to 14 years, begin to exercise more control over their own sleep routines, making this a critical time to develop healthy habits. One important approach for addressing inadequate sleep is to prevent its occurrence in the first place. Previous research has demonstrated that middle school presents a key time for the development of both positive and negative health-related behaviors (Schumacher & Queen,

2007). Adolescents seldom seek preventive care from health care providers, but most teens regularly attend school, making health classes a logical setting for implementing sleep intervention strategies with early adolescents.

Statement of the purpose. The purpose of this study was to investigate an educational program designed to increase nightly sleep time towards a target goal of the recommended 9 hours per night for 12-14 year old adolescents. The educational program, *Sleep For Your Health*, aimed to raise awareness of the importance of adequate sleep through implementation of a school-based curriculum conducted over a six-week period in an urban middle school. Two theories, learning and bio-behavioral, provided the framework for developing the curriculum. Bruner's (1966) Discovery Learning model encourages students to learn on their own through action and experience. Consistent with Bronfenbrenner's (2005) bio-ecological theory, the study also tested multi-level interventional strategies designed to educate youth, their parents, and teachers about the importance of healthy sleep habits. Findings provide useful information for families, health care providers and educators striving to help middle school students achieve personal goals related to their health, fitness, and academic achievement.

Specific aims. The specific aims of this research proposal are to:

1. Examine the relationship between total sleep time (TST) and self-reported daytime sleepiness (DS) in 12 to 14 year-old adolescents.
H1A. There will be a significant negative correlation between TST and DS.
2. Create, implement, and evaluate an educational program for middle school students, their parents, and teachers about the importance of sufficient sleep for optimal physical and emotional health, academic achievement, and performance related functioning.

3. Determine the impact of a school-based sleep education program on TST and DS in early adolescence.

H2A. TST in early adolescence will increase following a school-based sleep educational program.

H2B. Self reported DS in early adolescence will decrease following a school-based sleep education program.

Significance. Evidence indicates that increased sleepiness presents a widespread problem in schools resulting in reduced academic performance, primarily as a result of impaired memory and attentiveness, decreased problem solving and decision making abilities, poor concentration, and increased absences (Anderson et al., 2009; Wolfson & Carskadon, 2003). In addition, suboptimal sleep is associated with poor emotional regulation, noncompliance, increased oppositional behavior, depressive symptoms, increased smoking, and substance abuse (Patten, Choi, Gillin, & Pierce, 2000). Chronic insufficient sleep also places teens at risk for obesity (Chen, Beydoun, and Wang, 2007; Gangwisch, Malaspina, Boden-Albala, & Heymsfield, 2005; Knutson, 2005; Lumeng et al., 2007; Seicean et al., 2007), and older adolescents at risk for injuries and drowsy-driving related accidents (Pack et al. 1995). Clearly, chronically sleep restricted youth are at risk for potential problems related to health, relationships, and daytime functioning.

CHAPTER TWO

REVIEW OF THE LITERATURE

Definitions. Sleep is a dynamic activity during which many bodily processes vital to health and well being occur. The importance of sufficient sleep as a component of good health is a fundamental concept in nursing. As humans, we spend approximately one third of our lives sleeping, yet exactly what happens within our bodies during periods of sleep remains a relative mystery.

Sleep:

- *Sleep*, as defined by Webster (1977) is the natural periodic suspension of consciousness during which the powers of the body are restored.
- Marieb (2006) describes *sleep* as a reversible state of rest during which consciousness and responsiveness are decreased.

Sleep Debt:

- *Sleep debt* refers to the adverse effects of accumulated sleep lost to poor sleep habits, illness, awakenings due to environmental factors or other causes.
- The theoretical and empirical basis of *sleep debt* as a consequence of sleep deprivation is not well defined, and while the term is widely used, a definition of *sleep debt* is absent in scientific sleep literature (Van Dongen, Rogers, & Dinges, 2003).

Basal sleep:

- *Basal sleep* has been operationalized as one's normal or habitual sleep duration in the absence of pre-existing sleep debt (Van Dongen et al.).

- Most adolescents need at least 8.5 to 10 hours of restful *basal sleep* every night for optimal physical and emotional health and cognitive functioning (Carskadon et al., 1980; Mercer, Merritt, & Cowell, 1998).

Inter-individual differences:

- A confounding factor, *inter-individual differences* are the natural variability of sleep needs.

Sleep deprivation:

- *Sleep deprivation* is theoretically defined as the threshold of sleep duration when a person experiences *sleep debt*, or insufficient sleep to meet one's basal sleep needs (Van Dongen et al.).
- *Sleep deprivation* may be acute, happening occasionally, or chronic, occurring on a regular nightly basis. Sleep deprivation is used synonymously with the terms sleep curtailment, short sleep duration, sleep restriction, and inadequate sleep.

Critical attributes of sleep. Sleep patterns change across an individual's life span. In fact, age affects sleep more than any other natural factor (Bellenir, 2008). Adolescence is a developmental period marked by major changes in sleep habits. Sleep patterns of adolescents have been documented by parental and self reports on questionnaires, sleep time diaries, actigraphy, and in laboratory settings using polysomnography (Johnson et al., 2007; Knutson and Lauderdale, 2007; Laberge et al., 2001). Characteristics of adolescent sleep include staying up late at night and sleeping late in the morning, particularly on non-school days. Adolescents who experience sleep debt on school nights typically extend sleep on weekends (Millman, 2005). One

of the most characteristic age-related changes is a reduction in the time spent in the deepest stages of sleep (Bellenir).

As humans, we have an internal biological clock, located in the brain in a region called the suprachiasmatic nucleus (SCN), which regulates sleep timing, or circadian rhythm. The circadian clock in most humans has a natural length of just over 24 hours. Both internal and external factors affect our biological clock. Light and darkness are external cues that synchronize the internal clock to the environment. Internal factors such as cyclical changes in core body temperature are maintained even when environmental cues are removed (Bellenir, 2008). An additional factor controlled by the circadian clock in the SCN is the release of melatonin, a hormone produced in the brain. Melatonin levels begin to rise in the evening, aiding the onset of sleep, and drop in the morning prior to awakening.

During adolescence, many teens will experience a circadian phase delay, meaning teens have difficulty falling asleep until late at night and, consequently, prefer to sleep late in the morning. The circadian phase delay of sleep that adolescents experience *may* be a result of social/behavioral factors, but results of sleep studies support the idea that the development of sleep patterns in early adolescence is significantly influenced by physiological determinants at the onset of puberty (Carskadon, 2002; Knutson, 2005; Labege et al., 2001, Sadeh, S., Dahl, R., Shahar, G., Rosenblat-Stein, S., 2009). While specific sleep habits (i.e., bedtimes, wake times, naps, and sleep duration) vary among ethnic groups and global location, developmental trends in circadian sleep delays are similar (Millman, 2005).

In addition to circadian rhythms, there exists a homeostatic component that helps regulate sleep, the precise mechanism of which remains a mystery. The longer an individual stays awake, the stronger the need to sleep becomes. In the normal internal regulatory process, the drive for

sleep increases progressively during *wakefulness* until sleep is triggered when the homeostatic drive increases above a certain threshold. Waking occurs spontaneously when the homeostatic drive decreases sufficiently to cross another homeostatic threshold (Van Dongen et al., 2003). The homeostatic regulation of sleep reinforces the circadian cycle. The circadian and sleep homeostatic processes, working in concert, impact most physiologic and behavioral systems of the body and brain including the endocrine, thermoregulatory, neurobehavioral, renal, cardiovascular, and digestive systems.

Daytime sleepiness. Alarming numbers of adolescents report experiencing daytime sleepiness (DS). In a study reported by Noland, Price, Dake, & Telljohann (2009), 93.7% of the 384 respondents indicated that not getting enough sleep at night resulted in feeling sleepy the next day. Adolescents, like adults and children, respond to sleep deprivation with increased physiological sleepiness (Carskadon, Harvey, & Dement, 1981).

Causes of sleep debt and excessive sleepiness in teens. Adolescence marks a developmental period frequently characterized by insufficient sleep and sleepiness. In addition to changes in naturally occurring biorhythms, numerous extrinsic factors impact quantity and quality of sleep. *Sleep hygiene* is defined as behavioral practices that promote good sleep quality and adequate sleep duration, resulting in full daytime alertness (Lebourgeois, Giannotti, Cortesi, Wolfson, & Harsh, 2005). Examples of good sleep hygiene include avoiding intake of caffeinated or alcoholic beverages and nicotine before bedtime, maintaining a regular bed and wake time schedule including weekends, establishing regular relaxing bedtime routines such as taking a warm bath, reading, or listening to soothing music, creating a dark, quiet, comfortable, and cool environment, and not eating a large meal right before bedtime (National Sleep Foundation, 2009). Sleep hygiene and sleep patterns of adolescents are influenced by family

(Adam, Snell, and Pendry, 2007; Wolfson & Carskadon, 1998), school start times (Adam et al.; Hansen, Janssen, Schiff, Zee, & Dubocovich, 2005; Wahlstrom, 2002), the environment (Spilsbury et al., 2006), stress (Bernert, Braithwaite, Van Orden, & Joiner, 2007; Williamson et al., 1995), caffeine intake (Calamaro, Mason, and Ratcliffe, 2009; Lee, McEnany, and Weekes, 1999; Orbeta, Overpeck, Ramcharran, Kogan, & Ledsky, 2006), alcohol use (Lee, et al., 1999; Vitello, 1997), prescription and over the counter drugs (Hansen, Holstein, Due, & Currie, 2003) communication technologies (Calamaro et al.; Punamaki, Wallenius, Nygard, Saarni, & Rimpela, 2007; Van Den Bulck, 2007), employment (Wolfson & Carskadon, 1998), extracurricular activities (Drake et al. 2003), and newly developing or intense romantic relationships (Brand, Matthias, Von Planta, Hatzinger, & Holsboer-Trachsler, 2007). Sleep habits in youth differ by race and SES, with black and Hispanic adolescents and youth of lower SES reporting less nightly sleep than their peers (Adam et al. 2007; Lumeng et al., 2007). A meta-analysis of studies examining the effects of exercise on sleep was inconclusive (Driver & Taylor, 2000).

Studies examining adolescent sleep reveal that demands on adolescent's time are allowing societal standards to override biological processes (Carskadon, 1999, & 2002). Cultural, family, and life-style trends all provide pressure to shrink adolescent sleep time, even though adolescents need more, not less sleep as they move out of childhood. During the transition from childhood to adolescence, many parents change their influence on sleep patterns, particularly on school days (Carskadon, 1990). In Carskadon's (1990) study, as children progressed in age, they were less likely to report that parents set their bedtimes. In another study, more than 75% of older adolescents reported going to sleep once homework was completed, television viewing and socializing were finished, and they felt sleepy (Wolfson & Carskadon, 1998). Conversely, adolescents are much more likely than younger children to report that they

need an alarm clock or their parents to wake them on school mornings (Carskadon, 2002). These studies suggest the influence of parents on teens' sleep patterns shifts from setting bedtimes in childhood to helping adolescents wake up in the morning.

Another extrinsic factor strongly influencing sleep patterns in teens is the early hour at which school begins. After going to bed late, teens must get up early on week days due to early school start times, often resulting in insufficient sleep. In most U.S. school districts, high schools begin earliest, followed by middle schools, then elementary schools (Nudel, 1993). A number of researchers have concluded that early school start times impose a significant constraint on teen sleep patterns (Carskadon, 1999; Millman, 2005; Noland et al., 2009). For most youth, waking up for school is neither spontaneous nor negotiable (Millman). Two studies suggest when middle and high schools start one hour later, bedtimes typically do not change (Wahlstrom, 2002; Wolfson et al., 2007). As a result, students attending schools with later start times, typically obtain 45-60 minutes of additional sleep on weeknights. Later school start times have been associated with improved attendance and better grades (Wahlstrom), while teens attending schools with early start times report more irregular weekday sleep patterns and report increased daytime sleepiness (Wolfson et al.).

Many adolescents reduce sleep time in order to engage in activities that bring immediate rewards (Dornbusch, 2002). Whether for a job, homework, extra-curricular activities, or socializing, adolescents engage in activities that deprive them of sleep. One increasingly common antecedent of sleep debt may be junk sleep or semi-somnia, an adolescent technology cultural phenomena described in popular media that results from using cell phones, mp3 players, games, and computers to socialize long after many parents think their teens are asleep (Calamaro et al., 2009; Elgan, 2007; Punamaki, Wallenius, Nygard, Saarni, and Rimpela, 2007).

Additionally, consumption of caffeinated beverages may interfere with both sleep duration and sleep quality in teens (Calamaro et al., 2009; Giannotti, Cortesi, Sebastiani, and Ottaviano, 2002). A National Sleep Foundation poll (2006) revealed that 75% of adolescents consume caffeinated “energy drinks” to combat sleepiness. Calamaro et al. found that 33% of teens reported falling asleep during school, and caffeine consumption was 76% higher in those students who fell asleep.

Behavioral outcomes associated with acute sleep debt and daytime sleepiness. Sleep is essential for optimal physical, emotional, and daytime functioning. Regardless of the cause, insufficient sleep, even for periods of only a few consecutive nights, can produce serious detrimental effects. Sleepy adolescents may experience a number of negative consequences including increased risk of unintentional injuries (Stallones, Beseler, & Chen, 2006), poor school performance (Noland et al., 2009; Wolfson & Carskadon, 1998), negative moods (Evans, Kennedy, and Wertheim, 2005; Morrison, McGee, & Stanton, 1992), depression, and increased likelihood of substance use or abuse (Knutson, 2005; National Sleep Foundation, 2000). The lack of sleep may cause problems with attention, concentration, and memory (Millman, 2005; Noland et al.). After completing a critical analysis of 14 studies, Wolfson and Carskadon (2003) concluded that shortened total sleep and irregular sleep schedules are highly associated with poor school performance for adolescents. A study of 7th and 8th grade students conducted by Meijer, Habekothe, and Van Den Wittenboer (2000), found that youth who reported having difficulty getting up on school mornings were less motivated to do their best at school, whereas children who reported feeling more rested had a higher positive image of themselves as students and reported greater motivation to do their best in school.

Physiological (health) outcomes associated with chronic sleep debt. Two physiological factors appear to have a bi-directional relationship with sleep deprivation, obesity and major depressive disorders. The rapid increase in prevalence of adolescent obesity in the United States over the last 30 years represents one of the most pressing public health concerns today (Fulton, McGuire, Casperson, & Dietz, 2001). The causes of this pandemic include genetic and socio-economic (SES) factors; a sedentary lifestyle fueled by increased screen time (computers, televisions, and electronic games); and dietary intake of highly processed foods and sugared beverages. Emerging epidemiologic evidence reveal inadequate sleep increases risk for obesity (Chen, Beydoun, and Wang, 2007; Gangwisch, Malaspina, Boden-Albala, & Heymsfield, 2005; Knutson, 2005; Lumeng et al., 2007). In a study of 819 youth aged 8-11 years, Ievers-Landis, Storfer-Isser, Rosen, Johnson, & Redline (2008) found that each one-hour reduction in sleep duration resulted in a 41% increase in the odds of obesity. As average sleep duration decreased from 10.27 hours in the highest quartile of participants to 8.10 hours in the lowest quartile, the prevalence of obesity increased from 11.8% to 24.9% ($p=.0004$) (Ievers-Landis et al.). A review of the literature suggests that sleep deprivation likely increases the risk of obesity via multiple pathways. The proposed physiological mechanisms linking sleep deprivation and regulation of appetite involve decreased circulating levels of the hormone leptin and increased levels of ghrelin. Additionally, altered glucose metabolism leads to compromised insulin sensitivity (Chen et al.; Knutson, Spiegel, Penev, & Van Cauter, 2007; Lumeng et al., 2007). Findings from the Wisconsin Sleep Cohort Study involving 1024 adults suggest that sleep loss alters the ability of leptin and ghrelin to accurately signal caloric need, acting together to increase appetite (Taheri, Lin, Austin, Young, & Mignot, 2004). The same mechanism has not been studied in children or teens. Physical activity plays a critical role in the control of body weight. Sleep deprivation may

lead to low activity levels as a result of feeling fatigued and/or increased food consumption with more “awake” time to eat. As scientists continue to seek explanations for the rapidly increasing prevalence of adolescent obesity, evidence reveals sleep deprivation may be added to the list of possible contributing factors.

Conversely, overweight youth may be predisposed to insufficient sleep caused by obstructive sleep apnea (OSA). Due to adiposity surrounding the upper airway area, the pharynx intermittently collapses during sleep, causing arterial oxygenation levels to decrease and carbon dioxide levels to increase until a subconscious arousal from sleep occurs in order to restore normal blood gas levels. The obstructive process occurs multiple times throughout the night, interrupting normal sleep. Sleep disordered breathing (SDB) in adolescents leads to the same symptoms of excessive daytime sleepiness as seen with chronic shortened sleep duration. Due to of a paucity of studies and a lack of general consensus about minimum criteria for diagnosis, the true prevalence of OSA in overweight adolescents is not known (Kohler and Van Den Heuvel, 2008; Millman, 2005).

Another physiological factor associated with obesity, poor quality, and insufficient sleep is high blood pressure. Jahaveri, Storfer-Isser, Rosen, and Redline (2008) found the odds of prehypertension increased 4.5 fold in adolescents with short sleep duration. Associations were not explained by SES, obesity, sleep apnea, or other known co-morbidities, suggesting inadequate sleep without any additional factors, contributes to elevated blood pressure.

The relationship between daytime sleepiness and depressed mood in adolescents also appears to be bidirectional, with sleep problems being considered both a symptom and a consequence of major depressive disorders (American Psychiatric Association, 2000).

Adolescents with clinical mood disorders, particularly depression, report higher rates of

problems sleeping (Birmaher, Ryan, Williamson, Brent, & Kaufman, 1996; Goetz et al., 1987). Conversely, studies indicate that adolescents obtaining poor quality sleep and shorter sleep duration report increased negative moods and/or difficulties with mood regulation (Evans et al., 2005). In a study of 15,659 teens in grades 7-12, Gangwisch, Babiss, Malaspina, Turner, Zammit, & Posner (2010) report parental set bedtimes provide a significant protective factor against depression and suicidal ideation. Adolescents with bedtimes after midnight were 24% more likely to suffer from depression and 20% more likely to have suicidal ideation than teens with parental set bedtimes of 10:00 PM or earlier, after controlling for covariates (Gangwisch et al.). Evidence of the bi-directional relationship between insufficient sleep and depressive symptoms in adolescents generates a major concern; a “negative spiral” in school and social functioning (Millman, 2005). Sleep deprivation can erode mood and motivation, leading to poor school performance, increased stress, and difficulty falling and/or staying asleep. Further research examining the relationship between sleep and negative moods may inform potential interventions aimed at breaking this cycle.

Programs aimed at improving sleep in teens. Schools provide an obvious place for offering prevention and intervention programs as nearly all youth spend a significant part of every weekday in school. A search of the electronic data bases CINAHL, PubMed, PsycINFO, and Google Scholar using the key words adolescents, sleep, sleep habits, sleep hygiene, school based, and educational programs resulted in identification of five studies conducted in the U.S., Italy, Brazil, Australia, and Croatia. In all five studies, researchers implemented school based interventional programs aimed at improving sleep in adolescents.

De Sousa, Araujo, and De Azevedo (2007) implemented a sleep hygiene program conducted 50 minutes per day for a period of one week. Fifty-eight Brazilian adolescent students

were presented content that included sleep physiology, constructing a sleep ontogeny map, and discussing the causes and consequences of short sleep duration. Following the educational program, the students showed a reduction in sleep irregularity, decreased sleep latency, and an improved nap-wake schedule. The authors suggest making improvements to the curriculum and extending the study to a larger sample in order to achieve a more thorough evaluation of the impact of a school based sleep hygiene program.

Cortesi, Giannotti, Sebastiani, Bruni, and Ottaviano (2004) implemented a 2-hour interactive sleep educational course with 17 to 19 year old students attending three different public schools in Rome, Italy ($n=540$). The School Sleep Habits Survey (SSHS) was administered to all participants. Students then were randomly assigned to a control or intervention group. A pre- test evaluated baseline knowledge about sleep. Following the intervention, a post-test measured a change in knowledge about sleep. Additionally, an assessment was given 3 months later to determine retention of content. Improvement in knowledge was measured by an increase in the correct number of responses on the posttest. Paired data were available for 425 students. Results on the SSHS confirmed that 34% of students had unhealthy sleeping habits associated with high levels of perceived daytime sleepiness, increased vulnerability to injuries, and poor executive functioning. Pretest scores showed low base-line knowledge about sleep in both the control and intervention groups. Posttest scores in the intervention group showed an average 50% gain in the percentage of correct answers immediately after the educational program, with significant retention three months later. As hypothesized, the control group failed to demonstrate an increase in sleep knowledge 3 months after the intervention. Over 90% of the students participating in the intervention rated the program as useful. The ethnic and socioeconomic homogeneity of the sample limits the ability to

generalize findings. The study did not measure changes in sleeping habits as a result of increased knowledge about sleep.

The aim of a pilot study conducted by Rossi, Campbell, Vo, Marco, and Wolfson (2002) was to examine the effectiveness of a prevention program designed to teach young adolescents healthy sleep habits. Participants included 27 seventh graders; 75% students of color; and 35% from low-income families. Students were recruited from a middle school located in an urban New England community. One class ($n=11$) participated in the Sleep Smart program, once a week for 7 weeks during a regularly scheduled health course, and the other class ($n=16$) served as a control. Students in both groups self-reported sleep duration using an 8-day diary before and after the program. Prior to the intervention, no significant differences in sleep habits were reported between the two groups, and overall, most students were not obtaining adequate sleep. After implementation of the Sleep Smart program, there were no significant differences in sleep time between groups on school nights, but the intervention group reported earlier weekend bed times and less daytime sleepiness on the weekends. While this study did seek to measure a change in sleep habits following a program to increase knowledge about sleep, a limitation is the use of the self-reported sleep diaries, which do not correlate strongly with more accurate measures of sleep duration such as actigraphy (Wolfson & Carskadon, 2003). For a pilot study, the sample size was appropriate, but no generalizations can be made from such a small number of subjects.

In a recently reported study, Moseley and Gradisar (2009) investigated the effectiveness of a school-based intervention aimed at increasing sleep knowledge and improving adolescent sleep problems. Using a randomized controlled trial design with 2 groups (control and intervention), self-reported sleep problems were assessed using an online questionnaire that was

completed 3 times (pre- and post intervention and again at 6 weeks follow up). Eighty-one students with a mean age of 15.6 years from 2 schools located in South Australia participated in the study. Forty-one students at one school received four 50 minute classes across a 4-week period, while the control group ($n=40$) at a different school received class as usual. The intervention was aimed at educating teens on promoting and maintaining a healthy lifestyle based on a cognitive-behavior therapy framework. Baseline data demonstrated 53.1% of students reported insufficient (less than 8 hours) sleep on school nights, 35% reported excessive daytime sleepiness, and 77.8% had greater than 2 hours discrepancy between school and weekend rise times. The educational program increased sleep knowledge in participants ($p=0.001$); however, analysis revealed no significant effects between groups on the targeted outcome variables (total sleep time, sleep latency, regular bedtime, daytime sleepiness, and depressed mood). The online survey was comprised of questions from the Sleep Patterns Questionnaire, the Pediatric Daytime Sleepiness Scale, and the short form of the Depression Anxiety Stress Scale, all determined to be reliable and valid instruments. However, as previously noted, the discrepancy between self-reported TST and actual TST can be significant (Lauderdale et al., 2008.) The authors include outlines of the intervention lessons, which were focused on improving overall well-being rather than changing only sleep habits.

Using a different approach to educate teens about the importance of sleep, Bakoti, Radosevic-Vidacek, and Kojcec (2009) conducted a study to measure the effectiveness of distributing an informative leaflet to students aged 15-18 years, attending 12 high schools in Croatia ($n= 1209$). This particular study used multistage sampling in selected schools, randomly assigning participants to one of two intervention or control groups, according to a Solomon experimental design. Students in the intervention groups received educational leaflets while

control groups did not. Pre-testing of knowledge about sleep was conducted in one of the intervention groups and in one of the control groups using a Sleep Knowledge Test, constructed in accordance with the information on the leaflet. Data were analyzed by four-way ANOVA, and additional analyses of simple main effects were performed. Results of this study were mixed. A positive effect of the educational brochure was found in students aged 15 –17 years ($F=28.46$; $p<0.001$), ($F=5.74$; $p=0.017$), and ($F=17.17$; $p<0.001$), but no effect was found in students aged 18 years ($p=0.467$). Female students demonstrated greater knowledge about sleep than their male counterparts ($F=95.95$; $p<0.001$). The authors concluded that educational leaflets may provide an effective first step in educating younger adolescents about the importance of sleep. The approach this study used demonstrated more effective results with female than male students.

Summary of findings. Only one of the articles noted an underlying theoretical basis of the research. Not providing a theory to frame the research was a weakness of the other studies reviewed. The interventional strategies, varied ages of participants, and outcome measures reported in the literature are not similar enough to draw any conclusions about the effectiveness of school-based sleep hygiene programs aimed at altering adolescent sleep behaviors. Four of the studies used control groups to determine effect of the intervention. However, the primary outcome of the larger studies conducted in Italy by Cortesi et al. and Croatia by Bakotic et al. was increased knowledge about sleep, while the smaller studies sought to measure changes in self-reported sleep behaviors. The research conducted in Australia by Moseley and Gradisar aimed to increase knowledge about sleep and to produce positive changes in sleep related behaviors. While the positive effect of school-based health education programs has been previously demonstrated for other health-related behaviors (Basen-Engquist, Coyle, & Parcel, 2001; Cinelli and Illuzzi, 2000), results of the interventional studies did not demonstrate a

significant improvement in reducing adolescent sleep debt. Furthermore, no generalizations can be made due to the small sample sizes, non-probability sampling strategies, lack of standardized interventional programs, lack of standardized means of assessing nightly sleep, and the different outcome variables that were measured. Cultural components of sleep habits may also have impacted the findings.

Summary. Emerging research has determined that sleep is an important factor in regulating emotional, cognitive, behavioral, and physiological functioning in adolescents. Research demonstrates teens in many countries routinely get less than 7 hours of nightly sleep, although nine hours is required for optimal health and functioning. Nearly 40% of US teens surveyed said they feel tired every day (Elgan, 2007). Despite the lack of a simple solution to remedy the situation, school-based prevention or intervention sleep hygiene programs may help teens make positive choices related to regular sleep habits. Only one very small pilot study has looked at the effects of a middle school-based educational program on self-reported sleep time. Further investigations using much larger and more diverse samples are necessary to determine whether school-based sleep hygiene programs can significantly improve the long-term sleep habits of adolescents.

Additional considerations. The goal of this research project was to test a curriculum designed specifically for 7th and 8th grade students, aiming to increase TST and decrease DS through a school-based, multi-level program. As such, several other concepts and theories must be considered.

Growth and development of young adolescents. During adolescence, one of the primary tasks is achieving autonomy, defined as a developmental stage with the goal of realizing independence and self-actualization, while maintaining positive relationships with family

members or authority figures (Clark & Ladd, 2000). A review of literature using CINAHL and PsychInfo revealed no consistent definition for adolescent autonomy; however, behavioral, emotional, and cognitive characteristics were commonly described (Sessa & Steinberg, 1991). Literature addressing adolescent autonomy focused on self-determination, self-efficacy, independence, control, risk taking behaviors, and decision-making. A challenge for nurses working with adolescents, particularly teens with insufficient sleep, is to facilitate the development of positive health behaviors and lifestyle choices by tapping in to the adolescents' desire for autonomy and independent decision-making.

Attributes used to describe the concept of autonomy include dynamic, individualized, contextual, and process-oriented (Spear & Kulbok, 2004). To become independent, a teen must progress through identity formation and emancipation, eventually realizing that parental authority is not absolute and unquestionable. Feelings of conflict and ambiguity may be experienced as adolescents strive for independence. Autonomy may be influenced by gender, age, maturation, family structure, cultural determinants, and environmental factors, including the presence of a chronic illness. Family interactions may have either a positive or negative effect on the development of autonomy. To facilitate independence, the adolescent needs to be in a family environment that promotes and values self-direction and internal control (Spear & Kulbok).

Antecedents of autonomy include both internal and external variables. Internal factors include self-esteem, a desire for independence, decision-making skills, and maturation (Mann, Harmoni, & Power, 1989). External variables include primarily environmental factors such as family dynamics and relationships with peers and authority figures (Larson, Richards, Moneta, & Holmeck, 1996). Development of autonomy is enhanced if the teen perceives the external environment to be nurturing and supportive (Baumrind, 1987). *Consequences* of successfully

developing autonomy include positive self-concept, personal satisfaction, increased independence, and the ability to make sound decisions (Spear & Kulbok, 2004).

Concepts related to autonomy and quality of life in adolescents include self-esteem, self-efficacy, empowerment, separation, independence, decision-making, and family involvement (Baumrind, 1987; Spear and Kulbok, 2004). The complex process of developing autonomy involves a wide variety of human interactions and experiences.

In conclusion, facilitating the process of developing autonomy, specifically with regards to health behaviors, presents a challenge for nurses working with adolescents. Knowledge of the concept *autonomy* will be helpful for planning and implementing the sleep program intervention, in order to enhance the development of independence and thereby increase the adolescent's sense of personal responsibility and self-reliance.

Theoretical framework. Multi-level and multi-component intervention programs are currently being recommended when health behavior change among adolescents is the goal (Brinbaum, Lytle, Story, Perry, and Nurray, 2002). An Institute of Medicine report edited by Smedley and Syme (2000) concluded that effective health promotion programs should combine multiple approaches to “address multiple levels of influence simultaneously [on health and health behaviors] (p.5) and further, the report specifically recommended that programs for adolescents should address multiple components addressing the social environment. Adolescent sleeping patterns are shaped by environmental, social, and individual factors. By addressing all three domains, a program designed to change sleeping behaviors is expected to increase the probability of successfully impacting the desired outcome.

The conceptual framework for this study included Bronfenbrenner's (2005) bio-ecological systems theory. The bio-ecological model addresses the multiple interacting

influences on behavior, including environmental factors in a teen's family, school, and community. Applied to adolescent health, Bronfenbrenner's theory predicts that the most effective health promotion programs must involve co-coordinated interventions at multiple levels. The intervention used a multi-faceted approach employing individual, family, peer, and school-based methods to encourage behavior change in teens, as well as the integration of knowledge and attitudes regarding healthy lifestyle choices.

Both learning and bio-behavioral theories were used as a framework for developing the *Sleep for Your Health* curriculum. *Discovery Learning* is an instructional model based on cognitive views of learning and constructivist principles developed by Jerome Bruner in the 1960s. Constructivism provides a very broad conceptual framework frequently used in science instruction, with Bruner's (1966) model representing one particular perspective under this broad theoretical umbrella. In the Discovery Learning model, students are encouraged to learn on their own through action and experience. Bruner's theory suggests that students learn best through the process of discovery. Principles of constructivist theory include experimentation, cooperative learning, problem-solving, and learning through active involvement. The teacher's role is to ensure exploratory learning activities and to encourage students' curiosity. Discovery Learning attempts to address learning as a process rather than the accumulation of knowledge presented in textbooks. Bruner's theory includes four components. The first is a predisposition toward learning that sparks a student's curiosity. The second recognizes the role of the teacher who specifies ways information is structured so the student can readily grasp the knowledge. Third, the principle of sequencing instruction, progressively leads the learner through the content. Lastly, Bruner addressed the principle of motivation, believing it is more desirable for students to seek intrinsic rewards inherent in solving problems or understanding concepts, rather than

seeking extrinsic rewards such as praise from a teacher or achieving good grades (Pedroni, 2008). As such, lessons for the intervention will be arranged in a sequential manner, with a number of exploratory activities designed to self-motivate students to get sufficient sleep because they will feel healthier, more alert, and less irritable.

Curriculum development. While only five reported school-based studies have focused on improving sleep in adolescents, a review of the literature demonstrated that school-based programs for other health related behaviors, particularly tobacco and substance use, have been somewhat effective in changing behavior (Bruvold, 1993; Faggiano, Vigna-Tagliant, Zambon, Borraccino, & Lemma, 2005; Tobler, 1986). Suggestions from successful programs that have focused on changing other health related behaviors were incorporated when planning the intervention. One means of including social influences is to use peer leaders. Peer-led interactive programs are more effective than teacher-led programs and more effective when compared to control groups (Brinbaum et al., 2002; Valente, Hoffman, Ritt-Olson, Lichtman, & Anderson-Johnson, 2003). Meta-analyses of substance use programs have shown that interactive student-to-student exercises are more effective than lecture-style programs (Black, Tobler, & Sciacca, 1998).

Summary. Adolescents' developmental stage, peers, family, school, and community environment all impact teens' health behaviors, including sleep. Creative, multi-faceted strategies are needed to promote healthy lifestyles. An integrated approach should enable students to set personal goals related to their individual sleep needs, with additional support provided through peers, family, and school involvement.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

Study population. The pretest-posttest control group study was conducted using two health and fitness classes of combined 7th and 8th grade students ($n=48$) attending an urban public middle school. To obtain sufficient power, a minimum of 40 students aged 12 to 14 years were recruited to participate in the study (DSS Research, 2009). Glover Middle School (GMS) was randomly selected by drawing the name from a list of the six potential sites in Spokane Public Schools (SPS). GMS serves approximately 620 7th and 8th grade students primarily from lower and middle-income families. The gender and ethnic background of the student body at GMS during the 2008-2009 school year included: American Indian (5.49%); Asian (2.26%); Black (3.07%); Hispanic (3.88%); Pacific Islander (0.65%); White (77.54%); Multiracial (7.11%); male (51.71%); and female (48.39%)(Office Of The Superintendent Of Public Instruction, 2009). The reported blend of ethnic representation at GMS is reflective of the school district and community as a whole. The mission states, “GMS fosters a safe, comfortable and caring academic environment based on mutual respect and responsibility of students, staff, and parents in order to provide all students the optimum opportunity to become educated, productive citizens.” Belief statements include: (1) GMS is comprised of students, teachers, administrators, support staff, parents/guardians and community members working together to enhance the learning experience for each students. (2) GMS is an educational response to the specific needs and characteristics of young adolescents that supports their transition from elementary to high school. (3) GMS’s practices must be researched based and dedicated to meeting the needs of the students. Based on these beliefs, the researcher found the principal and teachers at Glover to be very encouraging and supportive of the proposed study.

Study design. Study participants wore a wrist actigraph (Ambulatory Monitoring Inc. (AMI) mini motion logger device) on their non-dominant hand for a period of 7 days before and after the intervention. When wearing the actiwatch, students completed a sleep diary every morning (Appendix C). DS was measured pre- and post-intervention using the CASQ (Appendix F). Students enrolled in health and fitness first period were recruited for the control group ($n=26$). The control group received no special treatment, attending class as usual. Students assigned to second period ($n=22$) received targeted information and participated in activities emphasizing the importance of sleep. All students in the class received information about sleep, even though all did not elect to participate in the study. The interactive sleep education curriculum, *Sleep for Your Health* (Appendix B), was facilitated by the researcher every Friday for 15 minutes for 6 consecutive weeks. On days the students received information about sleep during class, their parents and teachers received an email message from the researcher with information covering the same topic, along with additional links to resources available on the web, suggestions for ways to reinforce goals, and several questions that could be used to prompt family discussions about sleep. Parents without internet access or who indicated they preferred using the U.S. postal service were sent a written copy of the same information. At the conclusion of the intervention, TST and DS were again measured in both groups to determine any significant change. A 10-question quiz designed to measure comprehension of the information provided in the curriculum was administered to participants at the conclusion of the program. Evaluative feedback from students, parents, and teachers was solicited in order to improve the curriculum for future use.

Recruitment. In order to obtain sufficient power with a medium effect size, a minimum of 40 total subjects were enrolled in the study. Prior to implementing the research, sufficient time

was allowed to work with the many individuals the study potentially impacted, particularly the SPS Board of Directors, district administrators, school principal, health teachers, and students. After obtaining Institutional Review Board (IRB) approval from Washington State University and Spokane Public Schools, a letter of explanation from the researcher, a letter of support from the school principal and health teachers, and a consent form were mailed to parents/guardians of each student enrolled in the classes that were selected to participate (Appendix D). Included in the mailing was a pre-addressed stamped envelope for parents to return the signed consent form to the researcher. An explanation of the study was provided to potential adolescent subjects by the researcher during their regularly scheduled fitness class, and assent forms were distributed for each student's signature, if they chose to participate.

Sleep measurement. The “gold standard” for measuring sleep is polysomnography, which requires an overnight stay in a sleep laboratory. While asleep, a person is monitored in a number of ways including electroencephalography (EEG), which involves attaching electrodes to the scalp to record brain wave activity on a graph. The electrical activity of the brain appears as wavy lines on a computer screen or paper recording that is visually scored to depict stages of the sleep cycle. Another form of sleep monitoring, continuous electrooculography (EOG), records eye movements. EOG is used to determine the time periods during which a person is progressing through the stage of sleep called rapid-eye-movement (REM) sleep. Both EEG and EOG are helpful in determining sleep latency (the time period between laying down and the onset of sleep), total sleep time, the time spent in each sleep stage, and the number of arousals from sleep.

While polysomnography is considered the most accurate test for objectively measuring sleep, wrist actigraphy is considered a reliable and valid means of detecting sleep in normal healthy populations (Johnson et al, 2007; Lauderdale, Knutson, Yan, Lijing, and Rathouz, 2008;

Littner et al., 2002). Actigraphy measures periods of awake and sleep, but unlike an EEG, stages of sleep cannot be determined on an actigraph. The correlation between polysomnography and wrist actigraphy is over 0.9 in normal healthy adult subjects (Lauderdale, Knutson, Yan, Lijing, & Rathouz, 2008). Actigraphy, a relatively unobtrusive method, utilizes small computerized accelerometers in an actiwatch to measure sleep-wake patterns by assessing movement, most commonly of the wrist. The use of actigraphy as a method of measuring sleep duration and patterns is increasing as actigraphy simultaneously is more objective than self-reported sleep logs and less intrusive and expensive than polysomnography (Johnson et al., 2007). The American Academy of Sleep Medicine (AASM) recommends conducting actigraphy studies for a minimum of three consecutive 24-hour periods (Littner et al., 2002).

Daytime sleepiness (DS) measurement. Sleepiness is not an easily defined concept, as it reflects different transitional states. Quantifying or measuring sleepiness has proven difficult. Confusion in understanding the concept of sleepiness is evidenced by the many different words that are used, often interchangeably, including fatigue, tiredness, daytime sleepiness, drowsiness, somnolence, and weariness. Sleepiness represents a transitional state between wakefulness and sleep in which the sleep onset process has begun (Johns, 1998). Furthermore, sleepiness can be defined in two ways: (1) technically (objectively), sleepiness means entering Stage 1 sleep as measured by polysomnography; or (2) the subjective feelings and symptoms associated with feelings of drowsiness (Johns). Unlike measuring sleep, there is no “gold standard” for assessing DS in either youth or adults. Measuring DS can be done both objectively and subjectively. Tests in a laboratory setting can measure how rapidly a subject falls asleep, but must assume that the quicker one falls asleep, the sleepier the person is. The Multiple Sleep Latency Test (MSLT) is the most widely used objective assessment of sleep. The MSLT must be conducted in a

laboratory setting with trained technologists, involving considerable expense. The MSLT also assumes that DS as measured in a lab setting accurately reflects DS in other situations, including daily living. Other physiological determinants of DS include eye and eyelid movements. Additionally, tests that track memory, reaction times, and performance deficits may be used to determine physical and psychological effects of sleep deprivation (Van Dongen et al., 2003). Subjective tests measuring sleepiness in adolescents include the Pediatric Sleep Questionnaire – Sleepiness Subscale (PSQ-SS), the School Sleep Habits Survey (SSHS), the Pediatric Daytime Sleepiness Scale (PDSS), and the Cleveland Adolescent Sleepiness Questionnaire (CASQ). Such tests offer valuable information, but they do not explain all aspects of sleepiness (Cluydts, De Valck, Verstraeten, & Theys, 2002). Unfortunately, very few studies have examined the relationship between the objective physiological propensity to fall asleep quickly and the objective self-reported feelings of DS (Johns).

Description of Instruments. Actigraphy is an unobtrusive method utilizing tiny computerized accelerometers to measure sleep-wake patterns by assessing movement, most commonly of the wrist. Study participants were recruited to wear a wrist actigraph (AMI mini motion logger device) for a period of 7 consecutive days and nights, allowing for measurement of sleep on both school and weekend nights. The actiwatch looks like a black sports type wristwatch with a blank face. The wrist actigraphs contained a highly sensitive accelerometer that digitally recorded integrated measures of gross activity, which were analyzed in 1-minute epochs to identify sleep-wake periods. Actigraphy data were recorded using the Zero Crossing Mode (ZCM) and scored using Action-W analysis software (AMI) and the Cole-Kripke algorithm.

Students were asked to complete sleep diaries (Appendix C), noting the exact time they began trying to fall asleep and when they woke up on nights they wore the wrist actigraph. Sleep logs were kept to aid the researcher in the interpretation of specific event markers on individual actigraphs. For example, if a student removed the actiwatch for two hours to participate in a wrestling tournament, the actigraph would record the absence of movement as sleep. Sleep logs provide a far more economical means of recording sleep time than actigraphs, but the average correlation between self-reported sleep and measured sleep duration is only moderate (0.47), with subjects commonly over-reporting actual sleep time by 0.4 to 1.2 hours (Lauderdale et al, 2008). The sleep diary, patterned from forms used in sleep research with children at the University of Washington School of Nursing, was used in a recent pilot study by the researcher.

The Cleveland Adolescent Sleepiness Questionnaire (CASQ), developed specifically to measure daytime sleepiness in early adolescents, has been shown to be a reliable and valid measurement of this variable (Spilsbury, Drotar, Rosen, and Redline, 2007). The researchers' approach to validation was designed to avoid some of the potential limitations of other instruments that measure daytime sleepiness in teens by: (1) limiting each item to only one behavior; (2) utilizing exploratory and confirmatory factor analysis to develop a scale with a sound, verified structure; and (3) using structural equation modeling techniques to conduct confirmatory factor analysis, which allows the investigators to specify causal relationships among observed and latent variables while simultaneously accounting for measurement error (Spilsbury et al., 2007). The study was conducted using both a normative sample and a sleep disordered breathing sample. The normative group, comprised of 411 teens, was recruited from three different sources in order to obtain broad representation of normal sleep behavior among adolescents from varied socio-economic backgrounds (Spilsbury et al.). Youth were recruited

from two public schools (n=193 or 47%), control subjects from the sleep disordered breathing cohort study (n=127 or 31%), and churches in Ohio (n=91 or 22 %), with a resulting sample of 46% males, 72% Caucasian, and 21% African American teens. The sleep disordered breathing group included 62 participants in the Cleveland Sleep and Health Study whom were known to have either obstructive sleep apnea or primary snoring (Spilsbury et al.).

The initial selection of 46 potential items for the CASQ was based on empirical evidence and theory. Items and the Likert-type response format were pre-tested for ease of readability and comprehension. Based on recommendations from the pre-test subjects (n=23) and four experts in adolescent sleep medicine, the survey was reduced to 35 items. The CASQ was initially administered to the normative sample. CASQ responses were assigned a numerical value and then summed to produce an overall score, with higher scores reflecting greater sleepiness. A split sample approach using exploratory factor analysis (EFA); a principal axis extraction and varimax rotation was conducted to identify the underlying scale structure on half (n=181) of the normative sample. Critical eigenvalues were set at 1. Using SPSS (13.0) to complete the EFA process, items were then deleted until all remaining items had a primary factor loading $>.4$ and secondary loadings $<.3$, revealing four factors that explained 55% of the variance. A confirmatory factor analysis (CFA) was conducted using SEM and the software program AMOS (5.0) to test the scale structure established by the remaining half of the sample (n=218), with goodness of fit indicators ranging from good to excellent (Spilsbury et al., 2007). The resulting final version of the CASQ contained 16 items and demonstrated good internal consistency with a Cronbach's alpha = .89 (Spilsbury et al.). The mean CASQ score was 35.2 with a standard deviation of ± 11.0 (Spilsbury et al.). Limitations included: a sample that may not have been truly representative of normative sleep behavior in teens; no comparison of results was provided with

a more objective measure of excessive daytime sleepiness such as the Multiple Sleep Latency Test; and a self-reported measure of sleep duration was used rather than a more objective measure such as actigraphy (Spilsbury et al.).

CASQ scores in both the normative and sleep disordered breathing samples were highly positively correlated (Pearson's correlation coefficient = .75 and .70) with scores on the Pediatric Daytime Sleepiness Scale (PDSS) (Spilsbury et al., 2007). Total CASQ scores were negatively correlated with self-reported sleep duration on school nights (Pearson correlation coefficient = -.40), a correlation that is slightly stronger than the same correlation demonstrated with PDSS scores (-.33) (Drake et al. 2003).

In conclusion, the CASQ is an instrument that is inexpensive, easy to administer, score, and interpret, with psychometrically sound properties. The CASQ can be used for a slightly broader range of ages (11-17) than the PDSS (11-15), and the CASQ has also been tested using a known sleep disordered breathing sample. The CASQ could benefit from additional studies that include a more diverse population of adolescents. Higher scores on both the CASQ and PDSS reflect increased daytime sleepiness, a condition that is significantly associated with short sleep duration in teens (Drake et al., 2003; Spilsbury et al., 2007). Having an inexpensive, easy to administer, reliable, and valid tool such as the CASQ would be helpful for purposes of identifying youth who may be at risk for a number of serious problems resulting from excessive daytime sleepiness.

Curriculum development. The researcher conducted an extensive review of Spokane Public Schools' 7th and 8th grade fitness and health curriculum using the Health Education Curriculum Analysis Tool (HECAT), developed by experts at the Centers for Disease Control *specifically* for conducting a school health education curriculum evaluation (CDC, 2005).

Analyses of two current middle school health curriculums revealed either very brief descriptions or no inclusion of sleep content (Monroe County Health Curriculum Guide, 2005; SPS Fit for the Future, 2009). The National Institutes of Health (NIH) Heart Lung & Blood Institute has developed and made available to the public two exemplary programs, one that promotes better sleep habits for children ages 7-10 years (Garfield Star Sleeper) and a curriculum supplement that explores sleep, sleep disorders and biological rhythms for grades 9-12 (NHLBI, 2009; NIH, 2009). Both NIH programs contain useful content that were modified to create materials and lessons that were appropriate for use with middle school students. The National Sleep Foundation (NSF) has developed many interactive tools and resources for adults that were shared with parents via email messages (or print form if they preferred) containing specific links to the NSF website. Curriculum experts from SPS were consulted throughout the design process.

Understanding motivation as a factor in determining adolescent behavior is critical when identifying desired outcomes. Smith et al. (2005) conducted a systematic review of eight studies examining what 11-16 year old students believe impacts their motivation to learn in the classroom. Six themes were identified as the key to successful motivation, including:

1. Group work results in greater engagement and high teacher expectations impact the effort students expend.
2. Students are more motivated by activities they perceive to be useful or relevant.
3. Students prefer fun, collaborative, participative, and engaging activities.
4. Peers have a significant influence, particularly in group interactions.
5. Students believe that effort is important.
6. Curricula can serve to de-motivate some students, particularly assessments that influence how pupils view themselves as learners.

These themes, along with various learning style preferences, guided development of the sleep curriculum. Content was sequential in nature and used participatory, collaborative, inquiry-based activities to cover normal sleep-wake patterns across the life span, basic sleep physiology, chronobiology (circadian rhythms), consequences and risks associated with sleep deprivation in teens, good sleep hygiene, common sleep problems, and available treatments. Content validity was obtained by having two middle school health and fitness teachers (one male and one female), and one middle school life-skills curriculum consultant review the proposed lessons, making sure the content was appropriate for students in grades seven and eight. Lessons were held weekly for six consecutive weeks during regularly scheduled health and fitness classes, providing an opportunity to reinforce previously learned content during each successive session. Informational materials reinforced what students learned in the classroom, and additional links to informative web sites were provided for parents and teachers of participants (Appendix B). This approach reflects Bronfenbrenner's theory predicting the most effective health promotion programs involve co-coordinated interventions at multiple levels.

Adolescents' developmental stage, motivation, peers, family, school, and community environment all impact teens' health behaviors, including sleep. Creative, multi-faceted strategies are needed to promote healthy lifestyles. An integrated approach enabled students to set goals related to their individual sleep needs, with additional support provided through family involvement. The lessons provided a multi-level approach consistent with recommendations from a review of current literature as most likely to be successful in promoting healthy behaviors in middle school adolescents.

In order to maximize impact, a multi-media approach was designed for use in classroom presentations. A wide variety of learning activities were planned including interactive lectures,

video tapes, readings, web-based activities, power point slides, interactive computer modules, posters, games and sleep diaries. The original plans for the educational program included web-based activities that would allow for self-paced learning and assessments in a comfortable format engaging for many of today's youth. The web-based lessons for parents were designed primarily for their convenience and easy reference. The original plans for each of the six sessions are included (see Appendix A). However, once the study was initiated, computers were not available for use in the gymnasium for either the researcher or students, so learning activities were adapted to suit the environment (Appendix B). *Sleep For Your Health* was *not* a graded course. The intervention was intended to increase knowledge about sleep and help adolescents discover the benefits of regularly obtaining sufficient sleep.

Preliminary plans for the *Sleep for Your Health* program were constructed using the theoretical constructs described above. The intervention was designed to incorporate various types of learning. Most of the objectives were cognitive in nature involving knowledge and comprehension. Several activities required listening to others, participating in small groups, and a willingness to accept responsibility for one's own actions, objectives that are reflective of growth in emotional areas or the affective domain (Clark, 2008). Few of the course objectives reflected the psychomotor domain that involves true mastery of manual or physical skills, however motor skills were used in the learning process through incorporation in a number of the learning activities.

Data collection. Using wrist actigraphs, sleep diaries, and the CASQ, TST and DS were measured within two weeks before and after the intervention. This time frame allowed one researcher to provide directions for wearing the actiwatches, filling out the sleep diaries, and administering the CASQ surveys, thereby limiting the need to train additional researchers and

minimizing data collection errors. Both pre- and post-intervention TST data collection occurred over a period of two weeks, based on the 25 actiwatches secured for use in the study. Weekends with time changes due to daylight savings were avoided. Subjects were asked to wear a wrist actigraph for 7 consecutive days and nights to obtain data regarding average duration of sleep obtained on school and weekend nights. Concurrently, participants were given sleep diaries to complete (Appendix C). Each student's diary was kept in an individual file folder and locked in the teacher's office. The fitness and health teachers reminded students to fill out the forms at the beginning of each class. It was assumed that having students complete the sleep diary during class time helped to decrease the number of students who might forget to record sleep time each night or return forms at the completion of the study. On days the actiwatches were returned (both pre- and post intervention), participants completed the 16-question CASQ to measure self-perceived daytime sleepiness. Special efforts, such as allowing extra time to complete forms, were provided for students needing special accommodations per their individual education plans.

At the conclusion of the program, students and parents were given the same 10-question true/ false quiz to assess comprehension of the curricular content (Appendix E). The final piece of collected data was a subjective evaluation of the sleep curriculum. Students in the intervention group, their parents, and classroom teachers were asked to complete a brief evaluation survey that included two "check response" questions about how much they had learned and how likely they were to change sleep behavior, and three open ended questions regarding the strengths and weaknesses of the curriculum (Appendix F). Final data analysis commenced once all data (actigraphy readings, CASQ's, quiz, and evaluation forms) were collected.

Data analysis. Data collected using the actiwatches were analyzed using Action-W software. The actiware files (.ami) were converted to Excel for further analysis based on student

diaries and visual evaluation of the actigraphs (Figures 1 through 6). The CASQ responses at T1 and T2 were scored by hand, resulting in a total score for each subject ranging from 16-80. Data was recorded using Microsoft Excel and analyzed using SPSS version 17.0.

Human subjects assurances. The purpose of the study, confidentiality assurances, and study procedures were thoroughly explained to all study participants, including students, their parents/guardians, and teachers. The parental consent form and youth assent forms (Appendix D) clearly stated that participation was voluntary and that participants could choose to not answer any question, or could decline/withdraw from participation at any time for any reason. Youth could also decline to participate even when parental consent was obtained.

Potential Risks. Risks to parent/guardian participants included additional time-demand related stress, even from the relatively short amount of time required to participate in the study. Since parents could have experienced emotional distress related to perceived parenting skills if the information presented was at odds with current family practices regarding sleep habits, participants were encouraged to contact the researcher at any time if they had questions or wanted to further discuss information that was presented. Students wearing the actiwatches were unlikely to feel any discomfort and the device should not cause any harm. Students may have felt awkward if other people asked why they were wearing a watch with a blank face that doesn't keep time; thus participants were given an opportunity to ask questions about the actiwatch so they would feel more comfortable if someone asked about it.

Protection against risks. An explanation of the study was provided to potential subjects by the researcher. Permission forms were mailed to parents / guardians of all students eligible to participate in the study. Included with the permission form was a letter explaining the study and the researcher's contact information, should parents or students have any questions or concerns

(Appendix D). Assent forms were explained to students, section-by-section, before being distributed for signatures. Students could elect *not* to participate even though parents returned a signed permission form. However, students in the class selected for the intervention received the sleep curriculum even though they chose not to participate in the pre and post-testing.

Students and parents/guardians were assigned a study identification (ID) number in order to minimize any risk of personal identification. The list of names and associated ID numbers will be stored in a locked cabinet at Washington State University to which only the researcher and her doctoral committee will have access. Email addresses of parents were kept confidential by the researcher and not used for any purpose other than distribution of study related information. Data are being kept on a password-protected computer and in a locked file-cabinet. Participants were provided with the researcher's contact information. At the conclusion of the study the list of names, emails, and addresses were destroyed.

Potential benefits. The potential benefit to study participants included becoming more knowledgeable about sleep, more aware of how much sleep they regularly obtain and whether that amount of sleep is sufficient to remain alert and energetic throughout the day. Long term, participants *may* experience better health, behavioral, emotional, and cognitive consequences if they regularly get sufficient sleep. Researchers and others may benefit from results when planning future studies and interventions aimed at improving sleep in adolescents. Risks to subjects were minimal and appeared to be reasonable in relation to the knowledge that may have been gained by participating in the study.

Importance of knowledge to be gained. This study sought to determine whether a school-based intervention can motivate early adolescents to regularly obtain sufficient sleep. Knowing whether the planned curriculum had a positive impact on behavior is critical to future research

that seeks to improve the success of weight management strategies by including information about the importance of sleep. Gaining a better understanding of the relationship between TST and DS may further enhance future interventions aimed at improving sleep habits in teens. Wearing an actiwatch did not cause harm to subjects, and the risks appeared to be reasonable in relation to the knowledge that may have been gained about adolescent sleep habits.

Data and Safety Monitoring Plan. Wearing the actiwatch for 7 consecutive days and nights apparently did not cause any undue stress or harm to participants. Fitness and health teachers who had daily contact with the students Monday through Friday were asked to confirm with students that the actiwatches are not posing any problems. All participants were provided with the researcher's contact information and an alternative contact phone number (university advisor) in the unlikely event that wearing the actiwatch had an adverse effect on a subject. Participants were reassured they could take off the actiwatch and decline further participation at any point during the study.

Inclusion of Women and Minorities. Every effort was made to recruit equal numbers of boys and girls, and to include students and parents from diverse backgrounds reflective of the racial and ethnic makeup of the school district and community as a whole.

Inclusion of Children. The study included participation by 7th and 8th grade students, aged 12-14 years. The researcher has specific educational preparation (Master in Nursing Department of Family & Child Nursing), practical classroom expertise (founder and facilitator of Youth Leadership Spokane program), five years of clinical experience in the nursing care of children and adolescents, twenty-six years of parenting experience, and extensive knowledge of K-12 educational systems. All student participants were given a research study assent form to sign; the form previously approved by WSU's IRB. Initially, the researcher fully explained the study

to students, allowing ample opportunities for potential participants to ask any questions they had regarding the study. Students were then given the assent form that further explained the purpose of the study, what students were being asked to do, potential benefits and risks for taking part, assurances regarding confidentiality, and the right to refuse participation. All information contained in the assent form was reviewed one more time with potential participants, again allowing time to answer any questions. The researcher explained to students that they could refuse to participate even though their parents had signed a permission form. Only students with signed parental consent forms and youth assent forms on file were allowed to take part in the study.

CHAPTER FOUR

RESULTS

Descriptive statistics. Descriptive statistics were evaluated to determine mean age of participants, gender, and minority status (Table 1). The sample consisted of 48 adolescents, 26 in the control group and 22 in the experimental group. There were 52% males and 48% females ranging in age from 12 to 14 years, with a mean age of 159 months (13.26 years). Comparable to the community in which the study was conducted, 83% of the participants were white.

Table 1. Demographic Characteristics of Control and Experimental Groups

Characteristic	Control Group	Experimental group	<i>p</i> value	Total
N	26	22	--	48
Males	15 (58%)	10 (46%)	.398	25 (52%)
Age (months) \pm <i>sd</i> (min-max)				
Males	159 \pm 6.3 (148-169)	162 \pm 8 (151-172)	.463	160 \pm 7.1 (148-172)
Females	157 \pm 7.4 (146-168)	159 \pm 6.2 (147-168)		158 \pm 6.7 (146-168)
Total	158 \pm 6.8 (146-169)	160 \pm 7 (147-172)	.413	159 \pm 7.0 (146-172)
Race - White	23 (88%)	18 (81%)	.300	(83%)

Means were calculated for the sleep variables including total sleep time (TST) and self-reported sleepiness (CASQ) before and after the six-week intervention (Table 2). TST and CASQ scores demonstrated normality using histograms, stem and leaf plots, Q/Q plots, and Kolmogorov-Smirnov statistics. Two extreme values were identified as outliers, but were not eliminated from the data as they did not influence the significance of the results.

Table 2. Descriptive statistics for Total Sleep Time (TST) and Daytime Sleepiness (Cleveland Adolescent Sleepiness Questionnaire Scores)

	Total Combined Groups Pre-test	Control Group Pre-test	Control Group Post-test	Experimental Group Pre-test	Experimental Group Post-test
N	47	26	24	21	21
Total Sleep Time (minutes) mean \pm sd min – max	441 \pm 66 267-595	438 \pm 75 267-594	447 \pm 67 219-514	445 \pm 55 353-541	467 \pm 75 346-606
N	48	26	25	22	21
Mean Cleveland Adolescent Sleepiness Questionnaire Mean \pm sd min – max	31.1 \pm 9.3 16-60	30.68 \pm 8.6 20-59	32.16 \pm 7.7 21-49	30.36 \pm 10.3 16-60	30.81 \pm 10.8 17-58
Number of students getting sufficient sleep (\geq 540 minutes nightly)	3 (6.2%)	2 (7.7%)	0 (0.0%)	1 (4.8%)	4 (19.0%)

Results of Hypothesis Testing

Specific Aim 1 was to examine the relationship between total sleep time (TST) and self-reported daytime sleepiness (DS) in 12 to 14 year old adolescents. The null hypothesis predicted a significant negative correlation between TST and DS. Data for total sleep time (TST) and daytime sleepiness (DS) demonstrated normality in both groups pre- and post- intervention. A Pearson correlation was calculated examining the relationship between daytime sleepiness (CASQ score) and TST. Pre-test data revealed a non-significant correlation ($r = .014$, $p = .463$). Post-intervention data demonstrated non-significant weak negative correlations, ($r = -.149$, $p = .244$) in the control group and ($r = -.024$, $p = .459$) in the experimental group, indicating that self reported daytime sleepiness was not significantly related to total sleep time in this study. Further analysis demonstrated a relationship between age and total sleep time in the

experimental group at Time 2 ($r = -.618, p < .01$). The older the adolescent, the less their mean total sleep time.

Specific Aim 2 was to create, implement, and evaluate an educational program for middle school students, their parents, and teachers about the importance of sufficient sleep for optimal physical and emotional health, cognitive developments, and performance related functioning. Following implementation of the curriculum, participants in the *Sleep for Your Health* curriculum were asked to complete a 10 question true / false quiz to determine basic comprehension sleep concepts. The mean quiz score was 8.29 ($sd = 1.5$), indicating understanding of the important points covered in the *Sleep for Your Health* curriculum (Table 3).

Two closed response questions were posed, asking students how much they had learned from the sleep curriculum and how likely they were to change their sleep habits based on information they learned. Nearly 2/3 of the participants (63.2%) stated that they had learned “quite a bit” or “way more than expected”, while 36.8% stated they had learned “just a few helpful things”. More than 3/4 of the students (77.8%) responded that they were trying to find ways to get closer to the recommended 9 hours each night, while less than one quarter of the participants (22.2%) said they were unlikely to change sleep behaviors as a result of participation in the study. Of the students who indicated they were trying to increase their nightly sleep, 61.5% actually did so, while 38.5% obtained less sleep following the intervention.

Students were also encouraged to provide feedback about how much they learned about the importance of sleep, how likely they were to change their sleep habits as a result of participating in the study, the strengths and weakness of the course, and suggestions for improving the curriculum content and methods of delivery. A complete record of student responses is listed in Table 4. The open-ended responses were analyzed for themes, providing

valuable feedback regarding content and delivery of the curriculum, as well as how the participants perceived their sleep habits. Responses to the question, “What were the best things (strengths) of the *Sleep for Your Health* course?” were grouped into three focused areas. Seven students answered this question with brief comments such as “not being tired” or “getting to sleep soundly,” indicating positive consequences or changes in sleep habits. Seven students answered this same question with comments about the fun, interactive “hands-on” learning activities such as the tug-of-war used to demonstrate the sleep / wake cycle, or the “Greenday concert” where students sang re-written words to a current #1 hit song (Appendix B), in order to reinforce the importance of sufficient sleep to good health and doing well in school.

For the second open-ended question, “What were the worst parts (weaknesses) of the *Sleep for Your Health Course*?” responses were grouped into 3 themes. Eight students commented on changes in their sleep habits, such as “not staying up all night” or “getting to sleep on time.” While the researcher interpreted these responses as a strength or positive change, the students’ responses suggest that perhaps going to bed earlier may not be popular or “cool” (i.e., a perceived weakness of the program). Two comments were related to delivery of the content, and five students felt there were no weaknesses or weren’t sure how to respond. The last open-ended statement, “Please provide any suggestions you may have for improving the *Sleep for Your Health* course” elicited only one student response, “Make it more fun.”

Parents of students in the experimental group were mailed a copy of the identical 10-question quiz and 5-question survey, providing an opportunity to offer feedback about the materials sent home during the 6 weeks the study took place. Five parents (25%) returned the completed quiz and evaluation form. The mean parental score on the quiz was 9.6 ($sd = 0.5$), indicating a strong understanding of the content covered in the curriculum (see Table 5). Most

parents (80%) indicated they either learned “a few helpful things” or “quite a bit” from the materials that were mailed to them each week. These same parents (80%) said they were likely to encourage their son or daughter to obtain the recommended 9 hours of sleep most nights.

Parental responses to the open-ended question about strengths of the course *all* were related to learning about the importance of a good night’s sleep for teens. Answers to the question about weaknesses of the course were grouped in to three themes, with 3 parents noting no perceived weaknesses, one mentioning awareness of environmental impacts on sleep, and one sharing a comment on content delivery that her teen thought the talks could be more exciting (for summary of responses see Table 6).

Table 3. Sleep for Your Health Post-Intervention Quiz: Student responses (n=20)

Correct response	Percentage of students responding correctly (n=20)	Percentage of students responding incorrectly	Question
true	90.5%	9.5%	Most teens need at least 9 hours of sleep every night in order to look, feel, and do your best each day.
false	100%		When asleep, your body and brain are inactive, just resting
true	90.5%	9.5%	Light signals your brain to know when it's time to be awake and darkness helps your brain know when to go to sleep.
true	90.5%	9.5%	Without enough sleep you may feel and act moody, be forgetful, have poor coordination, and problems concentrating.
false	85.7%	14.3%	Your body is able to adjust quickly to different sleep schedules.
true	66.7%	33.3%	To do your best on an important test, it's better to get at least 8 hours of sleep the night before than to drink caffeinated beverages and stay up all night studying.
true	76.2%	23.8%	Many teens may experience a shift in their circadian rhythms, making it difficult to fall asleep before midnight or fully wake up before 9am.
false	61.9%	38.1%	Vigorously exercising is a good way to unwind and relax right before going to bed.
false	76.2%	23.9%	Sleep disorders are rare, with few teens ever experiencing problems sleeping
true	90.5%	9.5%	In order to get enough sleep you need to make sleep a priority and regularly practice good sleep habits

How much do you feel you learned about sleep from the “Sleep for Your Health” course?

- 5.2% responded I learned very little
- 31.6% responded I learned a few helpful things
- 47.4% responded I learned quite a bit
- 15.8% responded I learned a lot way more than I expected!

How likely are you to change your behavior (try to get enough sleep most nights) based on information presented in the “Sleep For Your Health” course and goals you have set?

- 22.2% responded I'm not likely to change how much sleep I get most nights
- 55.6% responded I'll try to find ways to get closer to 9 hours of sleep a night when I can
- 22.2% responded I'm already making changes in order to get 9 hours of sleep most night

Table 4. Analysis of Student Responses to Post-Intervention Survey

Student responses to post-intervention question, “What were the best things (strengths) of the “Sleep for Your Health Course”?”

Not being tired-----	}	(7) consequences or changes in sleep patterns
Getting to sleep soundly-----		
Getting asleep soundly-----		
Not being tired -----		
Darkness -----		
Help me sleep-----		
Sleep -----		
Some strengths are that everybody could have learned something new about sleep -----		
The fun -----	}	(7) interactive learning activities
The hands on learning -----		
Greenday concert -----		
Greenday concert -----		
The tug of war -----		
The watch was cool -----		
IDK (I don't know)-----		
I'm not sure -----	(2) not sure how to respond	

Student responses to post-intervention question, “What were the worst things (weaknesses) of the “Sleep for Your Health Course”?”

Not staying up late -----	}	(8)changes in sleep patterns
Getting to sleep on time-----		
Not being up all night -----		
Getting to sleep on time -----		
Light -----		
Actually getting 9 hours of sleep -----		
The weekends -----		
Not sleeping -----		
The watch -----		
The lectures -----	}	(2) delivery of content
Late for class sometimes -----		
Nothing -----	}	(5) not sure how to respond
Nothing -----		
IDK -----		
I don't think there are any weaknesses -----		
I missed 3 days of this -----		

Provide suggestions for improving the Sleep for Your Health course.

- (1) Make it more fun

Table 5. Sleep for Your Health Post-Intervention Quiz: Parent Responses (n=5)

Correct response	Percentage of students responding correctly (n=20)	Percentage of students responding incorrectly	Question
true	100%		Most teens need at least 9 hours of sleep every night in order to look, feel, and do your best each day.
false	100%		When asleep, your body and brain are inactive, just resting
true	100%		Light signals your brain to know when it's time to be awake and darkness helps your brain know when to go to sleep.
true	100%		Without enough sleep you may feel and act moody, be forgetful, have poor coordination, and problems concentrating.
false	100%		Your body is able to adjust quickly to different sleep schedules.
true	80%	20%	To do your best on an important test, it's better to get at least 8 hours of sleep the night before than to drink caffeinated beverages and stay up all night studying.
true	80%	20%	Many teens may experience a shift in their circadian rhythms, making it difficult to fall asleep before midnight or fully wake up before 9am.
false	100%		Vigorously exercising is a good way to unwind and relax right before going to bed.
false	100%		Sleep disorders are rare, with few teens ever experiencing problems sleeping
true	100%		In order to get enough sleep you need to make sleep a priority and regularly practice good sleep habits

How much do you feel you learned about sleep from the "Sleep for Your Health" course?

- 20% responded I learned very little
- 40% responded I learned a few helpful things
- 40% responded I learned quite a bit
- 0% responded I learned a lot way more than I expected!

How likely are you to encourage your teen to change his or her behavior (try to get enough sleep most nights) based on information presented in the "Sleep For Your Health" course?

- 20% responded I'm not likely to encourage him/her to change how much sleep they get most nights

__20% responded __I'll try to help my son/daughter find ways to get closer to 9 hours of sleep most nights

__60% responded __I'm already encouraging my son/daughter to make changes in their schedule in order to get 9 hours of sleep most nights

Table 6. Analysis of Parent Responses to Post-Intervention Survey Questions

Parent responses to post-intervention question, “What were the best things (strengths) of the “Sleep for Your Health Course”?

That sleep is more important than I previously thought -----	} (8) importance of sleep
My daughter learning the importance of a good night’s sleep -----	
Understanding the effects of good and poor sleep also -----	
Darkness (affecting ability to obtain deep sleep) -----	
Informing about disorders and possible solutions -----	
Hearing the importance of sleep from another source besides her parents, and tying it to important daytime effects. -----	

Parent responses to post-intervention question, “What were the worst things (weaknesses) of the “Sleep for Your Health Course”?

None -----	} (3) no weaknesses noted
Not sure -----	
I thought it was well informed and gives a base to start on-----	
Light (impacting sleep) -----	(1) environmental impacts on sleep
The talks need to be more exciting (per student report-----	(1) delivery of content

Suggestions for improving the Sleep for Your Health Course:

No suggestions – wanted to point out that I believe this is an important subject, and should be added to the health curriculum for ALL students. Thank you.-----	} (3)thanks
Thank you for doing this!-----	
Books and websites to look for more information -----	(1) additional resources

Specific Aim 3 was to determine if a school based sleep education program would impact TST or DS in early adolescence. The null hypotheses predicted that TST in early adolescence would increase and self-reported DS would decrease following participation in the school based sleep education program. Mean TST for all participants prior to the intervention was 441 minutes (7.35 hours) (*sd*= 66, range 266-594 minutes). While the mean TST in the experimental

group at T1 ($m = 445$, $sd = 55$) increased by an average of 22 minutes of sleep a night at T2 ($m = 467$, $sd = 75$), the increase was not statistically significant following participation in the *Sleep for Your Health* curriculum. However, 55% of students in the experimental group ($n = 11$, 7 females, 4 males) averaged a 65-minute increase in their sleep from pre-intervention to post-intervention ($sd = 53.3$, range 6 to 149). Conversely, 45% of participants in the experimental group ($n = 9$, 7 males, 2 females) actually decreased their average nightly TST following participation in the curriculum by an average of 49 minutes ($sd = 49$, range 9 to 145). Mean TST in the control group increased 9 minutes between Time 1 ($m = 438$, $sd = 74$) and Time 2 ($m = 447$, $sd = 67$). An independent samples t-test was calculated comparing the mean TST (post-intervention) of the control group to the mean TST scores of the students that participated in the *Sleep for Your Health* curriculum. Levene's test was not significant, indicating equality of variance. No significant difference was found ($t(43) = -.952$, $p > .05$) between groups. Even though the mean TST of the experimental group was 20 minutes of sleep each night greater than the control group, the mean TST of the experimental group was not significantly higher than the mean TST of the control group. Therefore, the null hypothesis cannot be rejected, indicating that the observed differences between the intervention group and the control group could possibly be due to chance.

In addition to sleep duration, actigraphy generates data on the quality of sleep, bed and wake times. Mean bedtime pre-intervention was 10:45 PM ($sd = .87$) for school nights (Sunday through Thursday) and 11:45 PM ($sd = 8.75$) on weekend nights (Friday and Saturday). Mean bedtimes post-intervention were 10:45 PM (control group $sd = .93$; experimental group $sd = .75$) and 12 midnight (control group $sd = 1.5$; experimental group $sd = 1.6$). Bedtimes on weekends ranged from 6:30 PM to 6 AM. While the data suggests most middle school students stay up later

on weekend nights, 19% of students had an earlier average bedtime on weekend nights. Being driven primarily by school start times on weekdays, wake times (~7AM) demonstrated consistency across both groups pre- and post-intervention. Mean sleep efficiency (SEFF), defined as the percentage of time in bed estimated to be asleep (i.e., total time estimated to be asleep / total time in bed for the major sleep period *100) (Javaheri et al, 2008), was calculated for each subject. Mean SEFF pre-intervention was 81.8% (*sd* = 11.3, range = 52). Javaheri et al (2008) determined adolescents with a sleep efficiency of $\leq 85\%$ were considered to have low sleep efficiency, demonstrating poor quality sleep. In this study, 26 of 47 participants or 55% demonstrated low sleep efficiency pre-intervention. Post-intervention, control group participants demonstrated a mean SEFF score of 84% (*sd* = 11%.) and experimental group students averaged a SEFF score of 84% (*sd* = 10%). Post-intervention, 9 of 23 students (39%) in the control group and 10 of 22 students (45%) demonstrated poor sleep efficiency (Table 7.). Additionally, the average number of minutes participants awakened after sleep onset (WASO) pre-intervention was 134 (*sd* = 72). Post-intervention, mean WASO for the control group was 127 minutes (*sd* = 55) and 136 minutes (*sd* = 70) for the experimental group. The measures demonstrating sleep quality (SEFF and WASO) were correlated with TST and one another (see Table 8) but were not significantly correlated to daytime sleepiness scores (CASQ).

Table 7. Descriptive Statistics for Measures of Sleep Quality

	Total (combined groups) Pre-intervention	Control Group post- intervention	Experimental group post- intervention
N	47	23	21
Coefficient of Variation min-max	17% ± 9.5 4-55%	18% ± 11 4-42%	21% ± 13 .13-58%
Mean Sleep Efficiency (SEFF) min-max	82% ± 11% 47-98%	84% ± 11% 55-96%	84% ± 10% 61-96%
Mean Wake After Sleep Onset (WASO) (minutes) min-max	134 ± 72 26-431	128 ± 54 51-241	128 ± 71 32-292

Table 8.

Pearson Correlations Between Total Sleep Time, Measures of Sleep Quality, and Self-Reported Daytime Sleepiness (CASQ), with associated two tailed p-value.

Total Sleep Time (TST)	Coefficient of Variance (CV)	Sleep Efficiency (SEFF)	Wake After Sleep Onset (WASO)	CASQ
Combined Groups Pre-Intervention (n = 47)				
TST	-.638	.731	-.522	.014
Sig. (2 tailed)	.000	.000	.000	.926
CV	—	-.030	-.005	.010
Sig.		.842	.972	.945
SEFF		—	-.853	.050
			.000	.740
WASO			—	-.052
				.727
Control Group Post-Intervention (n=23)				
TST	-.494	-.245	.373	-.089
Sig. (2 tailed)	.014	.285	.096	.692
CV	—	.578	-.563	.002
		.006	.008	.992
SEFF		—	-.807	-.133
			.000	.544
WASO			—	.229
				.292
Experimental Group Post-Intervention (n=22)				
TST	-.144	.199	-.081	.095
Sig. (2 tailed)	.534	.388	.726	.683
CV	—	.135	-.276	.258
		.559	.225	.260
SEFF		—	-.801	-.070
			.000	.756
WASO			—	-.067
				.766

Mean self-reported daytime sleepiness (CASQ) did not decrease significantly following implementation of the *Sleep for Your Health* program in the experimental group. An independent samples t-test was calculated comparing self reported daytime sleepiness (post-intervention) of the control group to the mean CASQ scores of students that participated in the *Sleep for Your Health* curriculum. Levene's test was not significant; therefore, variance among groups was assumed to be equal. No significant difference was found ($t(44) = .493, p > .05$) between groups. The mean CASQ of the experimental group ($m=30.81, sd=10.83$) was not significantly less than the mean CASQ of the control group ($m = 32.16, sd=7.7$). Therefore, the null hypothesis cannot be rejected, indicating the small observed difference in self-reported daytime sleepiness between the experimental group and control group could be due to chance. Mean CASQ scores were notably consistent pre- and post-intervention for both the control and experimental groups (Table 2). Strong positive correlations for CASQ scores as reported pre- and post-intervention were calculated in both groups; Pearson's correlation coefficient for the control group measured $+0.818$ ($p < .001$) and $+0.923$ for the experimental group ($p < .001$).

A paired samples t-test was calculated to compare the mean pre- and post-intervention TST and CASQ scores for both the control and experimental groups. The initial *mean* TST for control group participants was 438 minutes ($sd = 74$), while six weeks later the *mean* TST was 447 minutes ($sd = 67$) ($t(23) = -.766, p > .05$). In the experimental group, the *mean* pre-intervention TST was 445 minutes ($sd = 55.69$) and post-intervention the *mean* TST was 467 minutes of nightly sleep ($sd = 75$) ($t(19) = -.773, p > .05$). While no significant differences were found in the *mean* TST in either group, the *mean* TST increased in both groups from October to

December. A paired samples t-test of mean CASQ scores, control group ($t(24) = -1.665, p > .05$) and experimental group ($t(20) = -.573, p > .05$), were not significant.

Cronbach's alpha was used to test the homogeneity or internal consistency of the TST data. This analysis was used to determine reliability of the 5 measurements of TST on school nights and 2 measurements of TST on weekend nights, comprising the single construct, TST pre- and post-intervention. Grouped together ($n=48$) Cronbach's alpha equaled .778 for week 1 (pre-intervention) and .731 for week 2, post-intervention.

Night to night variability of sleep habits, i.e. bed and wake time, number and duration of night-time awakenings, were observed through visual evaluation of individual actigraphs (Figures 1 through 6). A coefficient of variation (CV) was calculated for each subject pre- and post-intervention. CV was calculated as the standard deviation of TST divided by the mean sleep duration, expressed as a percentage. The average CV for the control group pre- and post intervention was 17% ($sd=10$, range 48) ($sd=11$, range 37). Variability, as measured by CV in the experimental group, was less than the control group pre-intervention ($m=15\%$, $sd=9$, range=33), and greater than the control group post-intervention ($m=21\%$, $sd=13$, range=55). An independent samples t-test found the CV of the experimental group was not significantly different than the CV of the control group pre- or post-intervention ($t(45)=.51, p=.71$) ($t(43)=-.78, p=.78$).

Figure 1 . Example of actigraph demonstrating consistent bed and wake times with few night awakenings.

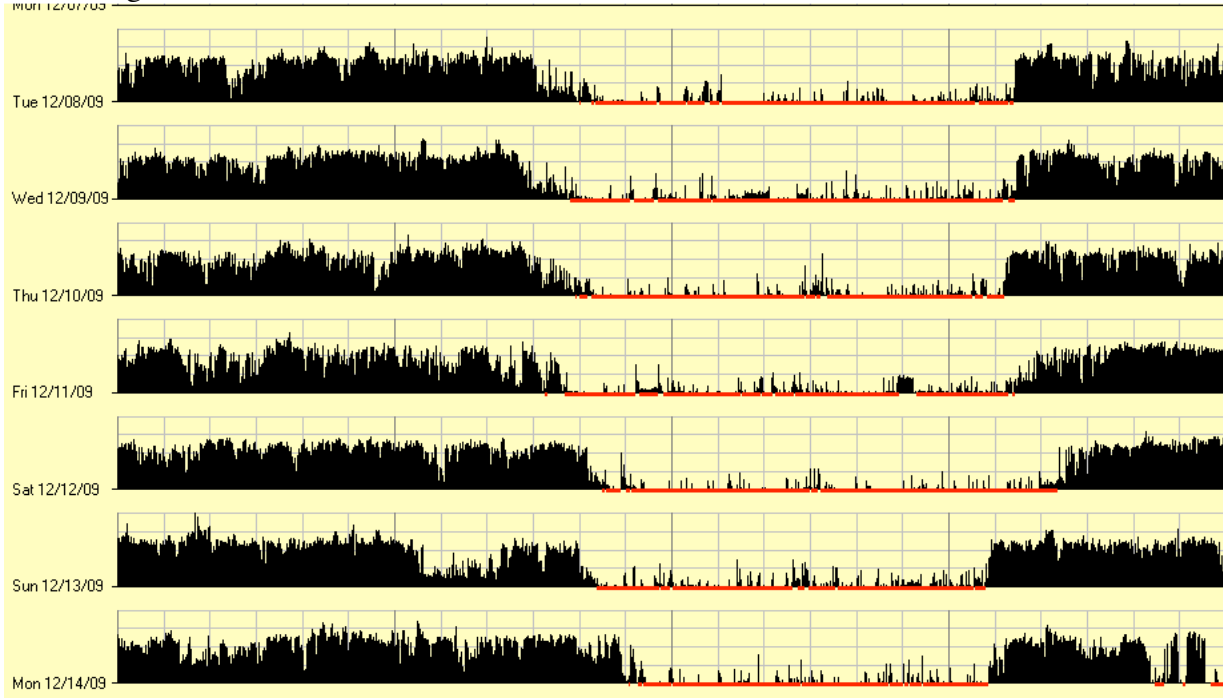


Figure 2. Example of actigraph demonstrating typical adolescent sleep pattern with extended sleep on weekend nights.

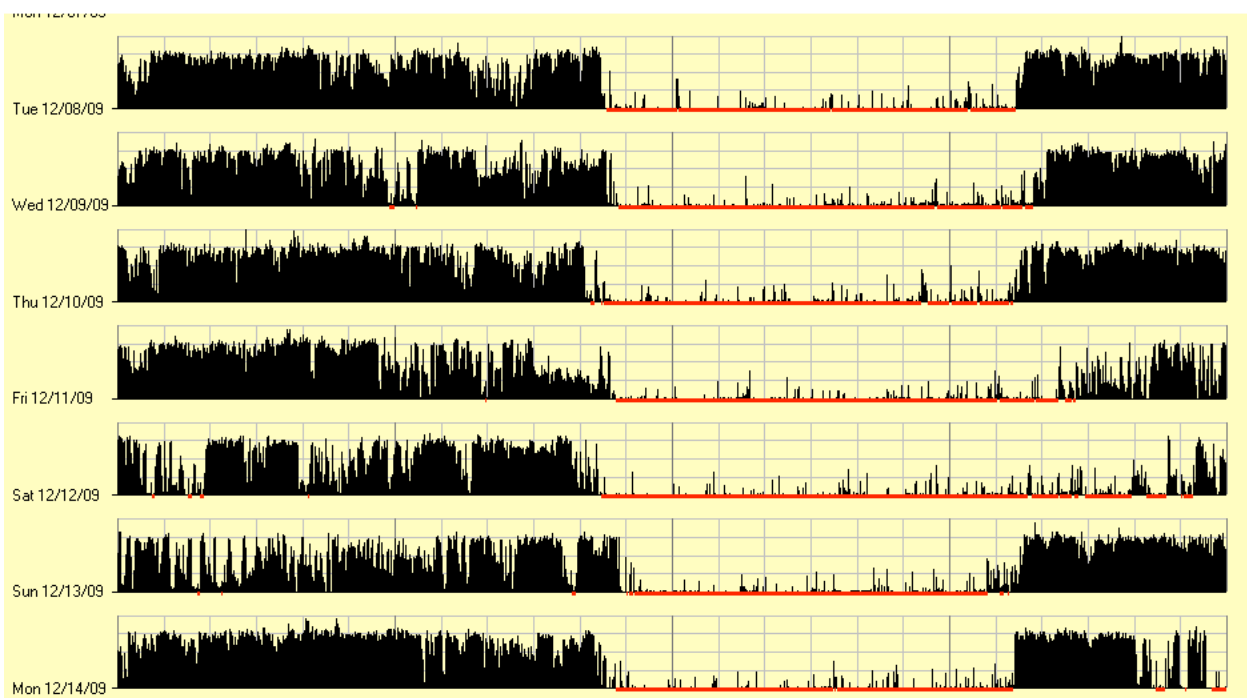


Figure 3. Example of actigraph demonstrating fairly consistent bed and wake times on school nights, extended sleep on weekend nights, and a moderate number of brief awakenings after onset of sleep.

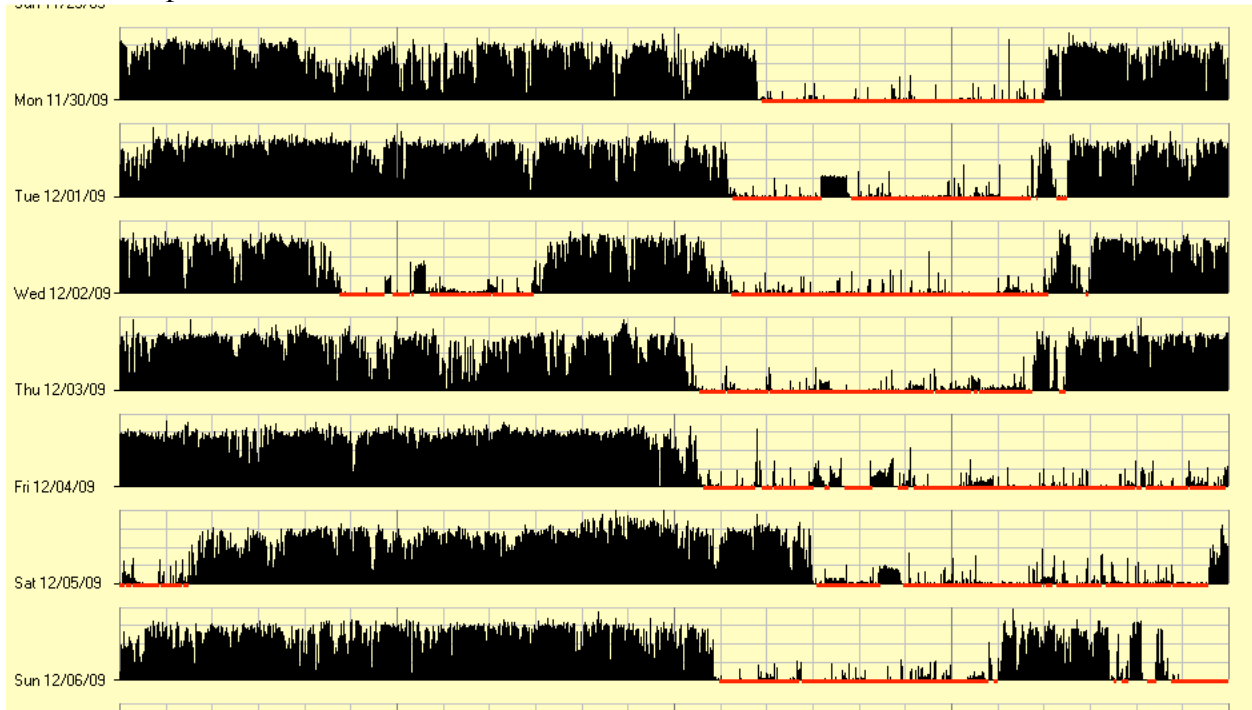


Figure 4. Example of actigraph demonstrating fairly consistent bed and wake times with numerous brief and prolonged nighttime awakenings.

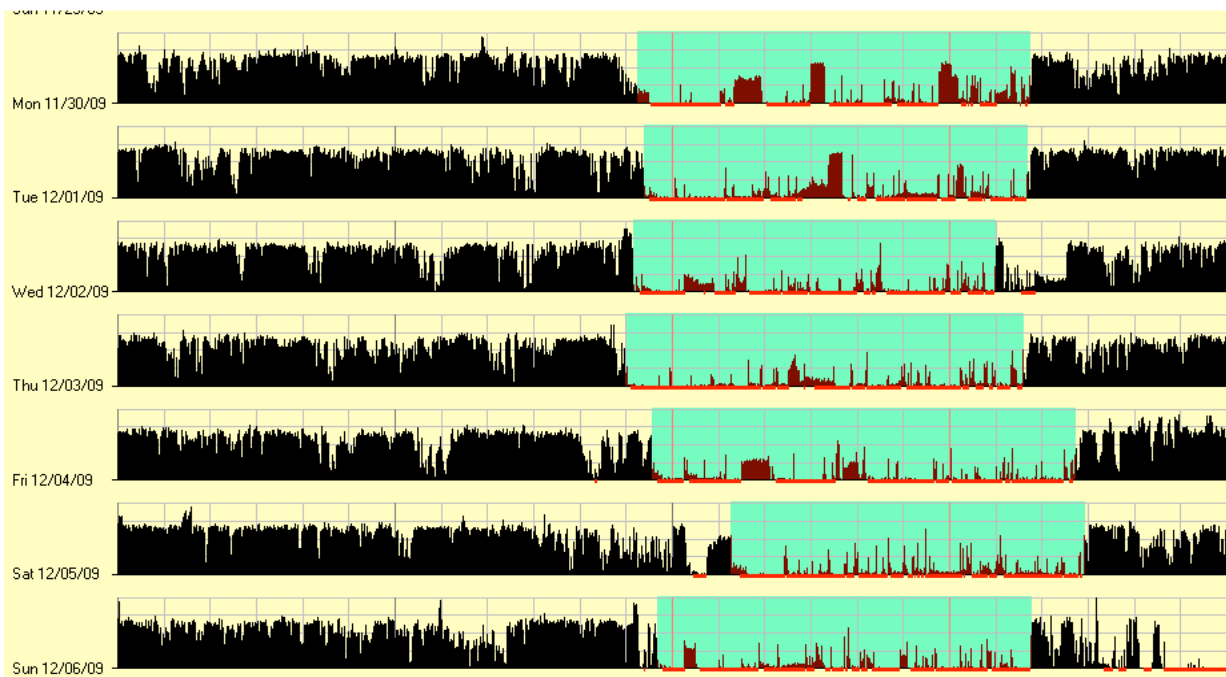


Figure 5. Actigraph demonstrating variable times for sleep onset and frequent night awakenings.

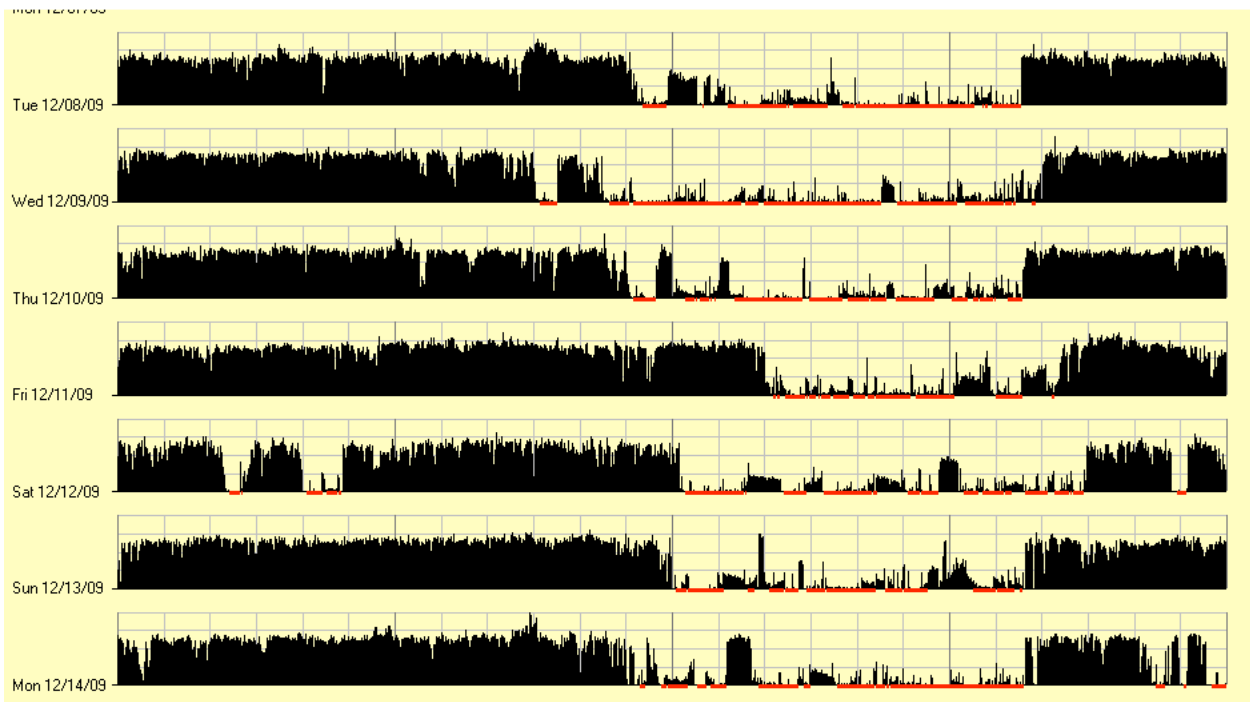
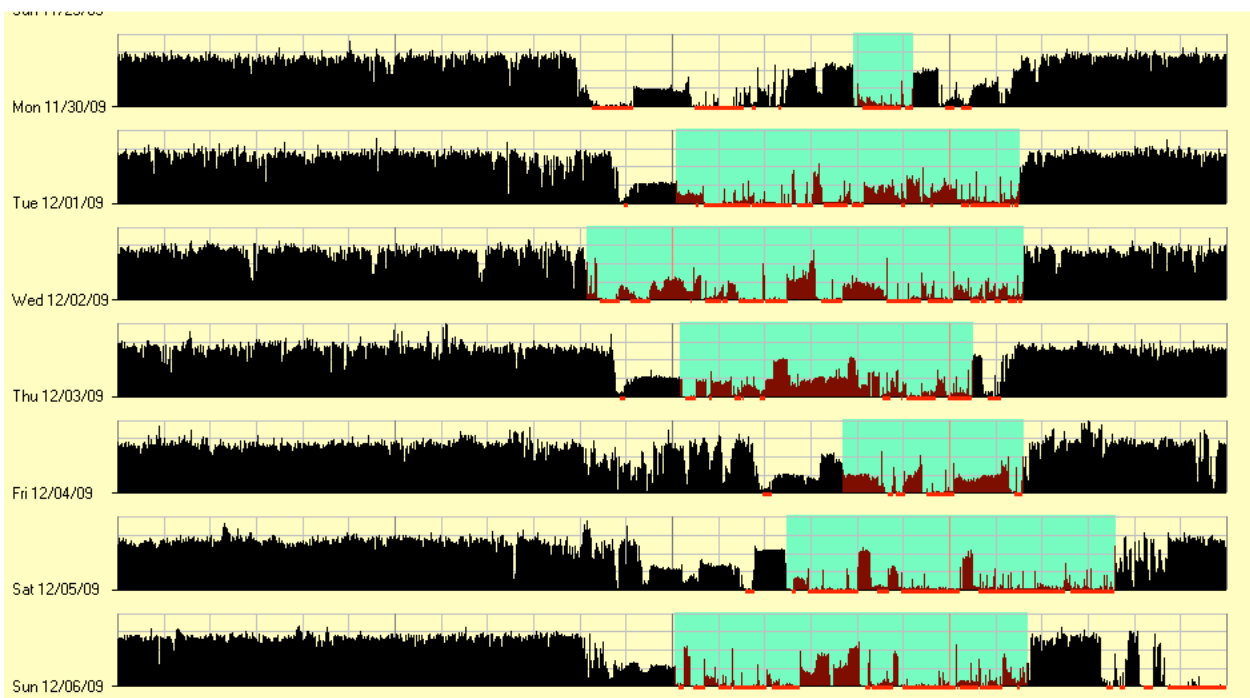


Figure 6. Actigraph demonstrating extremely variable times for sleep onset with numerous and prolonged night awakenings (insufficient amount and poor quality sleep).



CHAPTER FIVE

DISCUSSION

Sleep variables. This study was designed to measure the effect of a curriculum on the sleep habits of middle school students using actigraphy and a self-reported sleepiness questionnaire. Ultimately, learning about the importance of sleep through participation in the *Sleep for Your Health* curriculum did not significantly alter the amount of sleep or self-perceived sleepiness in the experimental group. However, the mean TST in *both* groups increased from early October to mid December, with the control group increasing an average of 9 minutes of sleep and the experimental group receiving an average of 22 additional minutes of sleep each night. This increase could be seasonal in nature as the hours of darkness increase across the autumn months. Further research of seasonal variations in sleep patterns of adolescents is recommended.

Cronbach's alpha (.778 pre- and .731 post-intervention) was determined to test for internal consistency of the measurements for nightly sleep on school nights and weekend nights. Internal consistency is a reflection of the correlation among the 7 measurements of sleep and the correlation of each night's sleep with the total score. As with other correlations, the closer the score is to 1.0, the stronger the relationship. A Cronbach's alpha of $>.7$ reflects a fairly high degree of consistency, so the nightly measurement of sleep duration can be considered reliable.

The original hypothesis predicted insufficient sleep would correlate with higher reported daytime sleepiness. The results of this study do not confirm what common sense would suggest. Experts suggest adolescents require approximately nine hours of sleep each night, yet the majority of 12-14 year olds in this study did not get the recommended amount of sleep. At the same time, these youth did not report feeling sleepy during the day. At Time 1, only 3 of 48 (6.25%) students averaged nine or more hours of total sleep time each night during the week that

sleep was recorded using the actiwatches. Even though the majority (93.75%) of study participants received well below the recommended amount of sleep, very few students reported experiencing strong feelings of daytime sleepiness. Grouping the data ($n=48$), the mean and median TST in October was just 441 minutes (~7 hours 20 minutes or 1 hour and 40 minutes short of the recommended amount) ($sd = 65.9$). At the same time, the mean CASQ score was 31, indicating little self-perceived daytime sleepiness ($n=48$, $sd = 9.3$, range =44, minimum =16, maximum = 60 with a possible range of scores from 16 to 80, higher scores indicating greater daytime sleepiness). While demonstrating very high consistency (e.g. reliability) pre- and post-intervention, perhaps the CASQ does not adequately measure the concept “daytime sleepiness” in adolescents. Future research designed to test the validity of the four constructs comprising the CASQ using larger samples of teens in diverse settings is strongly recommended.

Other factors potentially impacting self-reported sleepiness include the perception of how much sleep is sufficient and the quality of sleep obtained. In a study by Mercer, Merritt, and Cowell (1998), even though the 612 students received similar amounts of nightly sleep, 63% reported needing more sleep on weekends and regularly experiencing sleepiness that interfered with their school work, while the remaining 37% did not report experiencing sleepiness to the same degree. A review of the literature located no studies describing the relationship between sleepiness and quality of sleep in adolescents as measured by actigraphy or PSG. In this study, actigraphy was used to measure total sleep time in minutes per 24-hour period. Additionally, actigraphy may be used to measure variability in sleep habits that could potentially influence self-reported sleepiness. For example, actigraphy made it possible to document a wide variation in individual bed and wake times across 7 nights, as well as documenting fragmentation of sleep

throughout the night (see Figures 1-6). Variability of sleep as measured by the CV, SEFF, and WASO did not significantly correlate with increased DS.

Individual differences in the need for sleep also play a role in TST and perceived sleepiness. At this time, it is not possible to measure individual differences for sleep need, but as technology advances, such measurement will help researchers further analyze this important concept. Individual differences in sleep architecture (sleep stages) may also impact sleepiness, and studies using polysomnography in adolescents could help identify differences that lead to direct observations (objective) and self-reported feelings (subjective) of sleepiness.

Currently, 9 hours of nightly sleep is recommended for youth aged 10-17 years (NSF, 2010). According to Bellenir (2008), this recommendation, in place for over 40 years, is based on the seminal work of pioneering adolescent sleep researchers William Dement and Mary Carskadon. Nearly all sleep studies in the past decade that used adolescent subjects report a high percentage of today's youth are not getting the recommended 9 hours of sleep per night (Lebourgeois, Giannotti, Cortesi, Wolfson, & Harsh, 2005; Loessi et al., 2008; Mindell & Owens; Ng, Ng, and Chan, 2009; Paraskakis et al., 2008). One possible reason is the increased use of various technology and media throughout the day. In a recent study supported by the Kaiser Family Foundation (2010), youth aged 8-18 years reported devoting an average of 7 hours 38 minutes *every* day to using entertainment media. Most forms of entertainment media and classroom activities are sedentary in nature, leaving little time for teens to engage in regular vigorous physical activity. Perhaps with the shift to a less physically active life-style, the average youth in developed countries no longer require a full 9 hours of nightly sleep to feel rested and fully engaged throughout the day. Further research is recommended to test the

assumption that teens today require 9 hours of nightly sleep to maintain optimal physical, mental, and emotional health.

While TST did not correlate with CASQ as expected, further analysis revealed that age did demonstrate a positive relationship with TST in the experimental group following the intervention ($r(20) = -.618, p < .01$). The older the teen, the fewer hours of sleep they received each night. Significant physical developmental changes occur during the early teen years. Additional sleep may be required during early adolescence while bodily changes are occurring at a rapid pace. This notion was examined by Carskadon (1980), who found that sleep need, which was operationally defined as the amount of sleep obtained when given a 10 hour opportunity to sleep, did not change in adolescents aged 10 to 17 years. Further research examining the current phenomenon that as teens mature they may require less sleep time is also suggested.

Curriculum. A number of changes were necessary in order to carry out delivery of the planned curriculum *Sleep for Your Health*, making it difficult to test Bruner's (1966) Discovery Learning Theory, which informed the design of the originally proposed curriculum. In the Discovery Learning model, students are encouraged to learn on their own through action and experience (Bruner, 1966). Underlying Bruner's theory is the belief that students learn best through the process of discovery. Principles of constructivist theory include experimentation, cooperative learning, problem solving, and learning through active involvement. The teacher's role is to ensure that learning activities are exploratory in nature and encourage student's curiosity. Discovery Learning attempts to address learning as a process rather than the accumulation of knowledge presented in textbooks (Pedroni, 2008). The original proposal of this study called for numerous computer based activities and assessments that allowed for immediate individual feedback. Unfortunately, the school was not able to provide computer

technology in the gymnasium setting for either the researcher or students for purposes of delivering or gaining mastery of the content. In retrospect, one of the long-term goals for developing the sleep curriculum is to test the program in a wide variety of settings. Including “tech-free” lesson plans that can easily be delivered in places such as school gymnasiums, cafeterias, or health care clinics would have been a good idea. Not having technology available forced alterations in the way the content was delivered, but not in the concepts that were presented. Students in the experimental group *did* comprehend the concepts as presented, as evidenced by high post-test quiz scores. However, many of today’s youth are accustomed to the individual student-centered learning experiences that technology is able to provide. Listening to an instructor give a lecture proved significantly less engaging than learning content through interactive group exercises or self-paced computer programs. Of the 20 students in the experimental group, 55% ($n=11$) increased their TST by an average of 65 minutes a night post-intervention. Of the group that increased their nightly sleep, 7 were females and 2 were males, which suggests the implemented curriculum or more traditional types of learning activities may be biased in a way that appealed more to female than male students. In the investigation measuring the effect of an educational leaflet on the knowledge of sleep in Croatia teens, Bakoti, Radosevic-Vidacek, and Kojcec (2009) found the informational brochure had a greater impact on females than males in their study. In the future, this researcher would like to test the curriculum in a classroom setting as originally planned, using computer technology for interactive learning exercises and assessments, in addition to the group activities and brief presentations participants in this study experienced. Examining TST changes by gender following a more computer-based approach could address the issue of whether various delivery methods are more effective with adolescent girls or boys. Additionally, the researcher would like

to place greater emphasis on individual goal setting as a component of the curriculum. Time constraints did not permit this concept to be fully implemented over the 6-week study. In a study measuring effectiveness in a dietary and physical activity intervention with low-income adolescents, Shilts, Horowitz, and Townsend (2009) found that guided goal setting provided a viable strategy to promote behavior change. In this study, knowledge that adequate sleep is essential to physical, mental, and emotional well-being did not translate into significant behavior changes for all students. Incorporating guided goal setting and associated learning activities could potentially enhance the success of altering sleep behavior in teens in a school-based intervention. Additionally, helping young adolescents set a goal of going to bed earlier and turning off their cell phone and TV (tangible actions), may have a greater impact than suggesting teens get sufficient sleep (without providing specific ways of increasing sleep time). Established school start times make wake-up times less negotiable than bed times.

Study participants were asked to evaluate the curriculum using three open-ended questions. A pilot test of the post-intervention survey would have revealed a number of issues that became apparent in analyzing student responses. Middle school students are not accustomed to teachers asking for their opinion about ways to improve their learning experience. Several students verbalized discomfort about sharing criticisms, others provided very short answers, and a few chose not to respond. When designing the evaluation questions, a more effective approach might have been to create questions about specific aspects of the curriculum to which respondents could check short answer responses in order to provide feedback. Perhaps the anonymity of sharing responses electronically would also have elicited a greater number of useful suggestions for improving the curriculum. Interestingly, nearly equal numbers of students expressed opinions at opposite ends of a continuum, believing that getting more sleep was either

a positive or negative (e.g. feeling guilty) consequence of their learning more about the importance of sleep. The manner in which the question was worded allowed for very different interpretations. Both the checked responses and open-ended evaluative questions will be revised if the curriculum is tested again in the future.

Limitations. The relative lack of diversity in Spokane is a limitation of the study, as generalization of findings to other populations cannot be assumed. The size and convenience of the sample are also limitations in this study. Once a class at Glover Middle School was randomly selected for the intervention, the control group was selected for convenience of the teachers and researcher. A significantly larger, more diverse, and randomly selected sample would have strengthened the results.

Statistical Power. In retrospect, this study was not sufficiently powered with 48 participants to detect any significant differences that may, in fact, exist. Increasing the number of subjects would have provided greater statistical power, but sample size was limited by the number and cost of actiwatches available for lease. The ability to detect differences between groups is enhanced when the groups are distinctly different, which was not the case in this study. The variability of TST and measures of sleep quality within the groups were larger than predicted prior to data collection, making differences between the groups less obvious.

Instruments. Use of actigraphy to objectively measure sleep in this study was made possible by Ambulatory Monitoring Incorporated. AMI negotiated a lease agreement for the use of 25 actiwatches for two weeks prior to the intervention and again for the 2 weeks following the intervention. Such a lease agreement is extremely rare for this type of technology, since nearly all investigators purchase actiwatches for research purposes. The leased equipment was previously used and two of the actiwatches failed to record data. Subjects completed self-

reported sleep diaries that could have been used to fill in missing values as a result of the actiwatch failure or the student removing the actiwatch for some reason. The researcher decided, after analyzing the data with inclusion of the sleep diary values and finding no significant differences, that using *only* total sleep time as recorded by the actiwatches would provide the most standardized measurement of sleep.

Another weakness may be interpretation of TST using actigraphy. Aside from laboratory observation 24 hours a day, actigraphy is the best and least expensive means of objectively measuring sleep. However, an actiwatch cannot document whether the watch has been removed for a period of time or whether the subject is truly sleeping while wearing the watch. Visual assessment of the actigraphs revealed that on occasion, it was difficult to determine whether a subject was napping for an hour or had removed the watch. Students were asked to fill out sleep diaries concurrent with wearing the watches and to make note of times when the actiwatch was removed, but few students were diligent in completing their sleep diaries to this degree of accuracy.

Daytime sleepiness is a difficult concept to measure. The CASQ is a relatively new tool that has not been tested with large numbers of subjects in widely diverse settings. As a means of measuring sleepiness, the survey was easy to administer and was developmentally appropriate for adolescents. However, the CASQ may not have been the most accurate means of assessing daytime sleepiness. Further studies correlating CASQ scores with other measures of sleepiness, such as the MLST and the Epworth Sleepiness Scale, would strengthen the validity of this survey for measuring sleepiness in adolescent populations. Attempts to quantify daytime sleepiness in adults have been made using measurements of performance, including executive functioning and psycho-motor reaction times (Belenky et. al, 2003). The same types of clinical trials measuring

effects of sleep deprivation in youth have not been tested, perhaps due to the effects of developmental differences or out of concern for the ethical treatment of under-aged subjects.

The low return rate (25%) of mailed responses from parent participants limits the external validity of the survey results. Parental knowledge of the importance of sleep to their teen's health was not assessed prior to the intervention. Parents who returned the completed post-intervention quiz demonstrated a very clear understanding of the concepts presented in the *Sleep for Your Health* materials. Half of the parents indicated they learned quite a bit, while others responded they learned very little through participation in the study. All but one parent indicated they would encourage their son or daughter to get sufficient sleep. What the researcher did not assess via the questionnaire was whether the study sparked any family discussions about the importance of sleep. A question to this effect would have strengthened the theoretical testing of Bronfenbrenner's bio-ecological model.

Implications. As humans we spend approximately one third of our lives sleeping, yet there is much about sleep that remains a relative mystery. A good deal of what is known about sleep comes from measuring the behavioral effects of sleep deprivation. Not getting sufficient sleep can undermine a teen's health, contribute to depression, affect academic and athletic performance, potentially lead to weight gain, and put teens at increased risk for accidents. On the other hand, due to inter-individual differences, the precise amount of sleep needed to contribute most fully to health has not been quantified. The positive effects of sufficient quantity and quality of sleep include feeling and functioning at an optimum daytime level. The direct relationship of sufficient sleep as a health promoting behavior in teens needs further study. Dahl (1999) notes that any evaluation of the sleep habits of teens must include a careful consideration of the waking consequences of chronic sleep loss. While a shortage of well-controlled studies

documents the relationship between sleep and behavioral or emotional problems in adolescents, Dahl (1999) suggests researchers should begin to seek evidence of ways insufficient sleep among adolescents alters mood and motivation, and impacts daytime functioning.

Most previous studies used self or parent reported sleep times and sleepiness for adolescent subjects. Using actigraphy, this study confirms that middle school students generally do not sleep the recommended 9 hours per night. Even so, study participants did not perceive excessive levels of daytime sleepiness. Judging from the actual amount of sleep a number of the students received, this finding is surprising. Future research that discovers an easily measurable and inexpensive biomarker for sleepiness would be very useful for identifying youth at risk for the potential consequences of chronic sleep deprivation. In addition, further studies examining the physical, school achievement, and mental health related outcomes of excessive sleepiness in adolescents are needed. Exploring the effects of sleepiness on the severity of acute and chronic illnesses in adolescents would also provide useful information for health care providers.

While participation in the curriculum did not significantly increase total sleep time, a number of students, parents, and teachers expressed value in learning more about sleep, biorhythms, and sleep disorders in teens. An internet search of middle school health curriculums located only two programs in the U.S. that incorporated information about sleep. Working to inform local and state boards of education, health curriculum developers, educators, parents, students, and health professionals about including sleep in K-12 health curriculums is of critical importance. A media campaign to raise awareness about the consequences of sleep deprivation for people of all ages would be one way to inform youth, parents, and educators about this growing public health concern.

In summary, nearly all of the 12 to 14 year old adolescents in this study did not get the recommended nine hours of sleep each night. Concurrently, they did not report typically feeling sleepy during the day. As the subjects did not experience serious consequences related to chronic lack of sleep, the study suggests scant reason to change current behavior. Further studies are recommended to determine why youth do not feel particularly tired even when sleep deprived. Numerous factors, including having accurate information, impact sleep habits of adolescents. Based on the results of this study, learning about the importance of sufficient sleep for doing and feeling one's best did not significantly modify sleep behaviors. However, with 55% of the experimental group increasing nightly sleep by an average of 65 minutes, and the number of students in the experimental group obtaining the recommended 9 hours of nightly sleep increasing from 1 to 4 following the intervention, raising awareness through education may have clinical implications. Perhaps augmenting inclusion of techniques that have successfully helped teens change other negative health related behaviors, such as guided goal setting, would increase the effectiveness of the tested curriculum. The time teens must typically awake in the morning is determined by school start times. Helping young adolescents to specifically set a goal of earlier bedtimes may also have a greater positive impact on sleep duration. Additionally, research to discover a simple and inexpensive means for determining levels of sleepiness in individuals (such as a biomarker) would be helpful for identifying youth at risk for the more serious consequences of chronic sleep deprivation.

In conclusion, sleep is not a biological luxury, although often treated as such in the ever-increasing pace of today's world. Due to ethical concerns, few reports of well-controlled scientific studies examine measurable effects of insufficient sleep on health and behavior in adolescents. However, there is growing circumstantial and clinical evidence that regular sleep

loss in teens impacts such health outcomes as weight status and blood pressure, as well as emotional regulation and daytime functioning. Additional research is needed to improve understanding of the complex issues arising from consequences of insufficient sleep among teens. Identifying vulnerability to sleep loss suggests one important direction for future research, since there appears to be large individual differences in the effects of sleep loss (Dahl, 1999). The potential benefits of finding effective ways to increase adolescents' knowledge about the importance of sufficient sleep, and translating that knowledge to positive behavioral changes, is a goal worthy of continued research.

REFERENCES

- Adam, E., Snell, E., & Pendry, P. (2007). Sleep timing and quantity in ecological and family context: A nationally representative time-diary study. *Journal of Family Psychology*, *21*(1), 4-19.
- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: American Psychiatric Association.
- Anderson, B., Storfer-Isser, A., Taylor, H., Rosen, C., & Redline, S. (2009). Association of executive function with sleepiness and sleep duration in adolescents. *Pediatrics*, *123*(4), e701-707.
- Bakoti, M., Radosevic-Vidacek, B., & Kojcec, A. (2009). Educating adolescents about healthy sleep: Experimental study of effectiveness of educational leaflet. *Croatian Medical Journal*, *50*(2), 174-181.
- Basen-Engquist, K., Coyle, K., & Pareel, G. (2001). School wide effects of a multi-component HIV, STD, and pregnancy prevention program for high school students. *Health Education & Behavior*, *28* (2), 166-185.
- Baumrind, D. (1987). A developmental perspective on adolescent risk taking. *New Directions for Child Development*, *37*, 93-125.
- Belenky, G., Wesensten, N., Thorne, D., Thomas, M., Sing, H., Redmond, D., Russo, M., & Balkin, T. (2003). Patterns of performance degradation and restoration during sleep restriction and subsequent recovery: A sleep dose-response study. *Journal of Sleep Research*, *12*, 1-12.
- Bellenir, K. (Ed.). (2008). *Sleep information for teens*. Detroit, MI: Omnigraphics, Inc.

- Bernert, R., Braithwaite, S., Van Orden, K., & Joiner, T. (2007). Family life stress and insomnia symptoms in a prospective evaluation of young adults. *Journal of Family Psychology, 21*, 58-66.
- Birmaher, B., Ryan, N., Williamson, D., Brent, D., & Kaufman, J. (1996). Childhood and adolescent depression: A review of the past 10 years. Part II. *Journal of the American Academy of Child and Adolescent Psychiatry, 35*, 1575-1583.
- Black, D., Tobler, N., & Sciacca, J. (1998). Peer helping / involvement: An efficacious way to meet the challenge of reducing alcohol, tobacco, and other drug use among you. *Journal of School Health, 68*, 87-93.
- Brand, S., Matthias, L., Von Planta, A., Hatzinger, M., & Holsboer-Trachsler, E. (2007). Romantic love, hypomania, and sleep pattern in adolescents. *Journal of Adolescent Health, 41*(1), 69-76.
- Brinbaum, A., Lytle, L., Story, M., Perry, C., & Nurray, D. (2002). Differences in exposure to a multicomponent school-based intervention associated with varying dietary outcomes in adolescents? *Health Education and Behavior, 29*, 427-443.
- Bronfenbrenner, U. (Ed.). (2005). *Making human beings human*. Thousand Oaks, CA: Sage Publications.
- Bruner, J. (1966). *Toward a theory of instruction*. Cambridge, MA; Harvard University Press.
- Bruvold, W. (1993). A meta-analysis of adolescent smoking prevention programs. *American Journal of Public Health, 83*, 872-880.
- Calamaro, C., Mason, T., & Ratcliffe, S. (2009). Adolescents living the 24/7 lifestyle: Effects of caffeine and technology on sleep duration and daytime functioning. *Pediatrics, 123*, e1005-01010.

- Carskadon, M. (1990). Patterns of sleep and sleepiness in adolescents. *Pediatrician*, *17*, 5-12.
- Carskadon, M. (1999). When worlds collide: Adolescent need for sleep versus societal demands. *Phi Delta Kappan*, *80*(5), 348-353.
- Carskadon, M. (Ed.). (2002). *Adolescent sleep patterns: Biological, social, and psychological influences*. Cambridge, England: Cambridge University Press.
- Carskadon, M., Harvey, K. & Dement, W. (1981). Acute restriction of nocturnal sleep in children. *Perceptual Motor Skills*, *53*, 103-112.
- Carskadon, M., Harvey, K., Duke, P., Anders, T., Litt, I., & Dement, W. (1980). Pubertal changes in daytime sleepiness. *Sleep*, *2*, 453-460.
- Carskadon, M., Vieira, C., & Acebo, C. (1993). Association between puberty and delayed phase preference. *Sleep*, *16*(3), 258-262.
- Centers For Disease Control. (2005). *Health education curriculum analysis tool*. Retrieved March 24, 2009 from <http://www.cdc.gov/healthyyouth/HECAT>
- Chen, X., Beydoun, M., & Wang, Y. (2007). Is sleep duration associated with childhood obesity? A systematic review and meta-analysis. *Obesity*, *16*(2), 265-274.
- Cinelli, B., & Illuzzi, S. (2000). A coordinated school health program approach to adolescent obesity. *Journal of School Nursing*, *16*, 12-19.
- Clark, D. (2008). *Blooms taxonomy of learning*. Retrieved October 12, 2008, from Performance, Learning, Leadership, and Knowledge website:
<http://www.nwlink.com/~donclark/hrd/bloom.html#one>
- Clark, K., & Ladd, G. (2000). Connectedness and autonomy support in parent-child relationships: Links to children's socioemotional orientation and peer relationships. *Developmental Psychology*, *36*(4), 485-498.

- Cluydts, R., De Valck, E., Verstraeten, E., & Theys, P. (2002). Daytime sleepiness and its evaluation. *Sleep Medicine Reviews*, 6(2), 83-96.
- Cortesi, F., Giannotti, F., Sebastiani, T., Bruni, O., & Ottaviano, S. (2004). Knowledge of sleep in Italian high school students: Pilot test of a school-based sleep educational program. *Journal of Adolescent Health*, 34, 344-351.
- Dahl, R. (1999). The consequences of insufficient sleep for adolescents: Links between sleep and emotional regulation. *Phi Delta Kappan*, 80(5), 354-359.
- De Sousa, I., Araujo, J., & De Azevedo, C. (2007). The effect of a sleep hygiene education program on the sleep-wake cycle of Brazilian adolescent students. *Sleep and Biological Rhythms*, 5(4), 251-258.
- Dement, W., Rolfwarg, H., & Muzic, J. (1966). Ontogenic development of the human sleep-dream cycle. *Science*, 152, 604-619.
- Dornbusch, S. (2002). Sleep and adolescence: A social psychologist's perspective. In M. Carskadon (Ed.), *Adolescent sleep patterns* (pp. 1-3). Cambridge, England: Cambridge University Press.
- Drake, C., Nickel, C., Burduvali, E., Roth, T., Jefferson, C., & Pietro, B. (2003). The pediatric daytime sleepiness scale (PDSS): Sleep habits and school outcomes in middle-school children. *Sleep*, 26(4), 455-458.
- Driver, H., & Taylor, S. (2000). Exercise and sleep. *Sleep Medicine Reviews*, 4, 387-402.
- DSS Research. (2009). Statistical power calculator. Retrieved May 27, 2009, from http://dssresearch.com/toolkit/spcalc/power_a2.asp
- Elgan, M. (2008). *What to do about teen junk sleep syndrome*. Retrieved April 1, 2008 from <http://www.computerworld.com.au/index.php/id;1710270987;fp;fpid;;pf;1>

- Evans, L., Kennedy, G., & Wertheim, E. (2005). An examination of the association between eating problems, negative mood, weight, and sleeping quality in young women and men. *Eating and Weight Disorders, 10*(4), 245-250.
- Faggiano, F., Vigna-Taglianti, F., Versino, E., Zambon, A., Borraccino, A., & Lemma, P. (2005). School based prevention for illicit drugs' use. *Cochrane Database of Systematic Reviews*, Issue 2. Art. No.: CD003020. DOI: 1002/14651858.CD003020.pub2.
- Fulton, J., McGuire, M., Casperson, C., & Dietz, W. (2001). Interventions for weight loss and weight gain prevention among youth. *Sports Medicine, 31*(3), 153-165.
- Gangwisch, J., Babiss, L., Malaspina, D., Turner, J., Zammit, G., & Posner, K. (2010). Parental bedtimes and adolescent depression: Earlier parental set bedtimes as a protective factor against depression and suicidal ideation. *Sleep, 33*(1), 97-106.
- Gangwisch, J., Malaspina, D., Boden-Albala, B., & Heymsfield, S. (2005). Inadequate sleep as a risk factor for obesity. *Sleep, 28*(10), 1289-1296.
- <http://www.sleepfoundation.org>
- Giannotti, F., Cortesi, F., Sebastiani, T., & Ottaviano, S. (2002). Circadian preference, sleep, and daytime behavior in adolescence. *Journal of Sleep Research, 11*, 191-199.
- Goetz, R., Puig-Antich, J., Ryan, N., Rabinovich, H., Ambrosini, P., & Nelson, B. (1987). Electroencephalographic sleep of adolescents with major depression and normal controls. *Archives of General Psychiatry, 44*(1), 61-68.
- Hansen, E., Holstein, B., Due., & Currie, C. (2003). International survey of self-reported medicine use among adolescents. *The Annals of Pharmacotherapy, 37*(3), 361-366.
- Hansen, M., Janssen, I., Schiff, A., Zee, P., & Dubocovich, M. (2005). The impact of school daily schedule on adolescent sleep. *Pediatrics, 115*, 1555-1561.

- Ievers-Landis, C., Storfer-Isser, M., Rosen, C., Johnson, N., & Redline, S. (2008). Relationship of sleep parameters, child psychological functions, and parenting stress to obesity status among preadolescent children. *Journal of Developmental and Behavioral Pediatrics, 29*, 243-252.
- Iglowstein, I., Jenni, O., Molinari, L., & Largo, R. (2003). Sleep duration from infancy to adolescence; reference values and generational trends. *Pediatrics, 111*, 302-307.
- Javaheri, S., Storfer-Isser, A., Rosen, C., & Redline, S. (2008). Sleep quality and elevated blood pressure in adolescents. *Circulation, 118*, 1030-1040.
- Johns, M. (1998). Rethinking the assessment of sleepiness. *Sleep Medicine Reviews, 2*(1), 3-15.
- Johnson, N., Kirchner, H., Rosen, C., Storfer-Isser, A., Cartar, L., Ancoli-Israel, S., ...Redline, S. (2007). Sleep estimation using wrist actigraphy in adolescents with and without sleep disordered breathing: a comparison of three data modes. *Sleep, 30*(7), 899-905.
- Kaplan, J. P., Liverman, C., Kraak, V., & Wisham, S. L. (Eds.). (2007). *Progress in preventing childhood obesity: how do we measure up?* Washington, DC: National Academies Press.
- Kaiser Family Foundation. (2010). *Daily media use among children and teens up dramatically from five years ago*. Retrieved February 2, 2010 from <http://www.kff.org/entmedia/entmedia012010nr.cfm>
- Knutson, K. (2005). Sex differences in the association between sleep and BMI in adolescents. *Journal of Pediatrics, 119*, 1056-1062.
- Knutson, K., & Lauderdale, D. (2007). Sleep duration and overweight adolescents: Self reported sleep hours versus time diaries. *Pediatrics, 119*, 1056-1062.
- Knutson, K., Spiegel, K., Penev, P., & Van Cauter, E. (2007). The metabolic consequences of sleep deprivation. *Sleep Medicine Reviews, 11*, 163-178.

- Kohler, M., & Van Den Heuvel, C. (2008). Is there a clear link between overweight/obesity and sleep disordered breathing in children? *Sleep Medicine Reviews, 12*(5), 347-361.
- Laberge, L., Petit, D., Simard, C., Vitaro, F., Tremblay, R., & Montplaisir, J. (2001). Development of sleep patterns in early adolescence. *Journal of Sleep Research, 10*, 59-67.
- Larson, R., Richards, M., Moneta, G., Holmeck, G., & Duckett, E. (1996). Changes in adolescents' daily interactions with their families from ages 10 to 18: Disengagement and transformation. *Developmental Psychology, 32*(6), 744-754.
- Lauderdale, D., Knutson, K., Yan, L., Lijing, L., & Rathouz, P. (2008). Self-reported and measured sleep duration: how similar are they? *Epidemiology, 19*(6), 838-845.
- Lebourgeois, M., Giannotti, F., Cortesi, F., Wolfson, A., & Harsh, J. (2005). The relationship between reported sleep quality and sleep hygiene in Italian and American adolescents. *Pediatrics, 115*, 257-265.
- Lee, K., McEnany, G., & Weekes, D. (1999). Gender differences in sleep patterns for early adolescents. *Journal of Adolescent Health, 24*(1), 16-20.
- Littner, M., Kushida, C., Anderson, W., Bailey, D., Berry, R., Davila, D., ... Johnson, S. (2002). Practice parameters for the role of actigraphy in the study of sleep and circadian rhythms: An update for 2002. American Academy of Sleep Medicine Report. Retrieved March 12, 2009 from http://www.aasmnet.org/Resources/PracticeParameters/PP_Actigraphy_Circ.pdf
www.aasmnet.org/Resources/PracticeParameters/PP_Actigraphy_Circ.pdf

- Loessi, B., Valerius, G., Kopasz, M., Hornyak, M., Riemann, D., & Voderholzer, U. (2008). Are adolescents chronically sleep deprived? An investigation of sleep habits of adolescents in the Southwest of Germany. *Child: Care, Health & Development*, 34(5), 549-556.
- Lumeng, J., Deepak-Somashekar, B., Appugliese, D., Kaciroti, N., Corwyn, R., & Bradley, R. (2007). Shorter sleep duration is associated with increased risk for being overweight at ages 9 to 12 years. *Pediatrics*, 120(5), 1020-1029.
- Mann, L., Harmoni, R., & Power, C. (1989). Adolescent decision-making: The development of competence. *Journal of Adolescence*, 12(3), 265-278.
- Marieb, E. (2006). *Essentials of human anatomy and physiology* (8th ed.). San Francisco, CA: Pearson / Benjamin Cummings.
- Meijer, A., Habekothé, H., & Van Den Wittenboer, G. (2000). Time in bed, quality of sleep and school functioning of children. *Journal of Sleep Research*, 9, 145-153.
- Mercer, P., Merritt, S., & Cowell, J. (1998). Differences in reported sleep need among adolescents. *Journal of Adolescent Health*, 23, 259-263.
- Millman, R. (2005). Excessive sleepiness in adolescents and young adults: Causes, consequences, and treatment strategies. *Pediatrics*, 115(6), 1774-1786.
- Mindell, J., & Owens, J. (2003). *A clinical guide to pediatric sleep: diagnosis and management of sleep problems*. Philadelphia, PA: Lippincott Williams & Wilkins.
- Monroe County Community School Corporation. (2005) *Health curriculum guide*. Retrieved on March 5, 2009 from: <http://www.mccsc.edu/~curriculum/pdf/MShealth.pdf>
- Moore, M., & Meltzer, L. (2008). The sleepy adolescent: Causes and consequences of sleepiness in teens. *Paediatric Respiratory Reviews*, 9(2), 114-120.

- Morrison, D., McGee, R., & Stanton, W. (1992). Sleep problems in adolescence. *Journal of the American Academy of Child and Adolescent Psychiatry*, 31, 94-99.
- Moseley, M., & Gradisar, M. (2009). Evaluation of a school-based intervention for adolescent sleep problems. *Sleep*, 32(3), 334-341.
- National Heart Lung and Blood Institute. (2001). *Garfield star sleeper curriculum*. Retrieved March 5, 2009 from <http://www.nhlbi.nih.gov/health/public/sleep/starslp/>
- National Institutes of Health. (2003). *Sleep, sleep disorders, and biological rhythms*, NHLBI Curriculum Supplement Series for grades 9-12. Retrieved on March 5, 2009 from: <http://science.education.nih.gov/supplements/nih3/sleep/default.htm>
- National Sleep Foundation. (2006). *2006 Sleep in America poll*. Retrieved May 12, 2009 from <http://www.sleepfoundation.org/article/ask-the-expert/sleep-and-teens-biology-and-behavior>
- Ng, E., Ng, D., & Chan, C. (2009). Sleep duration, wake/sleep symptoms, and academic performance in Hong Kong secondary school children. *Sleep & Breathing*, April 18(e-published, ahead of print).
- Noland, H., Price, J., Dake, J., & Telljohann, S. (2009). Adolescents' sleep behaviors and perceptions of sleep. *Journal of School Health*, 79(5), 224-230.
- Nudel, M. (1993). The schedule dilemma. *American School Board Journal*, 180, 37-40.
- Office Of The Superintendent Of Public Instruction. (2009). *Total enrollment gender and ethnicity report 2008-2009 school year*. Retrieved March 5, 2009, from: <http://www.k12.wa.us/DataAdmin/default.aspx>

- Orbeta, R., Overpeck, M., Ramcharran, D., Kogan, M., & Ledsky, R. (2006). High caffeine intake in adolescents: Associations with difficulty sleeping and feeling tired in the morning. *Journal of Adolescent Health, 38*, 451-453.
- Pack, A. I., Pack, A. M., Rodgman, E., Cucchiara, A., Dingus, D., & Schwab, C. (1995). Characteristics of crashes attributed to the drivers having fallen asleep. *Accident Annals of Prevention, 27*, 769-775.
- Paraskakis, E., Ntouros, T., Ntokos, M., Siavana, O., Bitsori, M., & Galanakis, E. (2008). *Siesta and sleep patterns in a sample of adolescents in Greece. Pediatrics International, 50*(5), 690-693.
- Patten, C., Choi, W., Gillin, J., & Pierce, J. (2000). Depressive symptoms and cigarette smoking predict development and persistence of sleep problems in US adolescents. *Pediatrics, 106*(2), e23.
- Pedroni, L., (2008). Jerome Bruner. Retrieved October 1, 2008 from <http://www.my-ecoach.com/idtimeline/learningtheory.html>References
- Punamaki, R., Wallenius, M., Nygard, C., Saarni, L., & Rimpela. (2007). Use of information and communication technology (ICT) and perceived health in adolescents: The role of sleeping habits and waking-time tiredness. *Journal of Adolescence, 30*(4), 569-585.
- Roberts, R., Roberts, C., & Chen, I. (2001). Functioning of adolescents with symptoms of disturbed sleep. *Journal of Youth and Adolescence, 30*(1), 1-18.
- Rossi, C., Campbell, A., Vo, O., Marco, C., & Wolfson, A. (2002). Middle school sleep-smart program: A pilot evaluation. *Sleep, 25*, A279.
- Sadeh, A., Dahl, R., Shahar, G., & Rosenblat-Stein, S. (2009). Sleep and transition to adolescence: A longitudinal study. *Sleep, 32*(12), 1602-1609.

- Schumaker, D., & Queen, J. (2007). *Overcoming obesity in childhood and adolescence*. Thousand Oaks, CA: Corwin Press.
- Seicean, A., Redine, S., Seicean, S., Kirchner, H., Gao, Y., Sekine, M. ... Storfer-Isser, A., (2007). Association between short sleeping hours and overweight in adolescents: Results from a US suburban high school survey. *Sleep and Breathing, 11*(4), 285-293.
- Sessa, F., & Steinberg, L. (1991). Family structure and the development of autonomy during adolescence. *Journal of Early Adolescence, 11*(1), 38-55.
- Shilts, M., Horowitz, M., & Townsend, M. (2009). Guided goal setting: Effectiveness in a dietary and physical activity intervention with low-income adolescents. *International Journal of Adolescent Medicine and Health, 21*(1), 111-122.
- Smedley, B., & Syme, S. (Eds.). (2000). *Promoting health: Intervention strategies from social and behavioral research*. Washington, DC: National Academy Press.
- Smith, C., Dakers, J., Dow, W., Head, G., Sutherland, M., & Irwin, R. (2005) A systematic review of what pupils, aged 11-16, believe impacts their motivation to learn in the classroom. *Research Evidence in Education Library*. Retrieved March 5, 2009 from <http://eppi.ioe.ac.uk/cms/Default.aspx?tabid=304>
- Spear, H., & Kulbok, P. (2004). Autonomy and adolescence: A concept analysis. *Public Health Nursing, 21*(2), 144-152.
- Spilsbury, J., Drotar, D., Rosen, C., & Redline, S. (2007). The Cleveland adolescent sleepiness questionnaire: A new measure to assess excessive daytime sleepiness in adolescents. *Journal of Clinical Sleep Medicine, 1*-34. Retrieved September 4, 2007, from AAMS Web Site: <http://www.aamsnet.org/jcsm/JCSMAcceptedPapers/JC0000507.pdf>

- Spilsbury, J., Storfer-Isser, A., Kirchner, H., Nelson, I., Rosen, C., & Drotar, D. (2006). Neighborhood disadvantage as a risk factor for pediatric obstructive sleep apnea. *Journal of Pediatrics*, *149*, 342-347.
- Spokane Public Schools. (2008). *Fit for the future: Spokane public schools middle school health and fitness curriculum guide*. Retrieved March 23, 2009 from http://www.spokaneschools.org/professionallearning/curriculum/guidetemplate/fitness_health/middleschool/7thgrade/7thgradeframeset.html
- Spokane Public Schools. (2008). *Fit for the future: Spokane public schools middle school health and fitness curriculum guide*. Retrieved March 23, 2009 from http://www.spokaneschools.org/professionallearning/curriculum/guidetemplate/fitness_health/middleschool/8thgrade/8thgradeframeset.html
- Stallones, L., Beseler, C., & Chen, P. (2006). Sleep patterns and risk of injury among adolescent farm residents. *American Journal of Preventive Medicine*, *30*(4), 300-304.
- Strauch, I., & Meier, B. (1988). Sleep needs in adolescents: a longitudinal approach. *Sleep*, *11*, 378-386.
- Taheri, S., Lin, L., Austin, D., Young, T., & Mignot, E. (2004). Short sleep duration is associated with reduced leptin, elevated ghrelin, and increased body mass index. *PLoS Medicine*, *1*, e62.
- Taylor, S. (2001). The influence of exercise on sleep quality. *International Journal of Sports Medicine*, *2*(3), 1-10.
- Tobler, N. (1986). Meta-analysis of 143 adolescent drug prevention programs: Quantitative outcome results of program participants compared to a control or compassion group. *Journal of Drug Issues*, *16*, 537-567.

- Valente, T., Hoffman, B., Ritt-Olson, A., Lichtman, K., & Anderson-Johnson, C. (2003). Effects of a social-network method for group assignment strategies on peer-led tobacco prevention programs in schools. *American Journal of Public Health, 93*(11), 1837-1843.
- Vallido, T., Jackson, D., & O'Brien, L. (2009). Mad, sad and hormonal: The gendered nature of adolescent sleep disturbance. *Journal of Child Health, 13*(7), 7-18.
- Van Den Bulck, J. (2007). Adolescent use of mobile phones for calling and for sending text messages after lights out: Results from a prospective cohort study with a one-year follow-up. *Sleep, 30*, 1220-1223.
- Van Dongen, H., Rogers, N., & Dinges, D. (2003). Sleep debt: Theoretical and empirical issues. *Sleep and Biological Rhythms, 1*, 5-13.
- Vitello, M. (1997). Sleep, alcohol, and alcohol abuse. *Addiction Biology, 2*, 151-158.
- Wahlstrom, K. (2002). Changing times: Findings from the first longitudinal study of later high school start times. *National Association of Secondary School Principals (NAASP) Bulletin, 86*, 3-21.
- Webster's new collegiate dictionary. (1977). Springfield, MA: G. & C. Merriam Company.
- Williamson, D., Dahl, R., Birmaher, B., Goetz, R., Nelson, B., & Ryan, N. (1995). Stressful life events and EEG sleep in depressed and normal control adolescents. *Biological Psychiatry, 37*(12), 859-865.
- Wolfson, A., & Carskadon, M. (1998). Sleep schedules and daytime functioning in adolescents. *Child Development, 69*, 875-887.
- Wolfson, A., & Carskadon, M. (2003). Understanding adolescents' sleep patterns and school performance: A critical appraisal. *Sleep Medicine Review, 7*, 491-506.

Wolfson, A., Spaulding, N., Dandrow, C., & Baroni, E. (2007). Early versus late starting middle schools: The importance of a good night's sleep for young adolescents. *Behavioral Sleep Medicine*, 5(3), 194-209.

APPENDIX A

Sleep For Your Health – Proposed Curriculum

Course Instructor: Barb Richardson, RN, MN

The course will use active, collaborative, inquiry-based learning activities to cover normal sleep-wake patterns across the life span, basic sleep physiology, chronobiology (circadian rhythms), consequences and risks associated with sleep deprivation in teens, good sleep hygiene, and common sleep problems and available treatments. Middle school students will receive information in class. Parents will receive information on the same topics via email, or mailed to them if they prefer this option.

COURSE OBJECTIVES:

Upon completion of the course, participants will be able to:

- Describe what happens in your body during normal sleep
- Summarize the importance of sufficient sleep to good physical, emotional, cognitive, and behavioral health in adolescents
- Track their regular sleep habits to determine if there is a correlation between sufficient sleep, feelings of daytime alertness, school performance, and illness.
- Identify common sleep disorders and know where to seek treatment if necessary
- Apply knowledge of sleep by modifying behavior (if necessary) in order to obtain sufficient sleep on a regular basis.

Course Schedule of Lessons: One lesson per week for 6 consecutive weeks

Learning Activity (Data Collection)– Assessment /Tracking Sleep

Purpose: The purpose of this independent learning activity is to track regular sleeping habits for one week in order to identify patterns that either support or challenge the ability to obtain sufficient sleep.

Objectives: At the conclusion of the in-class instructions students will:

- Know how to complete a sleep diary for 7 consecutive nights
- Describe how they feel (overall health, alertness or daytime sleepiness) on days following sufficient sleep versus insufficient sleep and record this in their sleep diary on a *sleepiness scale* that will be used in a later session.
- Identify patterns of behaviors in their regular daily and bedtime routines that promote or hinder sufficient sleep.
- Gain experience in recording data that can be used for scientific analysis.
- Record dreams, if remembered, in their sleep diary (optional).

Note..... this is the week students will be asked to wear an actiwatch for 7 nights.

Learning Activity: A brief in-class presentation will be used to explain and demonstrate how to complete an age appropriate sleep diary. An overhead projector with pages from a sample sleep diary will be filled out by the instructor while offering verbal instructions on how to complete each section of the diary. Students will be asked to fill out the sleep diary when they come to fitness class Monday through Friday. Completing a sleep diary is an optional activity for parents.

Note: The instructor will send a reminder email along with helpful sleep related tips to participants each day, encouraging them to complete their sleep diary entries.

Parents will be encouraged to reflect on their own personal sleeping habits and to contact the instructor via phone or email if they have questions or need a referral to a physician or sleep center for serious sleep disturbances.

For some participants, improving alertness, memory, physical functioning, and mood may not be enough motivation to complete a sleep diary. So, an alternative motivation will be the *optional activity*: Record dreams in sleep diary, if remembered, for personal interest only.

If participants are interested in dream interpretation, the following book that contains a good deal of accurate information on sleep is recommended:

Pliskin, M., Just, S., Pliskin, C., Romaine, D. (2004). *The Complete Idiot's Guide to Interpreting Your Dreams (2nd ed.)*. New York, Alpha Books.

Sleep diaries will be provided to all participants. If participants want to track their sleep on a regular basis, an alternative sleep diary may be accessed on-line from the National Sleep Foundation.

For students:

<http://www.sleepfoundation.org/atf/cf/{F6BF2668-A1B4-4FE8-8D1A-A5D39340D9CB}/FinalDiary.pdf>

For adults:

http://www.sleepfoundation.org/atf/cf/%7Bd9b0c783-92e3-484e-acba-9c8aeaf8ea84%7D/TWO_WEEK_SLEEP_DIARY_REVA_8-073.PDF

Assessment of learning: Students will bring completed sleep diary to next class session, where they will be used to explore and evaluate their personal sleep habits in order to (1) set individual goals for improving regular sleep hygiene (if needed) and (2) compare their sleep habits with other students to determine common patterns or rhythms in adolescent sleep/wake cycles.

Session #1 - What Does Sleep Do For You? (first week in October?)

Purpose: The purpose of this lesson is to increase knowledge and understanding of normal sleep across the life span with particular emphasis on early teen years.

Objectives: At the conclusion of this class students will be able to:

- Describe the two major sleep states, NREM and REM
- Name at least four functions of sleep
- Identify normal sleep needs and patterns in adolescents

Content outline:

1. What is sleep?
2. Why do we need to sleep?
3. How much sleep do we need?
4. Misconceptions about sleep

5. How does our body regulate sleep?
6. Factors affecting sleep

Learning Activities:

1. In class, introductions of instructor, students, and course overview, followed by individual student completion of a short paper/pencil assessment (quiz), “So, what do you know (or think that you know) about sleep?”
2. In class PowerPoint presentation and discussion on normal sleep physiology
3. Class discussion about the correct answers to the introductory assessment and misconceptions about sleep
4. Independent viewing of two videos available on the web.

Video # 1, developed by Discovery Science and available at:

<http://www.youtube.com/watch?v=KOFYVbVtFXY&feature=related>

Video #2, “How your brain works during sleep” developed by PBS and available at:

<http://www.youtube.com/watch?v=pqpOZd2LtIo&feature=related>

Assessment of Learning:

1. Near the conclusion of class, students will be asked to complete a one-minute paper to include (1) the most interesting thing that they learned about sleep and (2) one question they still have about sleep. Results will be used to begin the next class discussion.

Session #2. Sleep – Are You In Debt?

Purpose: The purpose of this combined session is to help students and parents understand the importance of sleep to our health and to understand the consequences of poor sleep or the chronic lack of sleep.

Learning Activity #1 - Sleepy, Dopey, and Grumpy; Consequences of Chronic Sleep Debt in Teens

Purpose: The purpose of this learning activity is to provide an overview of known consequences and risk factors associated with chronic sleep debt in teens.

Objectives: At the conclusion of this lesson, students and parents will be able to:

- Describe the concept of sufficient sleep
- Explain why sufficient sleep is important for normal growth and development and good health
- List at least 4 adverse consequences or risk factors associated with chronic sleep debt in teens
- Share one way they plan to use knowledge attained from the lesson to change their regular sleeping habits in order to obtain sufficient nightly sleep on a regular basis.

Learning activity: In-class PowerPoint presentation, small group discussions, and large group summarization (reports).

The instructor will begin the session with a brief overview of what scientists know about the importance of sufficient sleep. A PP presentation will be given in a large group setting with a

copy of the slides and a space for note taking provided as handouts to all participants. Following the conclusion of the PP presentation the instructor will ask if there are any points needing clarification. Then, participants will break in to small groups 4-5 students in each group. Participants will be directed to share within their small groups how they would describe sufficient sleep. A group definition will be constructed for later discussion. Once a definition of sufficient sleep is recorded, participants will be asked to share a personal experience where they believe sleepiness impacted their behavior, emotions, cognitive ability, or health. Groups will be instructed to create a list of at least 4 personal examples of consequences associated with chronic sleep debt. Once these activities are completed, one person from each group will report the definition of sufficient sleep and the list of consequences of chronically sleep debt to the large group.

Participants will then be asked to take one minute to reflect on their own typical sleep patterns, and to write down on their handout ways they plan to use the information acquired from this program to alter their regular sleep hygiene in order to obtain sufficient sleep. Participants will be asked to share at least one idea with their small group. This portion of the class will conclude with an opportunity for anyone who would like to, to share their plans for improving sleep hygiene.

Assessment of Learning:

1. The large group recordings and reporting of the definition of sufficient sleep and the list of consequences of chronic sleep debt will provide one means of assessing student learning.

2. The participants will be asked to complete a short verbal quiz at the beginning of the next class session in order to “refresh” their memory regarding chronic sleep debt, *and* for the instructor to determine whether the information presented in the session was retained.

Learning Activity #2 – Your Health Is In Jeopardy

Purpose: The purpose of this leaning activity is to reinforce concepts covered in the first two learning activities of this lesson, while engaging students in a fun activity.

Objectives: At the conclusion of this learning activity, students and parents will be able to:

- Recall normal sleep needs of adolescents
- Recall how chronic sleep debt impacts the physical, emotional, behavioral, and cognitive health of teens
- Identify normal stages of sleep
- Describe how the internal body clock (circadian rhythms) change in adolescents
- List ways to promote good sleep hygiene (sleep habits)

Learning Activity: “Your Health is in Jeopardy” is a power point based version of a popular interactive TV game show, Jeopardy. Students will be equally divided into three teams. The instructor will serve as the game show host(ess). One student will be identified as the spokesperson for each team. Only this person will be allowed to verbalize the teams’ “question” to each “answer”, but he/she may get assistance from any/all members of the team. Points will be determined by the number of correct responses that are based on the level of difficulty of each question in the five categories. Winning team members will be given a prize (pens, water bottles, card games, jump ropes, books, etc not candy or certificates for fast food treats as the overall purpose of the sleep program is to promote better health in adolescents).

Assessment of Learning:

1. The game is designed to assess recall from previous learning activities, and as such, it can also be considered a means of assessment.

Session #3 - Chronobiology – I’ve Got Rhythm!

Purpose: The purpose of this lesson is to help students understand what circadian rhythms are and how our internal biological clocks influence our sleep habits.

Objectives: After completing this session the student will:

- Understand the concept of biological clock or circadian rhythm
- Describe the relationship between circadian rhythms and sleep wake cycles.
- Explain why external cues are necessary to reset our biological clocks
- Know how circadian rhythms in adolescents differ from children and adults
- Appreciate the role of science and math in daily life (*affective domain – valuing)

Content Outline:

1. What is an internal biological clock (circadian rhythm)?
2. What environmental cues help establish and reset this clock, keeping it in time with day/night cycles?
3. Besides sleeping and being awake, what other functions does our biological clock help regulate?
4. How do circadian rhythms vary across the life span?
5. What happens when our biological clocks are disrupted?

Learning Activities:

1. In class PowerPoint presentation on chronobiology.
2. In class, interactive 3-D media activity: Meet Joe, Jane, Minnie and Grandpa Doze in the "Cycles of Sleeping and Waking with the Doze Family." This multimedia CD-ROM addresses the following questions: Why do you feel sleepy at night? What happens to your body temperature when you sleep? Is there a difference between your "real world" clock and your biological clock? The National Sleep Foundation developed this educational tool.
3. In class completion of individual *sleepiness scale* graph (using information from completed sleep diary). Then, in-class completion of group sleepiness scale graph (each student will add their sleep information to a large poster sized graph). Students will examine graph for patterns, look at descriptive statistics such as mean and median number of hours of nightly sleep, and examine the relationship between hours of sleep and daytime sleepiness scale scores. Optional independent learning activity – listen to pod casts by “Dr. Sleep,” episode 1, Sleep Basics, and episode 3, Synchronizing your Inner Clock, accessed through the National Sleep Foundation website at http://www.cbsnews.com/stories/2008/03/14/60minutes/main3939721_page3.shtml

Assessment of Learning:

1. A verbal 10 question T/F quiz for self-evaluation purposes will be administered. Answers will be discussed near the conclusion of the session with additional time provided for subsequent questions and answers.

Session #4 - Sleep hygiene – Just Do It!

Purpose: The purpose of this lesson is to help students understand what constitutes good sleep hygiene and why it is important to their lives.

Objectives: At the conclusion of this unit students and parents will be able to:

- Explain why good sleep hygiene is important to overall health and school performance
- Assess their own sleeping habits
- List four ways to improve their own sleep hygiene on a regular basis

Content Outline:

1. Personal sleeping habits
2. Sleeping environment
3. Getting ready for bed – normal routines
4. Getting up in the middle of the night
5. What about TV and computers?
6. Other Factors affecting sleep

Learning Activities:

1. Students will take the web-based, Discovery Tools “Sleep Hygiene Test” accessed at http://discoveryhealth.queendom.com/sleep_hygiene_abridged_access.html
This activity will provide students with a baseline “personalized” score.
2. In-class power point presentation and interactive discussion about what constitutes “good” sleep hygiene and why it’s important.

3. Students will be given a handout to read and take home with guidelines for good sleep habits.
4. Poster construction. Students will break in to groups of 2-3 to create posters with “Sleep Tips for Teens” that will be displayed throughout the school. Poster boards, markers, scissors, glue, old magazines, paints, and brightly colored paper will be provided for poster construction.

Assessment of Learning:

1. Students will be sent an email message with the link to the “Sleep Hygiene Test” two weeks after this session, so they can re-take the web-based quiz for self-evaluation of improvement (or not) in their sleep habits.

Session #5 - Common Sleep Disorders – Are You Sleeping?

Purpose: The purpose of this lesson is to introduce common sleep problems and let students know most sleep disorders can be successfully treated.

Objectives: At the conclusion of this session students will be able to:

- Recognize that nearly everyone, at some time, experiences difficulty sleeping.
- List four external and four internal factors that affect sleep and sleep patterns.
- Give examples of two common sleep disorders and specific therapies currently available for treating them.
- Describe how sleep is measured in a laboratory setting.
- Demonstrate concern for people suffering from a sleep disorder

(in a role play setting - *affective domain)

Content Outline:

1. What is a sleep disorder?
2. What causes sleep disorders?
3. What are the most common sleep disorders?
4. What are the signs and symptoms commonly associated with sleep disorders?
5. How does a health care provider determine if someone has a sleep disorder?
6. How are common sleep disorders treated?

Learning Activities:

1. In-class PowerPoint presentation on the most common sleep disorders including insomnia, narcolepsy, sleep apnea, parasomnias (bedwetting, night terrors, sleep walking), and restless leg syndrome.
2. In class viewing of video “Why Can’t You Sleep? Understanding Sleep Problems”
Accessed on the web at:
http://www.everydayhealth.com/Publicsite/Healthology/VideoTopic.aspx?category=sleep_disorders
3. Case study – role play. Students will pair up with one student being “the patient” and the other student being “the nurse practitioner.” Students will be given information relevant to their character roles Students will be given 10 minutes to come up with a diagnosis and treatment plan and then they’ll switch roles. The instructor will facilitate a follow-up discussion, answering questions as time permits. Students will be directed to Healthlines

“Sleep Disorders Health Map” at http://www.healthline.com/channel/sleep-disorders_healthmaps for information on specific sleep disorders. By clicking on specific boxes in the sleep disorders health map, students can access information about a variety of sleep disorders including symptoms, causes, diagnosis, treatments, complications, and prevention.

Assessment of Learning:

1. A 10 question verbal quiz will be used to assess knowledge of sleep disorders.

Session #6 - Everything You Wanted to Know about Sleep But Were Afraid to Ask

Purpose: The purpose of this session(s) is to *review* all content areas covered in the previous five sessions, allow students an opportunity to ask *any* questions they have about sleep.

Objectives: At the conclusion of this session students will:

1. Apply information learned in previous lessons to identify ways they can improve their own sleep hygiene.

Content outline: (Review)

1. Functions of sleep (what happens in our bodies during sleep)
2. Stages of sleep
3. Circadian rhythms across the life cycle
4. Sleep hygiene

5. Consequences of insufficient sleep
6. Common sleep disorders

Learning Activities:

1. In-class PowerPoint presentation highlighting content covered in the previous 5 classes.
2. Question and answer “sleep-bee”: Students will be given a 3x5 card on which to write any questions they still have about sleep (1 question per card). The class will be divided in to 2 teams, one on each side of the room. The cards will be collected and shuffled. The instructor will draw a card from the stack and ask one team if they know the answer. If answered correctly by any team member, the team will get 1 point. If no one on the team can correctly answer the question, the other team will have an opportunity to answer, and score a point. Teams will alternate questions. If neither team can answer the question correctly, the instructor will answer the question (or find the answer) for the class. The team that has the most points at the end of the session wins, and will be rewarded small prizes. In the event of a tie, the instructor will have several questions that will be posed to the teams.

Assessment of Learning:

1. A participation rubric will be used to assess participation in the “sleep-bee” activity.

A Parent’s Guide to Teens and Sleep (addition lessons for parents)

Purpose: The purpose of these lessons is for parents to understand how important *sufficient sleep* is to the emotional, behavioral, cognitive, and physical health of their child(ren).

Objectives: At the conclusion of the web-based modules, parents will be able to:

1. State what happens in our bodies when we sleep.
2. Explain how much sleep a typical teen needs and why it's important for adolescents to get sufficient sleep on a regular basis
3. List 5 ways to improve sleeping habits for all family members (good sleep hygiene)
4. Encourage their teen to regularly obtain sufficient sleep.

Content outline:

1. Basic functions of sleep
2. Normal sleep patterns across the life span (biological clocks) and how much sleep do teens need?
3. Consequences of chronic sleep deprivation in teens
4. How to help your teen develop good sleep habits.

Learning activities:

1. View PowerPoint slide presentation prepared by instructor (sent via email) - covers sleep physiology, circadian rhythms, consequences of chronic sleep debt in teens, and tips for good sleep hygiene.
2. View video on science of sleep – part 1 and part 2 at:
http://www.cbsnews.com/stories/2008/03/14/60minutes/main3939721_page3.shtml
3. Reference article, “Excessive Sleepiness in Adolescents and Young Adults: Causes, Consequences, and Treatment Strategies “ by Richard P. Millman, MD, chair of the Working Group on Sleepiness in Adolescents/Young Adults, American Academy of

Pediatrics Committee on Adolescence, Pediatrics, 2005, volume 115, p. 1774-1786 (PDF emailed to parents).

4. Read, A wake-up call on sleep and health: scientists sound the alarm about the connections between sleep problems, disease, and even your weight. Here's what you need to know before you head hits the pillow (a clinical report).

Publication Date: 01-FEB-07

Publication Title: Tufts University Health & Nutrition Letter, Accessed at:

http://goliath.ecnext.com/coms2/gi_0199-6271097/A-wake-up-call-on.html

5. Peruse web site of the National Sleep Foundation, sleep topics A-ZZZ at:

http://www.sleepfoundation.org/site/c.huIXKjM0IxF/b.2417141/k.27D9/Home_of_the_Sleep_in_America_Poll.htm

6. Take Sleep IQ quiz, Caffeine IQ quiz, and The Cycles of Sleeping and Waking with the Doze Family quiz found under the "Tools and quizzes" tab of the NSF at:

http://www.sleepfoundation.org/site/c.huIXKjM0IxF/b.2418861/k.B1A8/Tools_and_Quizzes.htm

Assessment of Learning:

1. A 10 question multiple choice quiz for self-evaluation of understanding of sleep topics will be mailed to parents, along with the course evaluation questions.

APPENDIX B

Sleep For Your Health – Lesson Plans for curriculum (as taught for this research project)

Course Instructor: Barb Richardson, RN, MN

The course was implemented for 15 minutes once a week for 6 consecutive weeks in a large gymnasium. All students in 2nd period fitness and health participated in the *Sleep for Your Health* curriculum, whether they were enrolled in the study or not. Computers were not available on-site for the instructor or students. The purpose, objectives, and content outlines remained unchanged from the proposed curriculum (Appendix A). Only the learning activities were adapted to work in the environment where the course was taught. Each student and teacher was provided with a notebook that was kept on-sight for use during the weekly “sleep” lessons. At the beginning of each session, printed materials were distributed to each participant. Due to time constraints, weekly assessments of learning were limited to participation in activities and verbal questioning from the instructor. Time was provided at the conclusion of every session for students to ask questions or seek clarification of new content. At the completion of the course, students were given the notebooks to take home for future reference. In addition to a letter, identical materials were mailed, either electronically or via the U.S. postal service, to parents on the same day lessons were taught in class.

Assessments / Tracking Your Sleep

Students in both the control and intervention group were given identical instructions for completing their sleep diaries and wearing the actiwatches. Sleep diaries were kept in individual folders in a file cabinet that was locked in the health and fitness teacher's office. First thing each morning, students were reminded by the teacher to complete their sleep diary. Upon completion of data collection and printing actigraphs, each student was provided with a copy of their sleep record for the first week that sleep was recorded. A letter was attached to the report for students in the control group, primarily to encourage their participation again two months later (see mid-study letter).

Note: Having the students keep the diaries at school decreased the probability that the diaries would be lost at home. Having the teacher remind the students to fill out their sleep diaries significantly increased completion rates. One teacher did not remind students to complete their diaries each morning, resulting in only 1 of 8 completed sleep logs.

Sleep for Your Health

Session 1: What Does Sleep Do For You?

Learning activities:

1. Short lecture using handout as guide
2. Have students break in to 2 groups of 10 to compete against each other ... first team to spell melatonin correctly with “ body letters” (for example, spelling out the YMCA song)

AND give a correct description of what melatonin is and how it helps in the regulation of sleep wins!

3. Sleep regulation was demonstrated using student volunteers and a tug-of-war simulation between forces promoting waking and sleeping. (example: adding caffeine makes “awake” side stronger, students were encouraged to come up with their own suggestions to add to the teams).

Session 2: Are You in Debt?

Learning activities:

1. Students NOT enrolled in the study were provided with sleep diaries so they would have base-line information
2. To open the session, students were asked to share examples (to create a list) of how they felt or behaved when they didn't get enough sleep
3. A brief lecture on ways sleep debt can affect health, performance, appearance, and behavior in teens
4. Students were asked to complete the personal sleep assessment, set a specific goal (such as 10 minutes) for increasing their nightly sleep in the coming week, and to write down one action they would take to meet that goal.

Session 3: Good Sleep Habits – Just Do It!

Learning activities:

1. Students were asked to give themselves a grade for progress towards the goal of sleep 9 hours each night

2. Tips for getting a good night's sleep and a list of "sleep busters" was created through class participation – then compared to the list prepared by the instructor
3. Participants were asked to identify (and write down) their top 3 "sleep busters"
4. Participants were asked to build upon their individualized plan for getting enough sleep using the tips that were discussed in class (and on the handout)
5. Relay race for reinforcement: The class was divided in to 4 teams. Each participant was given a 3"x24" brightly colored strip of paper and a large marker. Each group was instructed to write down a *different* habit (promoting healthy sleep) on each strip of paper, then one at a time, run across the gym to a poster on the opposite wall, attach their "health habit tip" (using previously attached pieces of tape), and run back to their group. Each member of the winning team was given a mechanical pencil as a prize. The posters were left in place for the next 3 weeks to reinforce concepts learned.

Lesson 4: You've Got Rhythm!

Learning activities:

1. Chronobiology is a complex concept – so the lecture for this session lasted a full 10 minutes.
2. Students were encouraged to ask questions and share personal examples of a time when their circadian rhythm was interrupted (generally due to travel)
3. A mock concert was held with 3 student leaders volunteering to "be" the band "Green Day." All students were given a copy of the re-written words to Green Day's popular song, 21 Guns (see attached) and encouraged to sing along. The re-written words reinforced concepts presented in the curriculum.

Lesson 5: Common Sleep Disorders in Adolescents

Learning activities:

1. Students self-selected in to groups of three. In each group one person volunteered to be the nurse practitioner, one to be the patient, and one to be the sleep research specialist. The nurse practitioner and patient were each given role-specific script guidelines for the interview. The sleep research specialist was given a list of potential sleep disorders from which to identify the sleep disorder the patient was experiencing. Following the role play activity, the sleep researcher in each group reported back to the full class, stating what the signs and symptoms were for the particular sleep disorder they had identified.
2. The instructor summarized common sleep disorders in adolescents and encouraged participants to contact their regular health care providers if they had concerns about the possibility of having a recognized sleep disorder.

Lesson 6: Everything You Wanted to Know about Sleep But Were Afraid to Ask

Learning activities:

1. A brief summary of content of the previous 5 sessions was presented. Students were encouraged to write down questions on 3x5 index cards that were passed to the instructor – so they could ask *anything* they wanted to know about sleep.
2. Students were asked to share ways they had successfully used to get more sleep most nights. They were asked, again, to give themselves a grade on their progress of individual sleep goals.

3. Students completed the 10-question true/false assessment of sleep knowledge covering major concepts covered in the course. Following the quiz, students were asked to complete the brief course evaluation survey. All students were thanked and given their notebooks containing the *Sleep for Your Health* materials.

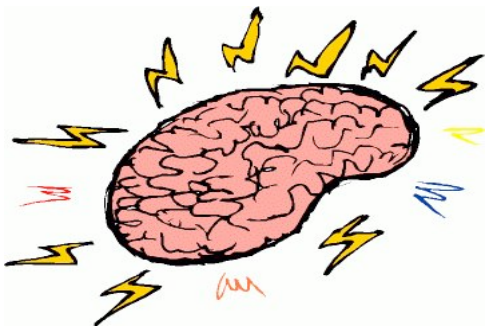
Sleep for Your Health

What is sleep? Sleep is required to live... it's not an optional thing! We don't know everything about sleep, but we do know that sleep is NOT just a time for your body and brain to shut down. Sleep is *DYNAMIC* ... not a passive process.

Why do we need to sleep?

Your brain needs sleep so you can:

- remember what you learned during the day
- be alert & pay attention, concentrate, be creative & solve problems
- get along with your friends, family, and teachers
- be in a better mood



Your body needs sleep so:

- >You will be better coordinated
- > you will look your best!

>your muscles, bones, & skin can grow

>injuries can be repaired

>you will stay healthier and fight illness

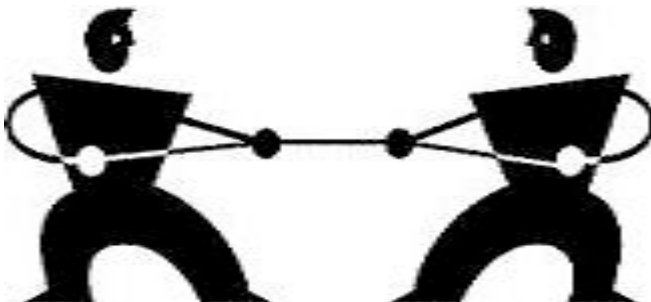
How much sleep do teens need? *About 9 hours every night*



Why so much? To refuel you tank! Our bodies are *driven* to sleep. We can't get by without it.

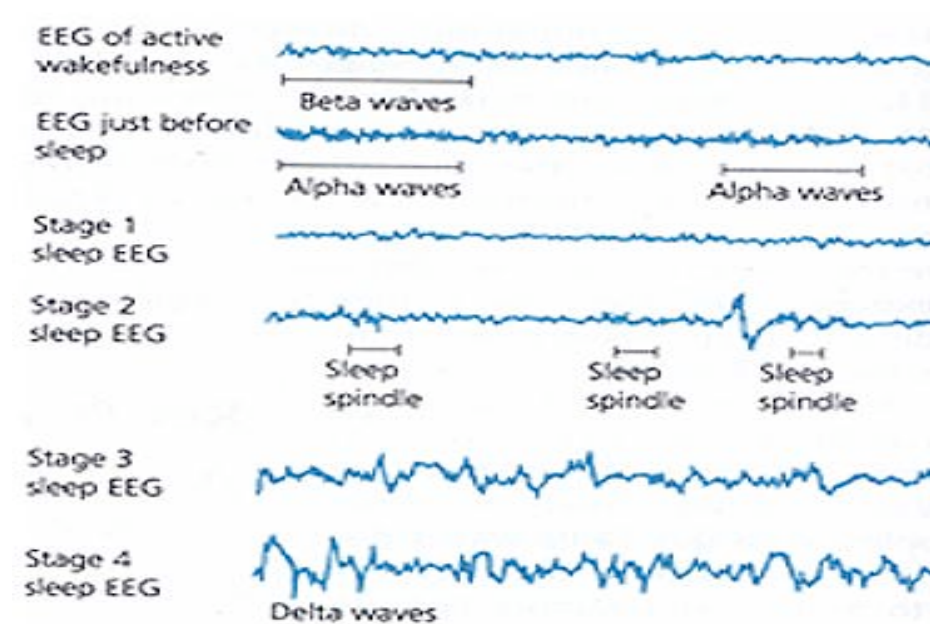
Sleep Cycles

We have 2 opposing “drives” that impact sleep. One force works to keep us awake (technically called the circadian arousal system), and the other works to make us sleepy (termed the homeostatic sleep drive).



There are 5 stages in 1 sleep cycle, lasting about 90 minutes. Sleep cycles are repeated 5 or 6 times a night.

How do we know this? Sleep researchers use a special test - called an electroencephalogram (EEG for short) - to measure the electrical activity in our brains.



Stage 1 – you feel drowsy, but you aren't in a deep sleep yet, eyes begin to roll, only lasts a few minutes ... easy to wake someone up

Stage 2 – a short period of light sleep

Stages 3 & 4 –periods of deep restful sleep where brain waves slow down, breathing slows down, time when body builds bone and muscle, heals & repairs

Together, sleep stages 1-4 are called **NREM** sleep (non-rapid eye movement)

Stage 5 – know as **REM** (Rapid Eye Movement) sleep, heart rate and breathing rate speed up, eyes move in all directions, but body becomes almost paralyzed – showing little or no movement

of muscles. Stage in which dreaming occurs. Throughout the night, each **REM** stage is a little longer.

Recommended resources:

<http://www.webmd.com/sleep-disorders/guide/sleep-101> (good descriptions of sleep stages)

<http://www.youtube.com/watch?v=KOFYVbVtFXY&feature=related> (10 minute scientific video about REM sleep and dreams)

<http://www.youtube.com/watch?v=pqpOZd2LtIo&feature=related> (great video clip about teens and sleep)

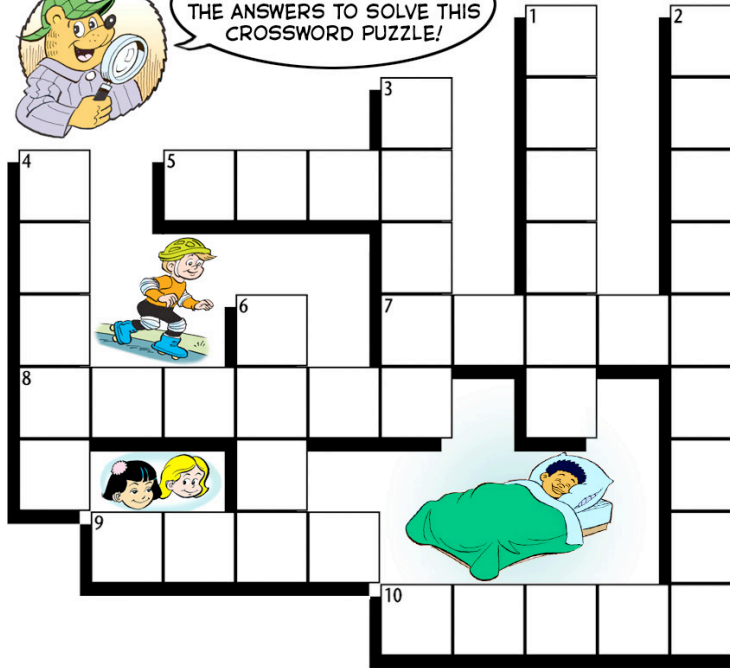
Book – Sleep Information for Teens, Edited by Karen Bellenir, copyright 2008, Omnigraphics, Inc.

SNOOZE CLUES

from sleepforkids.org



READ THE CLUES ABOUT SLEEP BELOW. USE THE ANSWERS TO SOLVE THIS CROSSWORD PUZZLE!



ACROSS

5. To help your muscles and bones grow and to keep you healthy, sleep renews and strengthens your _____.
7. In the morning, your eyes and brain are signalled that it is time to wake-up by _____.
8. Your body needs rest at night, but while you sleep it is still _____.
9. During stage 3 and 4 you are in a _____ sleep.
10. To help you concentrate, solve problems, and learn, sleep refreshes your _____.

DOWN

1. A full night of sleep helps you stay active all day by giving you enough _____.
2. Our brain makes a chemical that makes us sleepy called _____.
3. Five or six times a night, you go through one sleep _____.
4. Rapid-Eye-Movement sleep is the stage when we _____.
6. Each cycle of sleep has _____ stages.

ANSWERS Across: 5. Body 7. Light 8. Active 9. Deep 10. Brain
Down: 1. Energy 2. Melatonin 3. Cycle 4. Dream 6. Five

Sleep for Your Health – Session 2 – Are You In Debt?

Quick Review:

What is sleep?

Why do we need sleep?

Adequate sleep is necessary for optimal functioning.

Sleep affects every aspect of your physical, emotional, cognitive, and social development.

Sleep cycles, NREM and REM sleep

Dopey, Grumpy and Sleepy; Consequences of Chronic Sleep Debt in Teens



What is “sufficient sleep” Or how much is enough?

Most adolescents need at least 8.5 to 9.5 hours (510 to 570 minutes) of restful sleep every night for optimal physical health, emotional health, and cognitive functioning (cognitive functioning is how well you learn & problem solve)

Sleep debt (or **insufficient sleep**) refers to the adverse effects of accumulated sleep loss due to poor sleep habits, illness, awakenings due to environmental factors or other causes.... Sleep debt may be acute, happening occasionally, or chronic, occurring on a regular nightly basis.

Causes of chronic sleep debt in teens:

- Behavioral (activities, school, work, TV, video games, texting, poor sleep habits, consumption of caffeinated beverages)
- Environmental (noise, light, crowded living conditions)
- Physiological (bio-rhythm changes, illness, sleeping disorder)

Consequences of not getting enough sleep (sleep debt) *most* nights:

- Daytime sleepiness – poor concentration, unable to focus, short term memory problems
- Negative moods (easily become angry or irritable), increased risk of depression
- Increased risk of injuries – clumsy, slowed reaction times
- Immune suppression (get sick more easily)
- Risk of weight gain and high blood pressure



Personal Sleep Assessment

Do you wake up on your own? (If you rely on someone else or an alarm to wake you in the morning, answer no to this question.)

Do you feel completely rested when you get up each morning?

Do you have enough energy to stay alert and get through each day without feeling drowsy?

If you answered yes to all of these questions You are probably getting sufficient sleep.

Activity: Sleep diary

Keep a sleep diary for 1 week (form attached).

(Note – students in the sleep study already have this information computed and graphed for them)

How much sleep, on average, do you get on school nights? _____ hours

On weekend nights? _____ hours

What is your sleep debt? ____ (subtract how much sleep you usually get from 9 hours)

Personal Goal:

In order to feel my best, look my best, and do the best I can at school and in activities that are important to me, I need to increase the amount of sleep I am getting by _____ hours each night.

Additional resources:

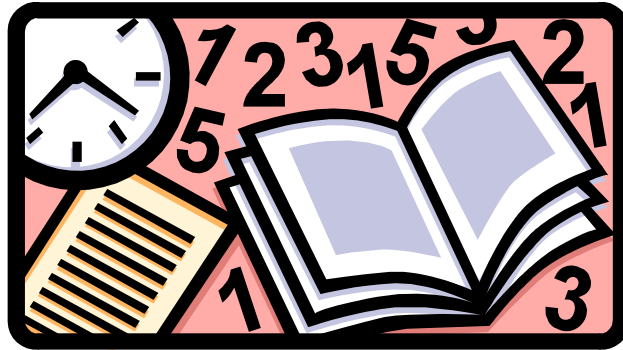
<http://www.washingtonpost.com/wp-dyn/content/article/2005/10/08/AR2005100801405.html>

http://www.nhlbi.nih.gov/health/prof/sleep/res_plan/section4/section4.html

<http://www.naturalnews.com/024490.html>

Sleep for Your Health – Session 3 – Good Sleep Habits – Just Do It!

Make sleep a priority. You must schedule sleep like any other daily activity, so put it on your "just-do-it list" and cross it off every night. But don't make it the thing you do only after everything else is done – stop doing other things so you can get the sleep you need.



Set a goal. Make a plan.

What steps will you take to get enough sleep?

- Tonight?
- Tomorrow night?
- Most nights

Some tips that may help you get more sleep:

- **Set a regular sleep schedule.** Going to bed around the same time each night signals your body that it's time to sleep. Try to stick to a similar sleep / wake schedule on weekends, even though it's tempting to stay up and sleep much later in the morning.
- **Exercise regularly (every day if you can).** However, don't exercise right before bed, as physical activity may make you feel wound up and make it more difficult to fall asleep. Try to finish exercising at least 2 hours before bedtime if possible.

- **Avoid caffeine after noon.** Don't drink caffeinated beverages such as sodas, Red Bull, or coffee after lunch. Nicotine is also a stimulant and effects from smoking can make it difficult to fall asleep.
- **Don't eat a big meal right before bedtime.**
- **Relax before bedtime.** Avoid violent, action packed, or scary movies, TV programs, video games, and books right before bed. They may get your mind and heart racing, making it difficult to fall asleep.
- **Unwind with a relaxing routine.** Keep light levels low as bright lights (including TV and computer screens) signal the brain that it's time to be awake ... not asleep. Listen to relaxing music, take a warm bath or shower, read a book (just not a thriller), or meditate.
- **Avoid taking naps** longer than 30 minutes during the day as a long nap may keep you from falling asleep at bedtime.
- **Create a good sleeping environment.** A dark, quiet room that is slightly on the cool side provides the best environment for sleeping. Cover your eyes with a dark cloth if you share a room with someone else and they need to keep a light on when you're trying to sleep. Loud music and other noise can make it hard to go to sleep so turn off your ipod, MP3 player, or radio before nodding off.
- **Avoid pulling an all-nighter before a big test.** Studies show that a good night's sleep may help you perform better on your exam than if you studied longer and got less sleep.
- **Wake up with bright light.** Turning on the lights or opening your curtains to let in the sun shine in the morning signals your brain that it's time to wake up.

Sleep Busters



What to do if you can't sleep

Some people have trouble falling asleep. What kinds of things can you do when you can't sleep?

- Nighttime fears, worries, and stress? If you're feeling overwhelmed, talk to somebody or try journaling. Take a comforting object to bed with you. Try to clear your mind ... use meditation or visualization. It helps some people to focus on their breathing – taking long, slow, deep breaths.
- Too hot? Sleep with just a sheet, or use a small fan.
- Too cold? Put on socks. This can help warm you up amazingly fast.
- No room in the bed for you? Find another place for your favorite pet, stuffed animals, or the clothes you've been wearing all week.
- Too bright? Cover your eyes with a dark cloth (eye mask).
- Tired but wired? Try a warm bath or shower an hour before you go to bed. Listen to soothing music, read with a dim light.

Additional resources:

Take a sleep hygiene quiz:

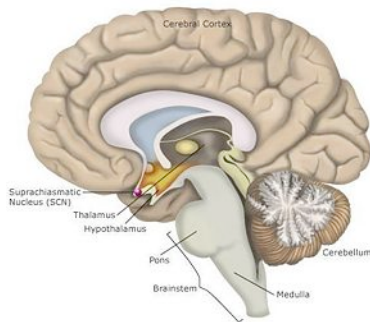
http://discoveryhealth.queendom.com/sleep_hygiene_abridged_access.html

<http://www.sleepfoundation.org/article/sleep-topics/teens-and-sleep>

Your Biological Clock – You’ve Got Rhythm! Session 4

An internal “biological clock” regulates sleep timing in humans. This internal clock is what makes us feel awake during the day and sleepy at night. Our circadian clock cycles about every 24 hours. Our circadian rhythms respond to both external and internal factors.

Our biological clock is controlled by a part of the brain called the suprachiasmatic nucleus (SCN), a group of cells in the hypothalamus that are sensitive to light and dark.



From the optic nerve of the eye, light travels to the SCN, signaling the internal clock that it is time to be awake (an external control factor). The SCN then sends signals to other parts of the brain that control hormones, body temperature, blood pressure, and other functions that make us feel sleepy or awake (the internal control factors).

In the mornings, with exposure to light, the SCN sends signals to raise body temperature and produce hormones. The SCN also responds to light by delaying the release of other hormones

like melatonin, which is associated with the onset of sleep and is produced when the eyes send a signal to the SCN that it is dark. Melatonin levels, which promote sleep, rise in the evening and stay elevated throughout the night. In teenagers, research has shown that melatonin levels naturally rise later at night than in younger children and adults. Since teens may have difficulty falling asleep at a time that allows them to get 9 hours of sleep, it may help to keep the lights dim as you get ready for bed. Sleeping in a darkened environment may make it easier to go to sleep. This is also why keeping a lit cell phone, computer, or TV screen near the head of your bed can prevent or disrupt sleep. Conversely, getting into bright light as soon as possible in the morning may help you wake up more quickly.

Changes to circadian rhythms occur during adolescence, when most teens experience a “sleep phase delay”. This shift in teens' circadian rhythm causes you to naturally feel more awake later at night, making it difficult for many adolescents to fall asleep before 11:00 pm. Since most teens must wake up early for school, this sleep phase delay can make it difficult for teens to get the sleep they need (9 hours a night). Chronic sleep deprivation (sleep debt) can influence a teen’s circadian rhythms; the strongest circadian “dips” that signal sleep tend to occur between 3:00-7:00 am and 2:00-5:00 pm, but the morning dip (3:00-7:00 am) can last until 9:00 or 10:00 am if the teen doesn’t regularly get sufficient sleep.

Our circadian rhythms can easily be disrupted when traveling across multiple time zones. The conflict experienced between our internal and external clocks causes jet lag, and may take several days to get re-adjusted. Jet lag can produce feelings of excessive sleepiness, loss of ability to concentrate, slowed reflexes, irritability, headaches, and problems sleeping through the night. These symptoms can also occur without travel when the circadian rhythm is disrupted by

illness, keeping irregular hours (such as shift work), or staying up all night for any reason.

Because of this, it is important to keep a regular sleep schedule, even on weekends. Sufficient time to sleep allows our two biological forces, the sleep/wake cycle and our circadian rhythms, to help us look, feel, and perform our best.

SLEEPING WITH YOUR CELL PHONE ONNOT SUCH A GOOD IDEA!!!



Additional Resources:

<http://www.sleepfoundation.org/article/sleep-topics/sleep-drive-and-your-body-clock>

http://www.cbsnews.com/stories/2008/03/14/60minutes/main3939721_page3.shtml

<http://www.azcentral.com/arizonarepublic/arizonaliving/articles/0328nosleep0328.htm>

Up-to-date scientific article about circadian rhythms:

<http://www.sciencenews.org/view/generic/id/48177/title/>

Sleep For Your Health Part 5 – Common Sleep Disorders in Adolescence

Sleep disturbances are relatively common in children and adolescents. Surveys report that up to 25% of all youth experience some type of sleep problem at one time or another. The most severe sleep problems can interfere with a teen’s daily functioning. The consequences of untreated sleep problems may leave a person feeling very sleeping during the day, affect their mood, and lead to memory problems or being unable to focus in school.

Some of the more common sleep disorders in teens include:

Insomnia – which is defined as trouble falling or staying asleep. The most common cause of insomnia is stress, but it can also be caused by illness or pain, depression, and overuse of stimulants such as caffeine, use of alcohol, an irregular schedule, and environmental factors (like too much noise). Some people are just more prone to having insomnia than others, just as some people tend to get a headache or others get an upset stomach. It’s common for nearly everyone to experience insomnia once in a while. But if the insomnia lasts for longer than a month, you may want to talk to a healthcare professional about ways to help you get a good night’s sleep.

Delayed Sleep Phase Syndrome – is a disorder that occurs when a person’s biological clock is “delayed” by 2 or more hours, resulting in the inability to fall asleep at the desired time. This condition is quite common in adolescents, particularly those that describe themselves as “night owls.” Teens with delayed sleep phase syndrome may try to go to sleep at 10pm, but just can’t fall asleep until after midnight. Because of this, they also experience trouble waking up before

9am. This becomes a problem when the teen has to get up for school, often resulting in frequent absences of morning classes. Delayed sleep phase syndrome rarely occurs after the age of 30.

Sleep Apnea – is a sleep disorder where a person’s breathing stops for a period of 10-60 seconds or more. These long pauses in breathing may occur up to 20-30 times an hour. When the person with apnea stops breathing, the level of oxygen in their blood drops. The brain responds by waking the person up just enough for them to take a breath. Normal breathing often starts again with a loud snort or gasping sound. This constant waking up prevents the person with apnea from getting enough deep sleep and REM sleep, resulting in excessive drowsiness during the day. Sleep apnea is linked to obesity, very large tonsils and adenoids, and conditions that cause your throat muscles and tongue to relax more than normal. The signs and symptoms of sleep apnea include *loud snoring*, gasping during sleep, and always feeling tired during the day. Other signs may include morning headaches, memory or learning problems, moodiness, and dry throat upon waking in the morning. Anyone who thinks they may have sleep apnea should discuss their concerns with their health care provider. This condition can be treated with a mask that you wear over your nose while you sleep. The mask is connected to a device that delivers continuous positive airway pressure (CPAP) by blowing air into your throat to keep it from collapsing.

Restless Leg Syndrome or RLS – is thought to be a hereditary disorder that causes unpleasant tingling, crawling, or prickling sensations in the legs and feet that causes the person to constantly want to move around in order to get relief. Lying down seems to activate these symptoms. As a result, people with RLS have a hard time falling and staying asleep. RLS is most common in older adults, but can happen at any age. In most cases, the cause of RLS is unknown. Symptoms

of RLS may come and go over time, but it is usually a lifelong condition. Decreasing use of caffeine, alcohol, and tobacco may provide relief for people with mild RLS. Physicians may also prescribe dietary supplements or medications, although do not always provide relief.

Narcolepsy – is a sleep disorder caused by the brain’s inability to normally regulate sleep-wake cycles. Throughout the day, people with narcolepsy fall asleep for periods lasting up to several minutes. People with narcolepsy involuntarily fall asleep just about anywhere and any time..... while at school, in the middle of a conversation, while eating, playing sports, or driving a car. In addition to falling asleep throughout the day, people with narcolepsy may experience cataplexy (a sudden loss of muscle tone), as well as vivid hallucinations and brief periods of total paralysis when falling asleep or waking up. Contrary to popular belief, people that truly have narcolepsy do NOT spend more hours actually sleeping than most people, because in addition to falling asleep during the day, they may also experience frequent awakenings during nighttime sleep. Symptoms of narcolepsy often first appear between the ages of 10 and 25 years. The cause is unknown and narcolepsy cannot be cured. However, it can often be controlled with prescription medication.

Parasomnias – are not truly sleep disorders, but they are behaviors that may disrupt normal nighttime sleep. Common parasomnias include sleep walking, nighttime sleep-related eating, nightmares and night terrors, bedwetting, and teeth grinding. It is thought that most parasomnias are a result of incomplete awakening from deep REM sleep. If you are concerned about repeatedly experiencing any one of these parasomnias, please talk with your health care provider.

Additional resources:

http://www.nlm.nih.gov/medlineplus/tutorials/sleepdisorders/htm/no_50_no_0.htm (excellent interactive power point presentation)

<http://emedicine.medscape.com/article/916611-overview>

<http://www.kidzzzsleep.org/phandouts.htm>

<http://www.sleepfoundation.org/> (select sleep related problems pull down menu)

<http://www.nlm.nih.gov/medlineplus/sleepdisorders.html>

ENOUGH SLEEP lyrics sung to the tune “21 Guns” by Green Day, Reprise Records, 2009

Do you know what’s worth sleeping for?

When it’s not worth missing more?

Does it take your sleep away?

And you feel yourself tired today.

Can’t remember how to divide?

And you lost your language arts guide...

Feels like you left your brain outside?

You’re in ruins

Ten-twenty P.M.

Lay down your head, turn out the light

Ten-twenty P.M.

Time now to sleep all through the night, you and I

When you’re at the end of the road

And you’ve lost all sense of control

Loss of sleep is taking a toll

A bad mood wrecks your spirit, don’t you know?

Wide awake, Red Bull in a glass...

And the math test, will you pass?

Without sleep – you’ll never last

You’re in ruins

Ten-twenty P.M.

Lay down your head, turn out the light

Ten-twenty P.M.

Time now to sleep all through the night, you and I

Can you wake up all on your own?

Oversleep if your Mom’s not home?

How much sleep now do you require?

Get 9 hours each night to feel your best, that much is known....

When it’s time to shut your eyes

Just relax, now give it a try

Skip the texting, your battery died

Your in ruins

Ten-twenty P.M.

Lay down your head, turn out the light

Ten-twenty P.M.

Time now to sleep all through the night, you and I (repeat)

Sleep Disorder Scripts

Physician script:

Hi – My name is Dr. _____

Tell me a little bit about yourself.

What brings you in today?

When did these symptoms start?

How long have you been experiencing _____?

What things have you tried to relieve these symptoms? Did it help?

Thank you for coming in. I'm going to order a few sleep tests, and confer with our sleep specialist to see what he/she thinks you might have, and how we may be able to help you.

Patient script 1:

It's nice to meet you Dr. _____

My name is _____ I'm 14 years old.

Chief complaint: I came to see you today because I just can't sleep. I go to bed about 9 o'clock on school nights but I just can't fall asleep until after midnight. I have lots of trouble waking up in the morning and sometimes I'm late for school because I oversleep. My grades aren't so good because I'm missing 1st period fairly often.

What do you think my problem is?

Patient script 2:

It's nice to meet you Dr. _____

My name is _____ I'm 65 years old.

Chief complaint: I came to see you today because I'm not sleeping too well. I get this funny tingling, or prickling sensation in my legs as soon as I lay down. Sometimes it feels like I have bugs crawling all over my legs. The only thing that makes it go away is to move my legs around,

but that keeps me from falling asleep. I'm really tired during the day and my family thinks I'm turning in to a cranky old person. What do you think my problem is?

Patient script 3:

It's nice to meet you Dr. _____

My name is _____ I'm 18 years old.

Chief complaint: I came to see you today because I'm really having a problem. I wake up a lot during the night even though I try to get 8 or 9 hours of sleep most of the time. It's during the day that's the problem. I seem to fall asleep just about anywhere. I was driving the other day and almost wrecked because I fell asleep at the wheel Even though I was talking to my best friend who was with me. If she hadn't grabbed the wheel we could have been in a really bad accident. This falling asleep any time, any where has been going on for a while and I'm scared. What do you think my problem is?

Patient script 4:

It's nice to meet you Dr. _____

My name is _____ I'm 13 years old.

Chief complaint: I came to see you today because I'm having problems sleeping. I fall asleep right away when I go to bed (usually around 11pm), but then I wake up around 2am and I can't go back to sleep, no matter what I try. This has been going on for more than 4 months. I'm starting to have problems in school and my friends are all mad at me because I'm usually in a bad mood. But I just can't help it. I'm sick of being so moody and depressed all the time. My parents are angry with me because I'm not doing as well as I used to in my classes. What's my problem?

Patient script 5:

It's nice to meet you Dr. _____

My name is _____ I'm 45 years old.

Chief complaint: I'm here today because I'm feeling tired all of the time. My spouse is tired too because I snore so darn loud all night long. A few times a week I wake up with a bad headache and a bit of a sore throat, but they seem to go away once I have breakfast. Why do you think I'm so exhausted all the time?

Mid-study Letter to Student Participants

Dear Sleep Study Participant,

Attached is the graph and the information I downloaded from the actiwatch you wore to measure your sleep. I have highlighted the number of minutes of sleep you got each night of the week on the second page. The last number in the highlighted column is the *average* number of minutes of sleep you got each night during the week you wore the watch.

Youth between the ages of 10 and 17 usually need about 9 hours (540 minutes) of sleep each night. If you almost always get less sleep than 540 minutes each night, you may want to set a goal of trying to increase the amount of sleep you are getting.

I would like for you to wear the watch for another week in December. The reason being, so I can take an average of the amount of sleep you got for 2 different weeks. For example, if you wanted to figure out what the average temperature is in Spokane in the summer and you only measured the temperature for one week in June when it was cold and rainy, you wouldn't get a very accurate picture of the average summer temperature. The same with sleep the week you wore the watch may have been average for you, but maybe you were sick, didn't get as much sleep as usual because you were up late working on a big project that was due at school, or you didn't sleep well for some other reason. By measuring your sleep for 1 week in October and another week in December, I will get a better idea of what an "average sleep pattern" is for 12-14 year old students.

If you have any questions, please email me at Barbara.Richardson@email.wsu.edu or call me at #255-6845.

Thank you again for participating in the sleep study. I truly appreciate you!

Sincerely yours,

Barbara Richardson

Washington State University

College of Nursing

Dear Parents of a Glover Middle School Sleep Study Participant,

First, I want to thank you for allowing your son or daughter to wear an actiwatch that measures their sleep for a week. I greatly appreciate your support of this research project about sleep in early adolescents.

As part of the sleep study, students in 2nd period Fitness and Health and Life Skills class will be receiving information about the importance of sleep to their health and well being. They will have an opportunity to learn more about sleep every Friday for the next 6 weeks. Each time students learn about some aspect of sleep in class, I will email or mail **you** the same information, so you can talk about it with them at home. Sometimes, I will suggest questions you can ask your teen about sleep. In this first lesson, there is a crossword puzzle you can work on together --- or as a competition to see who can complete it first with the most correct answers.

While students spend a good part of their day in class, reinforcing what they heard at school is a great way to increase the chances they will remember what they learned.

The program, called “Sleep for Your Health, “ will have 6 sessions including:

1. What is sleep? What does sleep do for you?
2. Sleepy, Dopey, and Grumpy; Consequences of Chronic Sleep Debt in Teens
3. Good sleep habits – Just Do It!
4. Chronobiology – You’ve Got Rhythm!

5. Common Sleep Disorders – Are You Sleeping?
6. Review session - Everything You Wanted to Know about Sleep But Were Afraid to Ask

At the conclusion of the sleep program, I will ask students to take a short quiz to see if they understand the concepts that were presented. I will also ask for their suggestions about how the curriculum could be improved. I would like for you to complete the same brief survey. I will also use your suggestions to improve the program when it is taught again. This is the first time such in-depth information about sleep has been included in the middle school curriculum. Your feed back throughout the process will be very valuable.

If you have any questions or concerns, please feel free to contact me at Barbara.Richardson@email.wsu.edu or call me at #255-6845.

Sincerely yours,

Barb Richardson, MN, RN

Washington State University, College of Nursing

Week 2, Report to Parents

Dear Parents of Glover Sleep Study participants,

I have completed the first round of collecting information about sleep using the actiwatches. I expected to find that some students are not getting the recommended 9 hours of sleep most nights. However, I was quite surprised at the extent of sleep debt experienced by most of the students participating in the study. Of the 48 students who wore an actiwatch for 1 week, only 2 youth routinely slept at least 9 hours a night on school nights. Only 5 additional students slept an average of 8.5 hours on school nights. Some students appear to be getting about half of the sleep they need to look, feel, and do their best.

Many students do obtain more sleep on weekends than school nights, but not enough to make up for the chronic sleep debt they are experiencing during the week. Thinking that you can “catch-up” on sleep once or twice a week has not been proven very effective at eliminating the cognitive, behavioral, and health problems that may result from getting too little sleep most of the time.

Your daughter or son was given a copy of their individual results (sleep patterns) in class. They are free to take these results home and discuss them with you. Last week, students learned about the consequences of not getting enough sleep on a regular basis. This Friday, students will learn about ways to improve their sleep habits. I encourage you to talk with your son or daughter and set realistic expectations for getting sufficient sleep. It’s unlikely that students will go from

getting 6.5 hours of sleep a night to the recommended 9 hours a night in a short period of time. However, increasing the amount of sleep your daughter or son gets by even 15 to 30 minutes each night may bring about a decrease in daytime sleepiness.

Ask your student to tell you the story of Randy Gardner, the teen that stayed awake for 11 days and nights as a science fair experiment. You might also encourage your adolescent to set a personal goal of trying to get 9 hours of sleep a night for just 1 week, to see if they feel a bit less like “Sleepy,” “Dopey,” or “Grumpy,” three of Disney’s famous seven dwarfs.

Again, thank you for allowing your student to participate in the Glover sleep study. If you have any questions or concerns, please don’t hesitate to contact me at #255-6845.

Sincerely yours,

Barbara Richardson, MN, RN

WSU College of Nursing

Weeks 3 and 4, Report to Parents

Dear Sleep Study Parent,

Last week, I did not have an opportunity to meet with your son or daughter's class, as many students were out of the building on Friday morning, a reward for having perfect attendance so far this year. Therefore, today we covered 2 topics..... tips for getting better sleep and biological clocks or "circadian rhythms." Enclosed is the information the students received in class on these two subjects.

I also asked the study participants to set a goal for themselves to get *closer* to 9 hours of sleep each night. It is highly unlikely that if a student is used to getting only 7.5 hours of sleep on school nights, that they will suddenly figure out how to carve out an extra 90 minutes in their average day, in order to get the recommended 9 hours sleep each night. Rather, I asked each student to set a *realistic* goal and then write down one step they believed they could take towards meeting that goal. Please take a few minutes to ask your son or daughter what they believe is a realistic goal and how they plan to reach that goal. Your reinforcement will go a long ways toward helping your teen establish a regular sleep schedule that help them look, feel, and do their best.

Ask your student to share with you two things they can do ensure getting a good night's sleep (also know as *sleep DO's*), and two things that can hinder getting (or staying) asleep (also known as *sleep DON'TS*).

Lastly, it is important for you to know that as your teen moves in to adolescence, they may naturally have trouble falling asleep before 11p.m. Getting up in the morning before 9a.m. may also be a real struggle. This shift in their biological clock (or circadian rhythm) is normal. Unfortunately, early school start times do not allow most teens to operate on their natural (biologically preferred) schedule. If your teen complains of not being able to fall asleep even though they go to bed in plenty of time to get 9 hours of sleep, be a little sympathetic. On the other hand, helping them establish a regular sleep routine that includes a time for winding down and relaxing prior to going to bed will help.

Be sure to let me know if you have any questions.

Thank you again for your participation.

Sincerely yours,

Barb Richardson, RN, MN

Week 5 Report to Parents

Dear Parents of a Glover Middle School sleep study participant,

Just prior to the Thanksgiving break from school, your son or daughter learned about some of the sleep disorders that are common in adolescents. Attached you will find a summary of the most common problems that teens may experience with regards to their sleep. If you or one of your family members feel that you may have one of these disorders, please tell your regular health care provider about the signs and symptoms you are experiencing.

Included with this mailing is a one page assessment and evaluation of the sleep curriculum. There are 10 true/ false questions that cover the concepts in the curriculum that I believe were the most important for the students to learn. Take the quiz if you'd like, and ask your student for help if you're not sure about any of the answers. More importantly, I would like for you to answer the last 4 questions that relate to evaluating the materials you received over the past month via mail or email. I would like to use the sleep curriculum again in the future, but need your feedback in order to make improvements. I will enclose an addressed and stamped envelope for your convenience. It should take you just a few minutes to complete the form, but the information will be of great value to me.

Lastly, your daughter / son will be asked to wear the actiwatch again, the week of December 8-15th (Tuesday to Tuesday). The actiwatch measures total sleep time, so I will be able to determine whether each participant is moving towards their personal goal of getting closer to 9 hours of sleep most nights.

My sincere thanks for allowing your student to participate in the sleep research study. Working with the youth at Glover Middle School has been a lot of fun and a most rewarding experience. Sincerely yours, Barbara Richardson, RN, MN

APPENDIX C

Sleep Diary for (your name) _____

Fill out this page right after you get up in the morning!

Today's date: _____

1. I got into bed last night at _____ am pm
2. I closed my eyes and tried to fall asleep at _____ am pm
3. I woke up this morning at _____ am pm
4. I got out of bed at _____ am pm
5. I took a nap yesterday from _____ am pm until _____ am pm
6. I took off the acti-watch yesterday from ___ am pm until ___ am pm

Today's date: _____

1. I got into bed last night at _____ am pm
2. I closed my eyes and tried to fall asleep at _____ am pm
3. I woke up this morning at _____ am pm
4. I got out of bed at _____ am pm
5. I took a nap yesterday from _____ am pm until _____ am pm
6. I took off the acti-watch yesterday from ___ am pm until ___ am pm

APPENDIX D

Institutional Review Board, Recruitment letters, Parent Consent and Student Assent Forms

MEMORANDUM :

TO: Ruth Bindler and Barbara Richardson

FROM: Malathi Jandhyala (for) Dennis Garcia, M.D. and Matt Layton, M.D., Co- Chairs, WSU

Institutional Review Board (3005)

DATE: 9/15/2009

SUBJECT: Approval of amendment to IRB Number #10973

Your proposal to amend the protocol titled "Alleviating Chronic Sleep Debt in Early Adolescence - Can a School-Based Intervention Make a Difference?" (IRB #10973) was reviewed for the protection of the subjects participating in the study. Based on the information received from you, the IRB has approved your amendment request on 9/15/2009. This amendment includes: Minor changes on the parental permission form for experimental and control groups. IRB approval indicates that the amendments described to the previously approved study protocol are designed to adequately protect the subjects participating in the study. This approval does not relieve the investigator from the responsibility of providing continuing attention to ethical considerations involved in the utilization of subjects participating in the study. It is important to note that this approval is for the amended research protocol, and does not alter the existing continuing review schedule. The approval for this Human Subjects Research Study expires 7/29/2010. If any more changes are made to the study protocol you must notify the IRB with an additional Request for Amendment and receive approval before implementation. If you have questions, please contact the Institutional Review Board at (509)

335-3668. Any revised materials can be mailed to Office of Research Assurances (Campus Zip 3005), faxed to (509) 335-6410, or in some cases by electronic mail, to irb@wsu.edu.

Review Type: Full Board Review Category:

Full Board Date Received: 9/15/2009 OGRD No.: N/A Agency: N/A

Sincerely,

Malathi Jandhyala

Human Subjects Review Coordinator

Office of Research Assurances

Albrook 205

PO Box 643005, Pullman, WA 99164-3005

E-mail: mjandhyala@wsu.edu

Phone: 509-335-3668

Fax: 509-335-6410

September 8, 2009

Barbara Richardson, RN, MN

P O Box 1495

Spokane, WA 99210-1495

Dear Ms. Richardson,

Your proposal to study *Alleviating Chronic Sleep Debt in Early Adolescence—Can a School-Based Intervention Make a Difference* has been approved by the Spokane Public Schools Research Council at their meeting on September 3, 2009.

You may conduct your research at Glover Middle School as outlined in your proposal:

- Recruitment of two classes of 7th and 8th grade students enrolled in Fitness & Health classes for the Fall Semester 2009.
- One class will serve as an experimental group, receiving information about the importance of adequate sleep for optimal physical, emotional and intellectual development. The other class will serve as a comparison group, with class as usual.
- A measure of sleep and sleepiness will be taken in both groups in September. The sleep educational program will be implemented for approximately 20 minutes once a week for six weeks. Sleep and sleepiness will be measured again for both groups at the conclusion of the sleep curriculum in early December.

Please submit the findings of your research for review by the district's Research Council upon completion of your study. Thank you for your interest in Spokane Schools.

Sincerely,

Razak Garoui, PhD

Research Council Coordinator

Director, Assessment & Program Evaluation

CC: Council Members and Extended Members

Travis Schulhauser, Principal, Glover Middle Schools

Peter Ellis, Coordinator, Health & Fitness

September 21, 2009

Dear Parents,

Your child that is enrolled in Fitness and Health during first period at Glover Middle School is eligible to participate in a unique opportunity that will help nurses learn more about sleep in young teens. I am writing to ask your permission for your child to be a part of a special program. This semester, your student will be learning about the importance of establishing healthy habits. Measuring the total amount of time your child generally sleeps will provide one additional indicator of his or her overall health. This project is being done to determine how much, on average, middle school students sleep on school nights and weekend nights. Just like diet and physical activity, sufficient sleep is essential for normal growth and development, physical and emotional health, and the ability to do well in school. In order to learn more about how sleep impacts health and well being, more information is needed about how to accurately measure sleep and sleepiness in adolescents.

We must have your written permission for your child to take part in the study. Your child will also be asked if they wish to participate. If you both agree, he or she will be asked to wear a special watch, called an actiwatch, for 7 consecutive days and nights without taking it off. It looks much like a digital sport watch, but it is actually a small computer chip that stores information about activity and sleep. Information from the actiwatch will be downloaded to a computer that will print out a graph of your child's level of activity and sleep. There will not be any personal information on the printed graphs that will identify your child. If you are interested, you may request a copy of the information that is collected and it will be mailed to you.

If you agree to allow your child to take part in this program, please talk it over with your child, then read, sign, and return the attached permission and contact forms in the enclosed envelope. If you believe your child is generally more reliable than the U.S. Postal Service, you may send the forms back to school with your student and have them give the forms to Mr. or Mrs. Crowley. If you think the US Postal Service is more likely to deliver the signed forms, please mail them as soon as possible in the enclosed stamped envelope.

If you have ANY questions, either before you sign the forms or when your child is wearing the acti-watch, please contact Barb Richardson at #255-6845 or barbara.richardson@email.wsu.edu.

Thank you, for considering this opportunity to help nurses learn more about sleep as it relates to health in middle school students.

Sincerely yours,

Barb Richardson, RN, MN
Washington State University
College of Nursing

Dear Parents,

Your child that is enrolled in Fitness and Health during 2nd period at Glover Middle School is eligible to participate in a unique opportunity that will help nurses learn more about sleep in young teens. I am writing to ask your permission for your child to be a part of a special program. This semester, your student will be learning about the importance of establishing healthy habits. Measuring the total amount of time your child generally sleeps will provide one additional indicator of his or her overall health. This project is being done to determine how much, on average, middle school youth sleep on school nights and weekend nights. Just like diet and physical activity, sufficient sleep is essential for normal growth and development, physical and emotional health, and the ability to do well in school. In order to learn more about how sleep impacts health and well being, more information is needed about how to accurately measure sleep and sleepiness in adolescents.

We must have your written permission for your child to take part in the study. Your child will also be asked if they wish to participate. If you both agree, he or she will be asked to wear a special watch, called an actiwatch, for 7 consecutive days and nights without taking it off. It looks much like a digital sport watch, but it is actually a small computer chip that stores information about activity and sleep. Information from the actiwatch will be downloaded to a computer that will print out a graph of your child's level of activity and sleep. There will not be any personal information on the printed graphs that will identify your child. If you are interested, you may request a copy of the information that is collected and it will be mailed to you.

Your student will be receiving information about the benefits of establishing healthy sleep habits in class for six weeks. Additionally, if you agree to have your student participate, *you* will receive weekly updates containing similar knowledge, allowing you to have access to the same

information your son or daughter is learning. Suggestions on how you can reinforce what they are learning about sleep will also be included. Please indicate whether you would like to receive the educational materials and additional resources by email or U.S. mail. Your contact information, including your email address will remain confidential. If you do not currently have access to a computer for personal use, there are computers available at the Spokane Public Library located near Glover at the corner of Belt & Wellesley (West 2111 Wellesley Avenue, phone #444-5390).

If you agree to allow your child to take part in this program, please talk it over with your child, then read, sign, and return the attached permission and contact forms in the enclosed envelope. If you believe your child is generally more reliable than the U.S. Postal Service, you may send the forms back to school with your student and have them give the forms to Mr. or Mrs. Crowley. If you think the U.S. Postal Service is more likely to deliver the signed forms, please mail them as soon as possible in the enclosed stamped envelope.

If you have ANY questions, either before you sign the forms or when your child is wearing the acti-watch, please contact Barb Richardson at #255-6845 or barbara.richardson@email.wsu.edu.

Thank you, for considering this opportunity to help nurses learn more about sleep as it relates to health in middle school students.

Sincerely yours,

Barbara Richardson, RN, MN, Washington State University, College of Nursing

Page 1 of 4

WSU IRB #10973-001

Approved: 9/15/09

Valid until: 7/29/2010

WASHINGTON STATE UNIVERSITY

College of Nursing

Research Study Parent Permission Form

Study Title: Alleviating Chronic Sleep Debt in Early Adolescence – Can a School-Based Intervention Make a Difference?

Researchers: Ruth Bindler, RNC, PhD, Professor

Barbara Richardson, RN, MN contact #509-280-2647

You are being asked to allow your child to take part in a research study carried out by Dr. Bindler and a PhD graduate student, Barb Richardson. Please read this form carefully, taking as much time as you need. Ask the researcher to explain anything you don't understand. This study has been approved for human subjects to take part by the Washington State University Institutional Review Board.

You may refuse to give permission, or you may withdraw your permission for your child to be in the study, for any reason. Your child will also be asked if he or she would like to take part in this study. Even if you give your permission, your child can decide not to be in the study or to leave the study at any time.

What is this research study about?

This research study is being done to determine how much, on average, middle school students sleep on school nights and weekend nights. Sufficient sleep is essential for normal growth and development, physical and emotional health, and the ability to do well in school. In order to learn more about how sleep impacts health and well being, more information is needed about how to accurately measure sleep and daytime sleepiness in adolescents.

We are asking your permission for your child to be in the study because he or she is enrolled in fitness and health fall semester at school. During this class information about muscular strength and endurance, heart rate, weight, blood pressure, and various other health indicators will be collected. Measuring the total amount of time your child sleeps on average school and weekend nights will provide one additional indicator of his or her overall health.

Taking part in the study will take seven consecutive days and nights for gathering information about sleep – once in October and again in early December.

What will my child be asked to do if he or she is in this research study?

If your child takes part in the study, he or she will be asked to wear a special watch, called an actiwatch, for 7 consecutive days and nights, without taking it off. It looks much like a digital sport watch, but it is actually a small computer chip that stores information about activity and sleep. Information from the actiwatch will be downloaded to a computer that will print out a graph of your child's level of activity and sleep in one minute intervals. There will not be any personal information on the printed graphs that

Page 2 of 4

WSU IRB #10973-001

Approved: 9/15/09

Valid until: 7/29/2010

will identify your child. If you are interested, a copy of the information that is collected will be provided to you.

Students will also be asked to complete a brief, 16 question survey about how sleepy they usually feel on an average day. Your child will be asked to fill out this survey on the day they finish wearing the actiwatch. Information about sleep collected from the actiwatch will be compared to your child's responses on this survey, called the Cleveland Adolescent Sleepiness Questionnaire, to see if there is any relationship between the

time your child actually sleeps and how tired your child typically feels. Your child may refuse to answer any question on the survey. A copy of the survey will be provided to you on request. Assessments of sleep will occur in September and again in December.

Are there any benefits to my child if he or she is in this research study?

The potential benefits to your child for taking part in this study include learning how much sleep he/she typically obtains on school nights and weekend nights, and how this compares to the recommended 9 hours per night that is needed for optimal physical, emotional health and intellectual development. Setting personal goals for one's own health may bring about positive changes.

Your child's grade for health and fitness will not be impacted by whether or not they participate in the study.

Are there any risks to my child if he or she is in this research study?

Your child may feel embarrassed about assessment of their sleep. Privacy will be maintained so that students do not learn each others' sleep habits or answers on questionnaires. Students might feel nervous about someone learning their answers on the questionnaires; we will reassure them that parents and no one else will learn those answers. We will be sure your child knows that in addition to the researcher, the school nurse is available for concerns raised by participating in the study that they want to

discuss. The student is unlikely to experience any discomfort related to wearing the actiwatch.

Will information about my child be kept private?

Information obtained as a part of this study will be strictly private and confidential. The information will be used only for research. Names of the youth participating in the study will not be kept by the researchers beyond conclusion of the research in December.

Signed permission and assent forms will be kept in a locked file in a different location from the data. The completed study information will be kept in a locked file at a WSU location. At no time will any youth's name be available to anyone other than the researchers. Study results will be reported only as part of the whole group.

The results of this study may be published or presented at professional meetings, but your child's name will not be used or associated with the findings. The data for this study will be kept for a minimum of 3 years after the completion of the study.

Are there any costs or payments for your child being in this research study?

There will be no costs to you or your child for taking part in this study.

WSU IRB #10973-001

Approved: 9/15/09

Valid until: 7/29/2010

You and your child will not receive money or any other form of compensation for taking part in this study.

What are my child's rights as a research study volunteer?

Your child's participation in this study is completely voluntary. Your child may choose not to take part in this study, choose not to answer specific questions, or leave the study at any time. There will be no penalty or loss of benefits to which you or your child are entitled if you choose not to give your permission for your child to take part or your child withdraws from the study.

Who can I talk to if I have questions?

If you have questions about this study or the information in this form, please contact the researcher:

Barbara Richardson, RN, MN

Washington State University College of Nursing

P.O. Box 1495

Spokane, WA 99210-1495

Phone #509-255-6845

Email address: Barbara.Richardson@email.wsu.edu

If you have questions about your rights or your child's rights as a research participant, or would like to report a concern or complaint about this study, please contact the Washington State University Institutional Review Board at (509) 335-3668, or e-mail irb@wsu.edu, or regular mail at: Albrook 205, PO Box 643005, Pullman, WA 99164-3005. The WSU Institutional Review Board (IRB) has reviewed and approved this study for human subject participation.

What does my signature on this consent form mean?

Your signature on this form means that:

- You understand the information given to you in this form
- You have been able to ask the researcher questions and state any concerns
- The researcher has responded to your questions and concerns
- You believe you understand the research study and the potential benefits and risks that are involved for your child.
- You understand that even if you give your permission, your child may choose not to take part in the study.

Statement of Consent

I give my voluntary permission for my child to take part in this study. I will be given a copy of this consent document for my records.

Signature of Parent Date

Page 4 of 4

WSU IRB #10973-001

Approved: 9/15/09

Valid until: 7/29/2010

Printed Name of Parent

Statement of Person Obtaining Informed Consent

I have carefully explained to the parent of the child being asked to take part in the study what will happen to their child.

I certify that when this person signs this form, to the best of my knowledge, he or she understands the purpose, procedures, potential benefits, and potential risks of his or her child's participation.

I also certify that he or she:

- Speaks the language used to explain this research
- Reads well enough to understand this form or, if not, this person is able to hear and understand when the form is read to him or her
- Does not have any problems that could make it hard to understand what it means for his or her child to take part in this research.

Signature of Person Obtaining Consent Date

Printed Name of Person Obtaining Consent

Research Co-investigator

Role of person obtaining consent

Page 1 of 3

WSU IRB #10973-001

Approved: 7/30/2009

Valid until: 7/29/2010

WASHINGTON STATE UNIVERSITY

College of Nursing

Research Study Assent Form

(For 11-14 year age range in social/behavioral studies)

Study Title: Alleviating Chronic Sleep Debt in Early Adolescence – Can a School-Based Intervention Make a Difference?

Researchers: Ruth Bindler, RNC, PhD, Professor (Primary investigator)

phone #509- 324-7403

Barbara Richardson, NR, MN, PhD student (co-investigator)

Phone #509-255-6845

My name is Barb Richardson. I am from Washington State University. I and the

other person listed at the top of this form are inviting you to take part in a research study. Your parent(s) know we are talking with you about the study. This form will tell you about the study to help you decide whether or not you want to take part in it.

What is this study about?

In this study, we want to learn about how much sleep middle school students generally get on school nights and weekend nights and how sleepy you usually feel during the day.

What am I being asked to do?

If you decide to be in the study, we will ask you to wear a special watch called an actiwatch that looks like a wristwatch with a blank face. You will be asked to wear the watch on your wrist without taking it off for 7 days and nights. It looks much like a digital sport watch, but it actually contains a small computer chip that stores information about activity and sleep. The actiwatch is waterproof and may be worn during all normal daily experiences such as showering, doing household chores, and extracurricular athletics. There are no times when you will need to take it off. You will also be asked to fill out a survey with 16 questions about how tired you generally feel on an average day. We will be measuring your sleep for 1 week in September and again in December.

What are the benefits to me for taking part in the study?

Taking part in this research study may help you reach a personal goal you may choose to set to get enough sleep most nights. Taking part in the study might not

Page 2 of 3

WSU IRB #10973-001

Approved: 7/30/2009

Valid until: 7/29/2010

help you in any way, but it may help us learn how to help other students get enough sleep.

Can anything bad happen if I am in this study?

We think there are few risks to you by being in the study, but some kids might become anxious because of some of the questions on the survey about how tired you feel. You don't have to respond any of the questions you don't want to answer. If you become upset, let us know and we will have your fitness teacher, Mr. or Mrs. Crowley, help you with those feelings. Also, other people may ask you why you are wearing a watch that doesn't tell time. We will show you the watch before you agree to participate in the study, tell you how the special actiwatch works, and answer any questions you have so you can explain it to

anyone that may ask you about why you're wearing it. It is unlikely you will feel any discomfort when you wear the actiwatch and the device should not cause any harm.

Who will know that I am in the study?

We won't tell anybody that you are in this study and everything you tell us and do will be private and confidential. Your parent may know that you took part in the study, but we won't tell them anything you said or did, either. When we tell other people or write articles about what we learned in the study, we won't include your name or that of anyone else who took part in the study.

Do I have to be in the study?

No, you don't. The choice is up to you. No one will get angry or upset if you don't want to do this. And you can change your mind anytime if you decide you don't want to be in the study anymore. Your grade in health and fitness class will not be affected by whether or not you choose to participate.

What if I have questions?

If you have questions at any time, you can ask us and you can talk to your parent about the study. We will give you a copy of this form to keep. If you want to ask

us questions about the study, call or email the researcher,

Barb Richardson at #255-6845 or Barbara.Richardson@email.wsu.edu

The Washington State University Institutional Review Board has reviewed this study to make sure that the rights and safety of people who take part in the study are protected. If you have questions about your rights in the study, or you are unhappy about something that happens to you in the study, you can contact them at (509) 335-3668 or irb@wsu.edu.

Page 3 of 3

WSU IRB #10973-001

Approved: 7/30/2009

Valid until: 7/29/2010

Do you have any questions about the study now?

IF YOU WANT TO BE IN THE STUDY, SIGN AND PRINT YOUR NAME ON
THE LINE BELOW:

Sign your name Date

Print your name

Statement of Person Obtaining Assent

I have carefully explained to the child taking part in the study what he or she can expect.

I certify that, to the best of my knowledge, the child understands the purpose, procedures, potential risks and benefits of the study and his or her rights as a participant.

I also certify that he or she:

- Speaks the language used to explain the research
- Reads well enough to understand this form or, if not, this child is able to

hear and understand when the form is read to him or her

· Does not have any problems that could make it hard to understand what it means to take part in this research.

Signature of person obtaining assent Date

Page 1 of 4

WSU IRB #10973-001

Approved: 9/15/09

Valid until: 7/29/2010

WASHINGTON STATE UNIVERSITY

College of Nursing

Research Study Parent Permission Form

Study Title: Alleviating Chronic Sleep Debt in Early Adolescence – Can a School-Based Intervention Make a Difference?

Researchers: Ruth Bindler, RNC, PhD, Professor

Barbara Richardson, RN, MN contact #509-280-2647

You are being asked to allow your child to take part in a research study carried out by Dr. Bindler and a PhD graduate student, Barb Richardson. Please read this form carefully, taking as much time as you need. Ask the researcher to explain anything you don't understand. This study has been approved for human subjects to take part by the Washington State University Institutional Review Board.

You may refuse to give permission, or you may withdraw your permission for your child to be in the study, for any reason. Your child will also be asked if he or she would like to take part in this study. Even if you give your permission, your child can decide not to be in the study or to leave the study at any time.

What is this research study about?

This research study is being done to determine how much, on average, middle school students sleep on school nights and weekend nights. Sufficient sleep is essential for normal growth and development, physical and emotional health, and the ability to do well in school. In order to learn more about how sleep impacts health and well being, more information is needed about how to accurately measure sleep and daytime sleepiness in adolescents.

We are asking your permission for your child to be in the study because he or she is enrolled in fitness and health fall semester at school. During this class information about

muscular strength and endurance, heart rate, weight, blood pressure, and various other health indicators will be collected. Measuring the total amount of time your child sleeps on average school and weekend nights will provide one additional indicator of his or her overall health.

Taking part in the study will take seven consecutive days and nights for gathering information about sleep – once in October and again in early December. Your child is currently enrolled in health and fitness period 2 where they will receive basic information about the importance of sleep during their regularly scheduled class once a week for six weeks. On the same days your son / daughter is learning about sleep in class, you will be sent, via email or US mail, similar information about various aspects of sleep and the important role sufficient sleep plays in the normal physical, emotional, and intellectual health of adolescents.

What will my child be asked to do if he or she is in this research study?

If your child takes part in the study, he or she will be asked to wear a special watch, called an actiwatch, for 7 consecutive days and nights, without taking it off. It looks

Page 2 of 4

WSU IRB #10973-001

Approved: 9/15/09

Valid until: 7/29/2010

much like a digital sport watch, but it is actually a small computer chip that stores information about activity and sleep. Information from the actiwatch will be downloaded to a computer that will print out a graph of your child's level of activity and sleep in one minute intervals. There will not be any personal information on the printed graphs that will identify your child. If you are interested, a copy of the information that is collected will be provided to you.

Students will also be asked to complete a brief, 16 question survey about how sleepy they usually feel on an average day. Your child will be asked to fill out this same survey on the day they finish wearing the actiwatch. Information about sleep collected from the actiwatch will be compared to your child's responses on this survey, called the Cleveland Adolescent Sleepiness Questionnaire, to see if there is any relationship between the time your child actually sleeps and how tired your child typically feels. Your child may refuse to answer any question on the survey. A copy of the survey will be provided to you on request. The 7 night assessments of sleep will occur in September and again in December.

Your child *and* you will be asked to complete a 10 question survey about the educational program at the conclusion of the study. This survey will be used to improve the curriculum for future use with teens and families.

Are there any benefits to my child if he or she is in this research study?

The potential benefits to your child and you for taking part in this study include learning how much sleep he/she typically obtains on school nights and weekend nights, and how this compares to the recommended 9 hours per night that is needed for optimal physical, emotional health and intellectual development. Setting personal goals for one's own health may bring about positive changes.

Your child's grade for health and fitness will not be impacted by whether or not they participate in the study.

Are there any risks to my child if he or she is in this research study?

Your child may feel embarrassed about assessment of their sleep. Privacy will be maintained so that students do not learn each others sleep habits or answers on questionnaires. Students might feel nervous about someone learning their answers on the questionnaires; we will reassure them that parents and no one else will learn those answers. We will be sure your child knows that in addition to the researcher, the school nurse and their health teachers are available for concerns raised by participating in the study that they want to discuss. The student is unlikely to experience any discomfort related to wearing the actiwatch.

Will information about my child be kept private?

Information obtained as a part of this study will be strictly private and confidential. The

information will be used only for research. Names of the youth participating in the study will not be kept by the researchers beyond conclusion of the research in December. Signed permission and assent forms will be kept in a locked file in a different location from the data. The completed study information will be kept in a locked file at a WSU location. At no time will any youth's name be available to anyone other than the researchers. Study results will be reported only as part of the whole group.

Page 3 of 4

WSU IRB #10973-001

Approved: 9/15/09

Valid until: 7/29/2010

The results of this study may be published or presented at professional meetings, but your child's name will not be used or associated with the findings. The data for this study will be kept for a minimum of 3 years after the completion of the study.

Are there any costs or payments for your child being in this research study?

There will be no costs to you or your child for taking part in this study.

You and your child will not receive money or any other form of compensation for taking part in this study.

What are my child’s rights as a research study volunteer?

Your child’s participation in this study is completely voluntary. Your child may choose not to take part in this study, choose not to answer specific questions, or leave the study at any time. There will be no penalty or loss of benefits to which you or your child are entitled if you choose not to give your permission for your child to take part or your child withdraws from the study.

Who can I talk to if I have questions?

If you have questions about this study or the information in this form, please contact the researcher:

Barbara Richardson, RN, MN

Washington State University College of Nursing

P.O. Box 1495

Spokane, WA 99210-1495

Phone #509-255-6845

Email address: Barbara.Richardson@email.wsu.edu

If you have questions about your rights or your child’s rights as a research participant, or would like to report a concern or complaint about this study, please contact the Washington State University Institutional Review Board at (509) 335-3668, or e-mail

irb@wsu.edu, or regular mail at: Albrook 205, PO Box 643005, Pullman, WA 99164-3005. The WSU Institutional Review Board IRB) has reviewed and approved this study for human subject participation.

What does my signature on this consent form mean?

Your signature on this form means that:

- You understand the information given to you in this form
- You have been able to ask the researcher questions and state any concerns
- The researcher has responded to your questions and concerns
- You believe you understand the research study and the potential benefits and risks that are involved for your child.
- You understand that even if you give your permission, you child may choose not to take part in the study.

Statement of Consent

I give my voluntary permission for my child to take part in this study. I will be given a

Page 4 of 4

WSU IRB #10973-001

Approved: 9/15/09

Valid until: 7/29/2010

copy of this consent document for my records.

Signature of Parent Date

Printed Name of Parent

Statement of Person Obtaining Informed Consent

I have carefully explained to the parent of the child being asked to take part in the study what will happen to their child.

I certify that when this person signs this form, to the best of my knowledge, he or she understands the purpose, procedures, potential benefits, and potential risks of his or her child's participation.

I also certify that he or she:

- Speaks the language used to explain this research
- Reads well enough to understand this form or, if not, this person is able to hear and understand when the form is read to him or her
- Does not have any problems that could make it hard to understand what it means for his or her child to take part in this research.

Signature of Person Obtaining Consent Date

Printed Name of Person Obtaining Consent

Research Co-investigator

Role of person obtaining consent

Page 1 of 3

WSU IRB #10973-001

Approved: 7/30/2009

Valid until: 7/29/2010

WASHINGTON STATE UNIVERSITY

College of Nursing

Research Study Assent Form

(For 11-14 year age range in social/behavioral studies)

Study Title: Alleviating Chronic Sleep Debt in Early Adolescence – Can a School-Based Intervention Make a Difference?

Researchers: Ruth Bindler, RNC, PhD, Professor (Primary investigator)

phone #509- 324-7403

Barbara Richardson, NR, MN, PhD student (co-investigator)

Phone #509-255-6845

My name is Barb Richardson. I am from Washington State University. I and the other person listed at the top of this form are inviting you to take part in a research study.

Your parent(s) know we are talking with you about the study. This form will tell you about the study to help you decide whether or not you want to take part in it.

What is this study about?

In this study, we want to learn about how much sleep middle school students generally get on school nights and weekend nights and how sleepy you usually feel during the day.

What am I being asked to do?

If you decide to be in the study, we will ask you to wear a special watch called an

actiwatch that looks like a wristwatch with a blank face. You will be asked to wear the watch on your wrist without taking it off for 7 days and nights. It looks much like a digital sport watch, but it actually contains a small computer chip that stores information about activity and sleep. The actiwatch is waterproof and may be worn during all normal daily experiences such as showering, doing household chores, and extracurricular athletics. There are no times when you will need to take it off. You will also be asked to fill out a survey with 16 questions about how tired you generally feel on an average day. We will be measuring your sleep in September and again in December.

Because you are in health and fitness class during period (X) you will be getting information about sleep during class, once weekly for 6 weeks. You will be asked to set a personal goal related to how much sleep you want to get. At the end of the 6 weeks you will be asked to fill out a short evaluation form about the curriculum. Information from your answers will be used to improve the classes about sleep in the future.

What are the benefits to me for taking part in the study?

Taking part in this research study may help you reach a personal goal you may choose to set to get enough sleep most nights. Taking part in the study might not help you in any way, but it may help us learn how to help other students get enough sleep.

WSU IRB #10973-001

Approved: 7/30/2009

Valid until: 7/29/2010

Can anything bad happen if I am in this study?

We think there are few risks to you by being in the study, but some kids might become anxious because of some of the questions on the survey about how tired you feel. You don't have to respond any of the questions you don't want to answer. If you become upset, let us know and we will have your fitness teacher, Mr. or Mrs. Crowley, help you with those feelings. Also, other people may ask you why you are wearing a watch that doesn't tell time. We will show you the watch before you agree to participate in the study, tell you how the special actiwatch works, and answer any questions you have so you can explain it to anyone that may ask you about why you're wearing it. It is unlikely you will feel any discomfort when you wear the actiwatch and the device should not cause any harm.

Who will know that I am in the study?

We won't tell anybody that you are in this study and everything you tell us and do will be private and confidential. Your parent may know that you took part in the study, but we won't tell them anything you said or did, either. When we tell other people or write

articles about what we learned in the study, we won't include your name or that of anyone else who took part in the study.

Do I have to be in the study?

No, you don't. The choice is up to you. No one will get angry or upset if you don't want to do this. And you can change your mind anytime if you decide you don't want to be in the study anymore. Your grade in health and fitness class will not be affected by whether or not you choose to participate.

What if I have questions?

If you have questions at any time, you can ask us and you can talk to your parent about the study. We will give you a copy of this form to keep. If you want to ask us questions about the study, call or email the researcher,

Barb Richardson at #255-6845 or Barbara.Richardson@email.wsu.edu

The Washington State University Institutional Review Board has reviewed this study to make sure that the rights and safety of people who take part in the study are protected.

If you have questions about your rights in the study, or you are unhappy about something that happens to you in the study, you can contact them at (509) 335-3668 or irb@wsu.edu.

Do you have any questions about the study now?

IF YOU WANT TO BE IN THE STUDY, SIGN AND PRINT YOUR NAME ON THE LINE
BELOW:

Page **3** of **3**

WSU IRB #10973-001

Approved: 7/30/2009

Valid until: 7/29/2010

Sign your name Date

Print your name

Statement of Person Obtaining Assent

I have carefully explained to the child taking part in the study what he or she can expect.

I certify that, to the best of my knowledge, the child understands the purpose, procedures, potential risks and benefits of the study and his or her rights as a participant.

I also certify that he or she:

- Speaks the language used to explain the research
- Reads well enough to understand this form or, if not, this child is able to hear and understand when the form is read to him or her
- Does not have any problems that could make it hard to understand what it means to take part in this research.

Signature of person obtaining assent

Date _____

APPENDIX E

Cleveland Adolescent Sleepiness Questionnaire

Today's Date: (fill in) ___/___/___

What is your age? (fill in years) ___ **What is your sex? (check one)** 1. Female 2. Male

We would like to know about when you might feel sleepy during a usual week. For each statement, mark the circle under the response that best fits with how often it applies to you. It's important to answer them yourself – don't have people help you. There are no right or wrong answers. For example, if we asked "I sleep with a pillow," and the response that best fit how often you sleep with a pillow was "often," you would mark the item as follows:

	Never (0 times per month)	Rarely (less than 3 times per month)	Sometimes (1-2 times per week)	Often (3-4 times per week)	Almost every day (5 or more times per week)
EXAMPLE					
I sleep with a pillow	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

Sleepiness Questions

	Never (0 times per month)	Rarely (less than 3 times per month)	Sometimes (1-2 times per week)	Often (3-4 times per week)	Almost every day (5 or more times per week)
1. I fall asleep during my morning classes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. I go through the whole school day without feeling tired	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I fall asleep during the last class of the day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I feel drowsy if I ride in a car for longer than five minutes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I feel wide-awake the whole day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. I fall asleep at school in my afternoon classes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Never (0 times per month)	Rarely (less than 3 times per month)	Sometimes (1-2 times per week)	Often (3-4 times per week)	Almost every day (5 or more times per week)
7. I feel alert during my classes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. I feel sleepy in the evening after school	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. I feel sleepy when I ride in a bus to a school event like a field trip or sports game	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. In the morning when I am in school, I fall asleep	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. When I am in class, I feel wide-awake	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. I feel sleepy when I do my homework in the evening after school	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. I feel wide-awake the last class of the day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. I fall asleep when I ride in a bus, car, or train	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. During the school day, there are times when I realize that I have just fallen asleep	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. I fall asleep when I do schoolwork at home in the evening	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Copyright © 2007 American Academy of Sleep Medicine.

To obtain permission for reproduction or use of the Cleveland Adolescent Sleepiness Questionnaire, send your request to Copyright Clearance Center via www.copyright.com. Please note permission is only granted for print use.

Spilsbury JC, Drotar D, Rosen CL et al. The cleveland adolescent sleepiness questionnaire: a new measure to assess excessive daytime sleepiness in adolescents. *J Clin Sleep Med* 2007;3(6):603-12.

APPENDIX F

Sleep for Your Health Assessment (student version)

Please circle the correct answer to the following 10 questions.

T=true F=false

T / F 1. Most teens need at least 9 hours of sleep every night in order to look, feel, and do your best each day.

T / F 2. When asleep, your body and brain are inactive, just resting.

T / F 3. Light signals your brain to know when it's time to be awake and darkness helps your brain know when to go to sleep.

T / F 4. Without enough sleep you may feel and act moody, be forgetful, have poor coordination, and problems concentrating.

T / F 5. Your body is able to adjust quickly to different sleep schedules.

T / F 6. To do your best on an important test, it's better to get at least 8 hours of sleep the night before than to drink caffeinated beverages and stay up all night studying.

T / F 7. Many teens may experience a shift in their circadian rhythms, making it difficult to fall asleep before midnight or fully wake up before 9am.

T / F 8. Vigorously exercising is a good way to unwind and relax right before going to bed.

T / F 9. Sleep disorders are rare, with few teens ever experiencing problems sleeping.

T / F 10. In order to get enough sleep you need to make sleep a priority and regularly practice good sleep habits.

How much do you feel you learned about sleep from the "Sleep for Your Health" course?

_____I learned very little

_____ I learned a few helpful things

_____ I learned quite a bit

_____ I learned a lot way more than I expected!

How likely are you to change your behavior (try to get enough sleep most nights) based on information presented in the “Sleep For Your Health” course and goals you have set?

_____ I’m not likely to change how much sleep I get most nights

_____ I’ll try to find ways to get closer to 9 hours of sleep a night when I can

_____ I’m already making changes in order to get 9 hours of sleep most nights

What were the best things (strengths) of the “Sleep for Your Health” course?

What were the worst things (weaknesses) of the Sleep for Your Health” course?

Please provide any suggestions you may have for improving the “Sleep for Your Health” course.

You may write on the reverse side of this page if you need more space for your reply.

Sleep for Your Health Assessment (parent version)

Please circle the correct answer to the following 10 questions.

T=true F=false

T / F 1. Most teens need at least 9 hours of sleep every night in order to look, feel, and do your best each day.

T / F 2. When asleep, your body and brain are inactive, just resting.

T / F 3. Light signals your brain to know when it's time to be awake and darkness helps your brain know when to go to sleep.

T / F 4. Without enough sleep you may feel and act moody, be forgetful, have poor coordination, and problems concentrating.

T / F 5. Your body is able to adjust quickly to different sleep schedules.

T / F 6. To do your best on an important test, it's better to get at least 8 hours of sleep the night before than to drink caffeinated beverages and stay up all night studying.

T / F 7. Many teens may experience a shift in their circadian rhythms, making it difficult to fall asleep before midnight or fully wake up before 9am.

T / F 8. Vigorously exercising is a good way to unwind and relax right before going to bed.

T / F 9. Sleep disorders are rare, with few teens ever experiencing problems sleeping.

T / F 10. In order to get enough sleep you need to make sleep a priority and regularly practice good sleep habits.

How much do you feel you learned about sleep from the "Sleep for Your Health" course?

_____ I learned very little

_____ I learned a few helpful things

_____ I learned quite a bit

_____ I learned a lot way more than I expected!

How likely are you to encourage your teen to change his or her behavior (try to get enough sleep most nights) *based on information presented in the “Sleep For Your Health” course?*

_____ I’m not likely to encourage him/her to change how much sleep they get most nights

_____ I’ll try to help my son / daughter find ways to get closer to 9 hours of sleep most nights

_____ I’m already encouraging my son/daughter to make changes in their schedule in order to get 9 hours of sleep most nights

What were the best things (strengths) of the “Sleep for Your Health” course?

What were the worst things (weaknesses) of the Sleep for Your Health” course?

Please provide any suggestions you may have for improving the “Sleep for Your Health” course.

You may write on the reverse side of this page if you need more space for your reply.