CAFFEINE CONSUMPTION AS A PREDICTOR OF SLEEP QUALITY, SLEEP HYGIENE, SUBJECTIVE SLEEPINESS, AND ACADEMIC PERFORMANCE AMONG NORTH TEXAS FEMALE COLLEGE STUDENTS

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KATHALENE M. HARRIS, MBA

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To the Dean of the Graduate School:

I am submitting herewith a dissertation written by Kathalene M. Harris entitled "Caffeine Consumption as a Predictor of Sleep Quality, Sleep Hygiene, Subjective Sleepiness, and Academic Performance Among North Texas Female College Students." I have examined this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy with a major in Health Studies.

Dissertation/Theses signature page is here.

To protect individuals we have covered their signatures.

DEDICATION

I dedicate this dissertation to my family and friends. Thank you for every encouraging word you offered to help me continue to move forward toward a goal set long ago and far away.

I thank each of you for every prayer and each reminder that What God has for me, is for me. Amen. It is done.

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"Life is not a journey to the grave with intentions of arriving safely in a pretty well-preserved body, but rather to skid in broadside, thoroughly used up, totally worn out and loudly proclaiming ... WOW! What a ride!"

Author Unknown

The ride to this point would not have been nearly as much fun without those of you who helped me along the way...and for that, I offer a hug, a kiss and a "fist bump" for each of you. Please accept my sincere thanks for a job well done! We made it.

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All praises to God from whom all blessings flow.

For I know the plans I have for you," declares the LORD, "plans to prosper you and not to harm you, plans to give you hope and a future. Jeremiah 29:11 (New International Version)

ABSTRACT

KATHALENE M. HARRIS

CAFFEINE CONSUMPTION AS A PREDICTOR OF SLEEP QUALITY, SLEEP HYGIENE, SUBJECTIVE SLEEPINESS, AND ACADEMIC PERFORMANCE AMONG NORTH TEXAS FEMALE COLLEGE STUDENTS

AUGUST 2009

Research during the last decade of the 20th Century reveals that Americans of all age groups are rapidly becoming members of a "sleep deprived nation". In fact, sleep disturbances are more prevalent in college students than in the general population. There is a considerable need for sleep hygiene awareness among college students. Understanding the role that sleep quality plays in academic success is paramount. Data from this research adds critical information to the health educator's knowledge base by outlining the effect of caffeine on sleep hygiene. It allows educators to focus on a single component of sleep hygiene that will make the most difference in student's sleep quality.

The present study used six survey instruments to describe whether caffeine consumption was a predictive factor of sleep quality, sleep hygiene, and academic performance among female college students in North Texas. One hundred and eighty-five female participants were surveyed using an electronic version of the Sleep Hygiene Index (SHI), the Epworth Sleepiness Scale (ESS), the Caffeine Consumption Questionnaire (CCQ), the Pittsburgh Sleep Quality Index (PSQI), and the Insomniacs' Perceived

Control over Sleep Questionnaire were deployed along with a general demographic questionnaire to collect data.

Descriptive statistics were used to illustrate the characteristics of the sample population as well as the dependent measures. Inferential statistics were used to test the hypotheses under study. Pearson's Product Moment Correlations were computed to test for significant relationships between the dependent variables, and between the dependent variables of the Perceived Control subscales, Sleep Hygiene, Sleepiness, GPA, and the PSQI. One way ANOVA and two-way MANOVA were conducted to test for significant differences between the dependent variables. Finally, multiple regression models were used in order to determine whether any of the demographic variables predicted the continuous dependent variables.

Caffeine intake is a positive predictor of sleep disturbances, sleepiness, and poor sleep quality. Additionally, multiple regression analysis showed that Medium-high intake of caffeine (306-487 mgs/day) predicted worse overall sleep quality as measured by the PSQI. While caffeine consumption was not found to be a significant predictor of academic performance multiple regression analysis results indicated that caffeine consumption is a significant predictor of subjective sleepiness, and a lack of perceived control of sleep.

The role of health educators and health services in meeting students' need for sleep related interventions is immense. Improving students' access to information through well-coordinated multi-media programs can have a significant impact. In fact, efforts directed at curtailing caffeine use may improve their sleep quality resulting in an

increase in learning capacity and academic performance. This is especially important for women who throughout their lifespan are at a disadvantage due to their gender.

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CHAPTER I

INTRODUCTION

Rationale

Research during the last decade of the 20th Century reveals that Americans of all age groups are rapidly becoming members of a "sleep deprived nation" (National Center on Sleep Disorders Research [NCSDR], 1997). The Institute of Medicine (2006) identifies the public health burden of chronic sleep deprivation as an immense problem affecting 50 to 70 million Americans. Since 1969, students' total sleep time per night had declined from an average of 7.5 hours to 6.5 hours by 1989 (Brown, Buboltz & Soper, 2006; Hicks & Pelligrini, 1991). Furthermore, since 2000, sleep difficulties continue to be number three on the American College Health Association-National College Health Assessment's (ACHA-NCHA) list of the top five impediments to academic performance (The American College Health Association [ACHA], 2007). In 2006, only 28.5% (n = 26,577) of students surveyed reported getting enough sleep in the last five of seven days to awake feeling rested (ACHA, 2007).

Sleep disturbances are more prevalent in college students than in the general population (Buboltz, Soper, Brown & Jenkins, 2002; McGee, Salafsky, & Hamilton, 2006). By late adolescence, sleep disorders are one of the most commonly noted health complaints (Smaldone, Honig, & Byrne, 2007; Yang, Wu, Hsieh, Liu, & Lu, 2003).

Approximately 15,000,000 American children ages six to seventeen are noted to suffer from problems associated with sleep deprivation (Smaldone et al., 2007). Beginning at age five the habitual amount of sleep on school nights falls one hour per night every three years (Fallone, Owens, & Deane, 2002). Progression into young adulthood with changes in living arrangements, freedom from parental supervision, and increased responsibility forces young adults to relegate sleep to a discretionary item. Together with irregular sleep-wake cycles, sleep deprivation then becomes the norm rather than the exception (Brown, Buboltz & Soper, 2002; Machado, Varella & Andrade 1998; McGee et al., 2006).

Current research exploring university students' sleep behaviors (ages 17-29), reveals that as little as 11% of students report good quality sleep, 73% report intermittent sleep problems, and 15% describe their sleep quality as poor (Buboltz et al., 2002). Engle-Friedman et al. (2003) reported that students acknowledged that they received less sleep than needed as often as one in every three days. Moreover, Skibinski (2007) reported that 60% of young adults ages 18-29 in their sample stated that they drove while drowsy in the past year, with 24% reporting that they were actually dozing off during driving in the past year.

Unfortunately, high school and college students are often unaware of how much sleep deprivation affects their cognitive functioning. Increased risk of unintentional injuries, low grades and poor school performance, difficulty controlling emotions, increased tendency toward depression and the rampant use of stimulants are noted as

consequences of poor sleep both in adolescents and in young adults (National Sleep Foundation [NSF], 2000).

Recently, there has been significant concern about the use of prescription drugs, particularly those prescribed for attention deficit disorders (ADD) and attention deficit hyperactivity disorder (ADHD) such as Ritalin (Novartis Pharmaceuticals Corp., East Hanover, NJ) and Adderall (Shire US Inc., Newport, KY; Teter, Esteban McCabe, LaGrange, Cranford, & Boyd, 2006). In fact, the use of medication to improve alertness is not new. There also exists a longstanding belief among college students that all-nighters and mega-caffeine consumption before tests gives them an edge when compared with students that slept eight hours. In reality, caffeine makes it much worse (Brown et al., 2002). Shohet and Landrum (2001) studied caffeine consumption in a group of undergraduate students ($N = 691$) and found that the on average they consumed almost 1600 mg per week. In addition, they discovered that not one person in the group was caffeine free (Shohet & Landrum, 2001). In documenting the use of high caffeine energy drinks in a random sample ($N = 496$) of university students Malinauskas, Aeby, Overton, Carpenter-Aeby, and Barber-Heidal (2007) found that 51% ($N = 253$) of the respondents described using more than one energy drink a month with 67% consuming them for episodes of sleep deprivation. There is no empirical evidence to support the belief that caffeine consumption can restore performance and mood lost due to sleep deprivation (James, Gregg, Kane, & Harte, 2005). In point of fact , the use of caffeine can have negative behavioral, cognitive and health effects, the most common being the disruption

of sleep (Malinauskas et al., 2007; Orbeta, Overpeck, Ramcharran, Kogan & Ledsky, 2006; Pollack & Bright, 2003; Shohet & Landrum, 2001).

The consequences of sleep deprivation can be serious. In addition to decreases in academic performance, researchers noted higher incidences of auto accidents were due to decreased ability to pay attention to avoid mistakes and a diminished capacity for multi-tasking (McGee et al., 2006; National Institute of Health [NIH], 2003; Van Dongen, Maislin, Mullington, & Dinges, 2003).

To address these issues, there is a significant need for sleep hygiene awareness among college students. Sleep medicine and behavioral scientists continue to emphasize the importance of understanding the role that sleep quality plays in academic success (Brown et al., 2002). Additionally, the NSF (2000) suggests that sleep-related education should be included in the science curriculum in addition to covering the prevalence and prevention of crashes due to drowsy driving in driver's education courses. Through education and wide promotion of good sleep hygiene, college health professionals and other health care providers can help set the normative belief that improving the quality of their sleep will decrease the impact of sleep deprivation on their quality of life (Mastin, Bryson, & Corwyn, 2006; McGee et al.; NIH, 2003; NSF, 2000). Employing the Theory of Planned Behavior (TPB) in assessing female students' perceived behavioral control as it relates to sleep hygiene in general and caffeine use in particular may provide insight into students' intent to incorporate these behaviors in relation to their academic performance (Azjen, 2006).

Statement of the Purpose

The primary purpose of this study was to determine whether the level of caffeine consumption is a significant predictor of sleep quality, sleep hygiene, subjective sleepiness, and academic performance among female college students in North Texas. A secondary purpose is to determine if there are significant differences in caffeine consumption, sleep hygiene, and sleep quality among female college students of different ethnicities and socioeconomic groups in a sample of college females in North Texas.

Research Hypotheses

Hypotheses for investigation included:

H1: Caffeine consumption (by level) is a significant predictor of sleep quality among North Texas female college students.

H2: Caffeine consumption (by level) is a significant predictor of sleep hygiene among North Texas female college students.

H3 Caffeine consumption (by level) is a significant predictor of academic performance (by GPA) among North Texas female college students.

H4: Caffeine consumption (by level) is a significant predictor of subjective sleepiness among North Texas female college students.

H5: Caffeine consumption (by level) is a significant predictor of perceived control of sleep hygiene among North Texas female college students.

Delimitations

Delimitations for this study included:

1. Participants must have the ability to read, write, and speak English fluently.

2. Participants must be a female college student in attendance at the North Texas College selected for sampling.

Limitations

Limitations of this study included:

1. This study is limited to female college students in North Texas and cannot be generalized to the larger population of college students.
2. This study will use convenience sampling and therefore is not generalizable to the population of female college students.
3. Participants who complete the surveys will be volunteers.
4. This study will use self-report and relies on subjective measurement of caffeine consumption and sleep behavior.

Assumptions

Assumptions for this study will include

1. Participants will answer all survey items honestly.
2. Participants will understand the intention of each survey question as designed.
3. Participants will not have in-depth knowledge of sleep hygiene practices.
4. Participants may have undiagnosed sleep disorders.
5. Participants will accurately recall their caffeine consumption and sleep behavior.

Definition of the Terms

1. Caffeine consumption – is measured by the number of milligrams per ounce in a beverage or the total number of milligrams in a dose of medication or food (Landrum, 1992).
2. Delayed Sleep Phase Syndrome – is characterized by a stable sleep schedule that is substantially later than the conventional or desired time that is very common during adolescence and can be a factor in academic failure (Sack et al., 2007).
3. Inadequate sleep hygiene – "sleep disorder due to the performance of daily living activities that are inconsistent with the maintenance of good quality sleep and full daytime alertness" (American Sleep Disorders Association [ASDA], 1990, p. 73).
4. Insomnia – a sleep disorder that is characterized by the inability to fall asleep or remain asleep (Cleveland Clinic, 2007).
5. Irregular sleep-wake rhythm – is characterized by the absence of a circadian pattern. Total sleep time may be somewhat normal, but may be randomly distributed throughout the day and night, most often the result of very poor sleep hygiene (Sack, et al., 2007).
6. Perceived control of sleep – a construct from the Theory of Planned Behavior model. It is the belief that one has control over and predictability of sleep (Vincent, Sande, Read, & Giannuzzi, 2004).

7. Sleep deprivation – a sufficient lack of restorative sleep over a cumulative period to cause physical or psychiatric symptoms and affect routine performance of tasks (Bowman, 2003).
8. Sleep disorder – a sleep disorder implies something abnormal about the way a person is sleeping. It might be that he or she cannot get enough sleep, as is the case in insomnia. In hypersomnia, the individual sleeps too much (Sheldon, 2005).
9. Sleep hygiene – this refers to the practices, habits, and environmental factors that are important for getting sound sleep (Cleveland Clinic, 2007).
10. Sleep quality – is largely subjective but includes quantitative aspects of sleep, such as sleep duration, sleep latency (how long it takes to fall asleep), or number of arousals (how many times do you awake during sleep) as well as more subjective aspects such as "depth" or "restfulness" of sleep. These aspects may vary between individuals (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989).
11. Subjective sleepiness – feelings of sleepiness (Johns, 1991).

Importance of the Study

In the Institute of Medicine's (2006) report entitled *Sleep Disorders and Sleep Deprivation: An Unmet Public Health Problem*, the National Center on Sleep Disorders Research recommended a strategy to ensure continued scientific and clinical advances related to the extent of health consequences associated with chronic sleep loss and sleep disorders. The report encourages that increased awareness among the public and health professionals is necessary to combat this problem. It supports an interdisciplinary

approach as a mechanism to gather data and develop patient-oriented solutions. Investigation of the relationship between caffeine use and sleep hygiene habits among college students will provide valuable data that can assist college health educators and professionals build effective prevention, education programs, and curricula to combat poor sleep quality, inadequate sleep hygiene, and stimulant consumption.

What is more concerning about the use or abuse of caffeine among college students is caffeine's ability to remove "...unwanted sleepiness either when the person is working at night or when they are she is sleep deprived" (Smith, 2002, p. 1250). In fact, Smith suggests that an individual's ability to "... control their caffeine intake to prevent interference with sleep" can circumvent any problems that may arise as a result (p.1250). Nevertheless, caffeine is frequently used as a "psychoactive, performance-enhancing stimulant". With the increased marketing of highly caffeinated "energy" drinks to adolescents and young adults, this presents as a growing problem in this age group. The increase in consumption of caffeinated drinks comes with a price of increased reports of caffeine intoxication and problems with caffeine dependence and withdrawal (Reissig, Strain, & Griffiths, 2009).

The question arises, what is the real cost? In Smith's (2002) review of caffeine's effect on human behavior, she posits that:

> There is little evidence supporting a link between caffeine consumption and sleep, [she does] recommend further studies to produce a more detailed profile of the effects of regular levels of consumption, [and notes that] the impact of caffeine-

induced changes in sleep on behavior the next day and long-term health is not known (p.1251).

Unfortunately, it is not sufficient to merely know about proper sleep hygiene practices related to caffeine's influence. It is more important to practice good sleep habits. They are strongly related to sleep quality (Brown et al., 2002; Pilcher & Ott, 1998; Pilcher & Walters, 1997). For that reason, a deeper investigation of caffeine's interference with sleep patterns and its effects on various groups is worthwhile. In fact, Forquer, Camden, Gabriau, & Johnson (2008) concluded that sleep hygiene might help college students adjust their circadian rhythm and improve their sleep quality leading to improved academic performance.

The average college student sleeps less than seven hours per night and is generally dissatisfied with his/her sleep habits (Brown et al, 2006, Edens, 2006; Tsai & Li, 2004). In fact, in the 2005 NSF's *Sleep in America* poll, the researchers observed that women are more likely than men to have sleep-related problems. Women tend to have more problems not only falling asleep, but staying asleep as well. Furthermore, research documents that too little sleep can result in daytime sleepiness, increased accidents, and more problems concentrating. Additionally, poor performance on the job, in school, and possibly increased sickness and weight gain may also occur (NSF, 2007). Unfortunately, these conclusions are not well documented among college age women of different socioeconomic status (SES) and ethnicities. This study will utilize a diverse North Texas sample from a public university predominantly for women. Currently, this is lacking in the literature.

CHAPTER II

REVIEW OF LITERATURE

Introduction

Sleep is an essential element of good health. It is one of the most basic physiological needs of human beings (Epstein & Mardon, 2007; NSF, 2005). For over one hundred years, sleep has been studied both subjectively and objectively, but the true mechanisms of how sleep restores the function of the body and mind remains a provocative question (Bowman, 2003; Sheldon, 2005). The theories supporting the necessity of sleep for physiologic and cerebral renewal for daily function are plentiful. Most of them point to the restoration of somatic and central nervous system (CNS) function (Sheldon; Spriggs, 2002).

As restoration theory suggests, there are two main states of sleep that assist the body and mind in its renewal – Rapid eye movement (REM) and non-REM (Dement, 1999; Dinges, 2005; Sheldon, 2005; Spriggs, 2002). Renewal of the body's tissues occurs during Non-REM (NREM) sleep, and brain tissues are repaired during REM sleep (Sheldon). Additionally, REM sleep is thought to "...have evolved in order to "reprogram" innate behaviors and to incorporate learned behaviors and knowledge acquired during wakefulness" (Sheldon, p.2).

Evolutionary and adaptive theories point to dogs, cats, rabbits, and humans displaying similar patterns following sleep deprivation. Although humans are often seen

as related mammalians to dolphins, because dolphins actually sleep resting one hemisphere of the brain at a time, this is questionable, and somewhat disputes the evolutionary theory (Bowman, 2003; Sheldon, 2005; Spriggs, 2002). In fact, Sheldon (2005) posits that sleep may be more of an instinctive behavior. Its role being to respond to stimuli that "...conserves energy, prevents maladaptive behaviors, and promotes survival" (p.2).

Of specific interest in this work is learning theory. Sleep is suggested to play a significant role in consolidating learning and memory (Mednick, Nakayama, & Stickgold, 2003; Sheldon, 2005; Wolfson & Carskadon, 1998). In view of that, retention of new information may in fact be dependent on activating "...some brain function that occurs at a critical period after the registration of this information" (Sheldon, p.3).

Mednick et al., (2003) and Sheldon (2005) note that consolidation of memory is enhanced and retention is increased when associated with REM sleep. A significant amount of brain activity occurs during this phase of sleep supporting the hypothesis that quality REM sleep periods are critical to information processing (Sheldon; Mednick et al.). Sleep deprivation has the capacity to significantly impact cognition, thereby leading to decreased academic success (Brown et al, 2006; Forquer et al., 2008). In their work studying sleep schedules and daytime functioning in adolescents, Wolfson and Carskadon (1998) found a relationship between sleep deprivation and poorer grades. The study reviewed the academic records of three thousand high-school students. In it they found that those students with grades of C or less were noted to have at least twenty-five minutes less sleep and went to bed forty minutes later than those receiving A's and B's.

In fact, in Edens' (2006) research evaluating the relationship between university students' sleep habits and academic motivation, 42% (n = 159) of the students who experienced daytime sleepiness also engaged in procrastination which was linked to poor grades.

Although a relationship between academic performance and sleep has been shown, causality in this situation is elusive (Wolfson & Carskadon, 2003). It is suggested that moving school times later for adolescents and providing more afternoon courses for college students may help. However, the side effect of this effort may result in changes to the students' circadian rhythms (Wolfson & Carskadon, 2003). Despite the research covering these topics, the data is limited in identifying the exact function of sleep and its link to the learning and memory processes (Sheldon, 2005).

This review of the literature will highlight research that relates to sleep and caffeine use and their effect on academic performance. These topics will be elucidated through a discussion of associated circadian rhythm disorders, sleep deprivation, insomnia, and the problem of sleepiness. In addition, the differences between sleep quality and quantity are highlighted. Finally, development and maintenance of sleep hygiene as a method to improve sleep habits in the lifestyle of female college students along with educational methods available to assure a good night's sleep are identified.

Sleep

Sleep is sometimes relegated to a discretionary process in the twenty-four -hour life cycle. Humans believe that time spent performing activities not related to meeting needs of goal attainment, sustenance, happiness, or success is wasted time gaps

in the day (Sheldon, 2005). However, the importance of sleep should not be so callously discarded. Those who consistently sleep short may find that they are prone to illness as well as an unhappy life.

In 2005, the NSF *Sleep in America* poll collected data from 1003 random phone interviews of women 18-64 and found that 75% of adults had at least one symptom of a sleep problem. Sleep-related problems are astounding in their effect on almost 70 million Americans, including a significant increase over the last 20 years in the percentage of individuals who sleep 6 hours or less a night (Colten & Altevogt, 2006; Epstein & Mardon, 2007; NSF, 2005). Almost 30% of the U.S. population experiences periodic bouts of insomnia, with up to 12% having chronic insomnia (Ancoli-Israel & Roth, 1999; Ford & Kamerow, 1989). Over the long-term, sleep loss is associated with cardiac disease, fatigue and mortality, which are independent of any other risk factors including body mass index (BMI), substance abuse, and sleep apnea (Moore, Adler, Williams, & Jackson, 2002). The *National Sleep Disorders Research Plan* (NIH, 2003) suggests that these deleterious effects on health are exacerbated by decreases in the duration of sleep, as well as the quality of sleep.

In the 2007 NSF study of *Sleep in America,* women with poor sleep exhibited negative moods which led to a more than 2.5 times chance of infrequently getting a good night's sleep. Women were also three times more likely to experience daytime sleepiness. Surprisingly, only 15% of this group routinely took antidepressants or other sleep aids (NSF).

Of the 71 percent of women reporting that they only got a good night's sleep a few nights a week, 20% were more likely to be in bed for less than 6 hours a night. Colten and Altevogt (2006) wrote that:

> [The] cumulative long-term effects of sleep loss and sleep disorders have been associated with a wide range of deleterious health consequences including an increased risk of hypertension, diabetes, obesity, depression, heart attack, and stroke. After decades of research, the case can be confidently made that sleep loss and sleep disorders have profound and widespread effects on human health (p.55).

The new focus on sleep in modern America is intense (Colten & Altevogt, 2006; Epstein & Mardon, 2007). Americans spend more than $2 billion a year on sleep medications and spend almost 2 million nights in sleep laboratories to get to the root of their nighttime problems (Epstein & Mardon, 2007). Over the last eleven years, the NSF has looked into the price of the fast-paced life of Americans. Across the continuum from adolescents to geriatrics, the individual cost is high. For example, researchers now know that lack of sleep is directly linked to poor health. The risk of developing a chronic disease such as diabetes or cardiovascular disease is significantly increased (Epstein & Mardon, 2007; NSF, 2007). Nagging complaints of ailments like stomachaches and headaches are a constant plague on those who sleep less than five hours a night on a regular basis (Epstein & Mardon; NSF, 2007).

As obesity looms on the horizon affecting every facet of life, it should not be surprising that it is also tied to sleep restriction. In a study measuring two appetite-related hormones, sleep insufficiency increases appetite. Sleep insufficiency is associated

with lower levels of leptin, a hormone produced by an adipose tissue hormone that suppresses appetite and higher levels of ghrelin, a peptide that stimulates appetite (Taheri, Ling, Austin, Young, & Mignot, 2004). In another small randomized, crossover clinical trial, sleep restriction was again associated with lower leptin and higher ghrelin levels (Spiegel, Knutson, Leproult, Tasali, & Van Cauter, 2005). These findings suggest that a hormonally mediated increase in appetite may help to explain why short sleep is related to obesity. If obesity continues its exponential rise in America, education related to sleep and sleep disorders may become critical.

Biological changes can also exacerbate sleep disorders in women. The NSF (2007) poll documents the impact of hormonal changes throughout the lifespan. Women of child bearing age (24%) get only a few nights of quality sleep per month and the number of nights women experience poor sleep increases as they make their way through the lifespan (NSF, 2007). In fact, a large percentage of working mothers (72%) and single women (68%) are likely to experience insomnia. The consequences of poor quality sleep inevitably leads to poor mood, heightened depression, generalized fatigue, and anxiety (NSF, 2007).

Lavidor, Weller, and Babkoff (2003) found fatigue to be multidimensional in their testing of sleep characteristics, depression, and somatization. When working women were queried about their fatigue or tiredness complaints, they often responded that they were related to a combination of home and outside work along with poor sleep.

Pilcher and Ott (1998) noted that the subjective sleep reports completed by their cohort of healthy college students found that measures of health and well-being

(including depression) were strongly related to quality versus quantity of sleep. Looking at the effects of sleep on fatigue and its relationship to depression and somatization reveals that these issues are highly correlated with sleep patterns in those suffering from clinical depression (Lavidor et al., 2003).

In their analyses, Lavidor and coworkers (2003) uncovered a pattern suggesting "self-perception of mood, somatization, and sleep quality can explain fatigue levels better than the (subjective) quantitative aspects of the night's sleep" (p.102). Researchers encouraged medical professionals to be aware of the significant correlation between depression and somatization when dealing with complaints of fatigue and to realize that relatively depressed people may not perceive their sleep quality as poor.

Circadian Rhythms

Poor quality sleep may also contribute to circadian rhythm disorders that can occur due to chronic alterations, disruptions, or misalignment of the circadian clock in relation to environmental cues and the terrestrial light-dark cycle (Colten & Altevogt, 2006). The International Classification of Sleep Disorders (ASDA, 2005) has designated nine different circadian disorders to include delayed sleep phase type, advanced sleep phase type, non-entrained sleep-wake type, irregular sleep-wake type, shift work type, and jet lag. When the variance in the daily wake and sleep rhythms is observed through the prism of Johns' (1991) four-process model describing the nuances in moving from sound sleep to wakefulness, circadian rhythms provide a logical explanation for the length of the daily wake/sleep cycle first described by Hauty, Steinkamp, Hawkins, and Halberg in the 1960s (as cited in Chelminski, Ferraro, Petros, & Plaud, 1997).

Differences in sleep-wake patterns and biological rhythms occur along with a predilection for physical and mental activities. Along the continuum, these activities may show a trend towards advanced or delayed sleep phase adjustment in circadian systems (Chelminski et al., 1997; Lieberman, Wurtman, & Teicher, 1989). Circadian rhythm works in response to daylight and darkness but is somewhat slow to respond when routines are changed (Chelminski et al., 1997; Colten & Altevogt, 2007; Giannotti, Cortesi, Sebastiani, & Ottaviano, 2002; NCSDR, 1997).

Chelminski et al. (1997) evaluated sixteen-hundred college undergraduates using The Horne and Osteberg Questionnaire to determine whether their preference for morningness-eveningness was related to any specific differences in sleep-wake patterns. They found that the majority of college students (62.4%) were evening types. Only 8.3% were of the morning typology. The remaining 29.3% had no preference (Chelminski et al.). The college students in this study showed a tendency toward eveningness that is consistent with recent research on college students' sleep patterns (Chelminski et al.; Forquer et al., 2008). The consensus is that college students' lifestyles and the social pressures to stay up late can exacerbate any associated circadian rhythm disorder already present, particularly delayed sleep phase disorder, putting the student at increased risk of behavioral problems and depression (Cataletto & Hertz, 2008; Pilcher & Ott, 1998; Pilcher & Walters, 1997).

Delayed Sleep Phase Disorder

Further insight into the sleep habits of college students (Pilcher & Ott, 1998; Pilcher & Walters, 1997) reveals the impact that preference for eveningness may have on

the sleep schedule. If forced to attend courses in the early morning, students may develop a delayed sleep phase disorder (DSPD) sleeping pattern. DSPD, as noted earlier, is one of the circadian rhythm disorders identified in the International Classification of Sleep Disorders (ICSD) (ASDA, 2005). DSPD is distinguished by:

> A stable sleep schedule that is substantially later than the conventional or desired time. Patients with DSPD have sleep onset insomnia and extreme difficulty arising when they attempt to conform to a conventional work schedule or other social demands. A tendency for a delayed sleep schedule is very common during adolescence and can be a factor in academic failure. However, in these otherwise normal young people, it is unclear whether this is a manifestation of intrinsic pathology (being "stuck" with a delayed sleep propensity) or a socially reinforced sleep-wake schedule that can be readily modified if circumstances require it (Sack et al., 2007, p. 1489).

In their extensive work on the sleep habits of college students, Brown, Soper and Buboltz Jr. (2001) reported that among the students in their study, 11.5% of the participants described symptoms consistent with DSPD. This work suggests that the increased autonomy experienced in their new college lifestyles might be responsible for DSPD occurring more than twice as likely in this group than in the general population (Brown et al., 2001; Machado et al., 1998).

Although there is evidence that DSPD is prevalent among college students, the actual etiologic factors of it are unknown (Kripke et al., 2008; Pilcher & Ott, 1998; Pilcher & Walters, 1997). Researchers have suggested that it is simply a disorder of the

body's biological clock. However, there is a possibility that those who have DSPD may have an extra long circadian rhythm. It may just be a result of an abnormal response to evening light. Unlike normal persons who fall asleep easily if they are somewhat deprived of sleep from the evening before, persons with DSPD are unable to go to bed earlier than the night before regardless of their level of sleep deprivation (Kripke et al, 2008; Sack et al., 2007, Uchiyama et al., 1999).

The disproportionate rate of college students reporting symptoms of this disorder may also be the result of students' tendency to voluntarily participate in sleep deprivation on weekdays and try to repay the accumulated sleep loss, also called, "sleep debt", during the weekend by sleeping long hours. Nevertheless, this only aggravates the problem and possibly leads to the development of DSPD (Brown et al., 2001; Carney, Edinger, Meyer, Lindman, & Istre, 2006; Uchiyama et al., 1999). Outcomes for the college students who do develop this disorder are poor. They often have lower grades, more drowsiness, and more irritability than those who exhibit normal circadian rhythms (Brown et al.; Edens, 2006). It is also important to note that the resultant sleep deprivation in DSPD reduces the amount of REM sleep because of shortened sleep periods. Brown et al. (2001) and Pilcher and Ott (1998) have long documented that shortened REM periods reduce the ability to learn. Because of sleep's consolidating effect on memory, college students significantly impacted by DSPD may exhibit excessive daytime sleepiness as a result (Edens, 2006; Kripke et al., 2008; Wagner, Gals, Halder, Verleger, & Born, 2004).

Problem Sleepiness

The ACHA 2007 *National College Health Assessment* documented that more than 27% of the students surveyed identified sleep difficulties as an impediment to academic performance (ACHA, 2008a). Research has shown an age-dependent sleep variance in daytime sleepiness in adolescents and young adults (Carskadon, 1990; Carskadon, Viera, & Acebo, 1993; Levine, Rohers, Zorick & Roth, 1988). In 1997, the NCSDR targeted the prevalence of problem sleepiness in adolescents and young adults. While sleepiness is a normal response to the body's circadian rhythm, it becomes problematic when it interferes with daily routines and activities or diminishes ability to function in school or at work (NCSDR, 1997; NIH, 2003). In reality, problem sleepiness is one of the most common complaints evaluated by sleep medicine specialists, and it has shown to have a significant impact on society (Wise, 2006). The NCSDR (1997) suggests that evaluation of problem sleepiness should occur when:

(a) There is a consistent problem with not getting enough sleep or poor quality sleep.

(b) There are episodes of falling asleep while driving.

(c) It is a struggle to stay awake when sitting quietly such as watching television or reading.

(d) There is difficulty in paying attention or concentrating at work, school, or home.

(e) There are performance problems at work or school.

(f) There is difficulty in recall or responses are slowed.

(g) There is difficulty in controlling emotions or,

(h) There is a significant need for a nap on most days.

In a recent study, Canadian researchers queried students' methods for coping with sleepiness (Digdon, 2008). While there is ample data to support the fact that college students tend to be evening types (Chelminski, et al., 1997; Forquer et al., 2008; NCSDR, 1997), Digdon asked students to rate the effectiveness of ten methods used to cope with sleepiness. Interested in whether choices were related to circadian preference of morning or evening typology, data revealed that evening types tended to select methods that were not conducive to a good night's sleep, such as caffeine (Digdon). It was surmised that the methods students use to combat sleepiness such as self-medicating with caffeine, napping during the day, or allowing time to wind down before bedtime might in fact be the cause of sleep problems and represent a lack of sleep hygiene knowledge (Digdon).

Sleep Hygiene

In 1977, Peter Hauri developed a list of sleep hygiene habits to address the behavioral components that interfered with normal sleep patterns. Directed at promoting good quality sleep, this list of habits was updated in 1992 and became more focused on addressing the cognitive issues related to insomnia. Although there are many different definitions of sleep hygiene, the issues of interest in this literature review are those that address caffeine intake, alcohol use, and exercise (Stepanski & Wyatt, 2003). Gellis and Lichstein (2009) define sleep hygiene as "behaviors that influence the quality of one's sleep" and identify *inadequate sleep hygiene* as the formal diagnostic category (p. 1). The International Classification of Sleep Disorders (ASDA, 1990) defines inadequate

sleep hygiene as a "sleep disorder due to the performance of daily living activities that are inconsistent with the maintenance of good quality sleep and full daytime alertness" (p.73). Proper sleep hygiene is highly recommended that for those diagnosed with obstructive sleep apnea, delayed sleep phase syndrome, excessive sleepiness, or insomnia that is related to a mood disorder.

Gellis and Lichstein (2009) noted that The International Classification of Sleep Disorders identified *inadequate sleep hygiene* related to the insomnia subcategory is defined by:

> ...engaging in one or more behaviors related to the following five categories: (1) improper sleep scheduling, (2) the use of sleep-disturbing products, (3) engaging in activating or arousing activities close to bedtime, (4) the use of the bed for activities other than sleep, and (5) maintaining an uncomfortable sleeping environment (p.1).

Assessment of sleep hygiene is important as it evaluates the behaviors and environmental factors associated with poor sleep quality (Gellis & Lichstein, 2009; Mastin et al., 2006). Sleep hygiene, as a whole, has been rigorously studied as it relates to poor sleep habits (Brown et al., 2001, Brown et al., 2006; Cataletto & Hertz, 2008; Forquer et al., 2008; Gellis & Lichstein; Mastin et al.; Stepanski & Wyatt, 2003). However, research has not found sufficient data supporting inadequate sleep hygiene as the primary cause for insomnia, but literature does support it as a feature of other types of insomnia, particularly those that affect college students (Gellis & Lichstein; Stepanski & Wyatt). Again, college students are notorious for having poor sleep habits as discussed previously

in the Delayed Sleep Phase Disorder subsection. Brown et al. (2002) examined the relationship of sleep hygiene awareness, practices, and sleep quality in university students and found that knowledge of sleep hygiene is related to sleep practices and consequently to sleep quality.

Sleep Quality

Sleep quality is a commonly used word in sleep medicine, but the literature has not clearly defined its fundamental nature (Krystal & Edinger, 2008). Evidence abounds supporting sleep hygiene as an important predictor of sleep quality in college students (Brown et al., 2002; Forquer et al., 2008; Gellis & Lichstein, 2009; Kripke et al., 2008; Pilcher, Gitner, & Sadowsky, 1997; Pilcher & Ott, 1998; Pilcher & Walters, 1997; Sack et al., 2007, Stepanski & Wyatt, 2003). In 1997, Pilcher et al. evaluated the relationships between sleep and measures of well-being using seven-day sleep logs and several surveys designed to provide insight into the participants' health, well-being, and sleepiness. They found that sleep quality was better related to these measures than sleep quantity (Pilcher et al., 1997). It was also observed that components of sleep quality such as the number of awakenings at night and general satisfaction with sleep appeared to be responsible for the relationships between sleep quality and measures of health and well being and sleepiness in a group of non-clinical students reporting seven to eight hours of sleep per night (Pilcher et al., 1997).

Clear measurement of sleep quality is quite precarious. The "gold standard" for studying sleep is the polysomnogram (PSG), but it is limited by the way it identifies quality sleep (Krystal & Edinger, 2008). When a PSG is scored, it provides information

on sleep onset latency (SOL, how long it takes to fall asleep), total sleep time (TST), wake after sleep onset (WASO), and the number of awakenings, and stages of sleep. The authors noted that evaluating sleep in this manner is neither sensitive nor comprehensive enough to measure sleep quality (Krystal & Edinger). In attempting to provide objective measures to quantify the subjective experience of sleep quality, Krystal and Edinger employed an index using a Likert-style rating system for a single item reflecting the previous night's sleep quality as part of a sleep diary. Of concern to the researchers was the fact that sleep quality could be related to "non-sleep" issues such as pain, health status, mood, or anxiety or the fact that it could mean different things to different people. They suggested that future directions in quantifying "quality" might include combining different types of measures based on the subgroups being evaluated (Krystal & Edinger).

It is important for health educators who develop health programs and curriculum in university settings to address sleep among college students. Developments of preventive and interventional techniques that work to improve sleep and prevent sleep disturbances are important as researchers continue to learn how sleep affects daily living. Education on sleep hygiene and related sleep issues could be useful for increasing well-being and quality of life in undergraduates, especially during stressful times like final exams (Pilcher et al., 1997; Pilcher & Ott, 1998).

Issues That Affect Sleep

Caffeine

Caffeine is undoubtedly one of the most widely used psychoactive stimulants in the world (Nehlig, 1999). In the twenty-first century, it has emerged from its humble

beginnings as a "pick me up morning habit" into the marketplace disguised as boutique favorite in specialty coffee houses or as an energy drink targeted towards young adult consumers providing the "jolt" needed to make the 24-7 economy thrive (Calamaro, Mason, & Ratcliffe, 2009; Czeisler et al., 1999; Malinauskas et al., 2007; Miller, 2008). While regular sodas contain approximately 30 mg per 8 ounces, energy drinks can contain up to 80 mg (Lee & Balick, 2006; Malinauskas et al.). Since 1987, more than one-thousand energy drinks have been marketed generating billions of dollars. Targeted at the thirty and under crowd, these caffeinated beverages offer a "stimulant and recreational effect" but also offer the likelihood that any problems with caffeine dependence and withdrawal will increase (Ressig et al., 2009).

Caffeine's affect on sleep is profound. It can increase sleep latency (time it takes to fall asleep) while decreasing total sleep time and sleep efficiency (time asleep/time in bed). Even moderate users of caffeine (one to three cups a day), are subjected to the addictive effect of caffeine. While many believe that it improves alertness and performance, the most consistent result to emerge in the literature is that caffeine reduces performance in decrements due to reduced alertness (e.g. conditions of fatigue or sleep deprivation; Bonnet et al., 2005). Caffeine causes an increase in arousal through its mild stimulating effect on the central nervous system (Lee & Balick, 2006; vanBoxtel, Schmitt, Bosma, & Jolles, 2003). Being aware of this effect is important to observing good sleep hygiene, especially in college students who use it as a stimulant. It is generally used to improve their focus during bouts of excessive daytime sleepiness while engaged in coursework.

Caffeine is absorbed rapidly into the body reaching its peak in thirty-seventy-five minutes (Roehrs & Roth, 2008). In polysomnographic studies where caffeine was delivered in different doses thirty minutes before sleep to people without any previous caffeine dependence, Roehrs and Roth found that caffeine use reduced total sleep time, increased sleep latency, and reduced restorative sleep dependent on the amount of caffeine consumed. Roehrs and Roth provided evidence in their review of literature that a high rate of basal sleepiness is associated with habitual daily caffeine intake of 200 mg or less in a large sample (n=129) of young adult volunteers. In other words, this group of young adults was chronically sleepy at baseline. In another study comparing a group of young adults defined as sleepy (Multiple Sleep Latency Test [MSLT] of six minutes or less to fall asleep) with a normal group (MSLT or sixteen minutes or greater to fall asleep) over several nights, it was found that daily intake of 200 mg or less of caffeine regardless of the time frame did not make a significant difference in this chronically sleepy group (Roehrs & Roth).

Health education professionals must be aware that caffeine is available in many dietary sources, such as coffee, tea, energy drinks, candy, soft drinks, and cocoa (Roehrs & Roth, 2008; vanBoxtel, et al., 2003; Lee & Balick, 2006; Pollak & Bright, 2003). In addition, it is available in many frequently used over-the-counter drugs. The use and abuse of caffeine can significantly affect a student's sleep pattern placing them in a spiral that can be detrimental to their academic performance. Health education professionals may be better able to assist students with their sleep problems if they can identify the

components of their daily habits that can significantly impact their sleep – one of them being the use of caffeine.

When examining caffeine related problems in the general population, there is a limited research directly linking sleep problems with caffeine use. In available data, daily caffeine intake has been found to be a contributing factor to non-restorative sleep (Roehrs & Roth, 2008). This fact emphasizes the importance of good sleep hygiene practices in those college students prone to DSPD. The avoidance of regular high doses of caffeine, as well as late afternoon caffeine intake, is important. If not, caffeine use then becomes part of a vicious cycle where caffeine shortens sleep or is used to counteract short sleep, causing an increased use of caffeine. The result is a vicious "caffeine circle". Unfortunately, this is a reality in 5.9% to 10.6% moderate to high (more than 300 mg) consumers of this psychoactive drug in the general population (Lee, McEnany, & Weekes, 1999; Roehrs & Roth).

Energy Drinks

Coffee drinks are not the only way caffeine plays a role in students' lives. Since 1997, energy drinks have gained popularity among college students (Malinaukas et al., 2007; Miller, 2008). While college students consume energy drinks for a variety of reasons, Malinaukas et al. (2007) found that the majority of college students in their study (n = 253) consumed energy drinks to compensate for insufficient sleep (67%) or to increase energy (65%).

One of the most dangerous uses of energy drinks is associated with risk taking behavior (Malinaukas et al., 2007; Miller, 2008). Students often mix energy drinks with

alcohol for an extra burst of energy while partying (Malinaukas et al.). These alcoholic energy drink cocktails reduce the lethargy linked with drunkenness (Miller). However, this mix can give drinkers a false sense of security and can lead to an underestimation of their level of intoxication (Malinaukas et al.; Miller). As a result, risky behaviors ranging from sexual victimization to alcohol-related motor vehicle collisions can occur (Miller). Although caffeine has a cognitive stimulating effect (Smit, Cotton, Hughes & Rogers, 2004), mixed in energy drinks there can be serious side effects like "jolt and crash episodes" with heart palpitations and headaches (Miller, 2008; Smit et al., 2004). It is important that students understand the amount of caffeine they are using and the effects these products can have on their health (Malinaukas et al.) and it is equally important for health educators to realize the effect this dangerous habit has and develop interventions to address these issues.

Socioeconomic Issues

The impact of socioeconomic status (SES) on sleep is significant. In 2002, Moore et al. investigated the role of sleep in the relationship between socioeconomic status (SES) and health. In evaluating a collection of over 1100 self-reported measures of income, education, sleep quantity, sleep quality, and mental and physical health documented in a fourteen-day diary, Moore and colleagues found evidential support that individuals with low SES were more likely to experience sleep disturbances that are associated with poor health.

In addition to linking SES and sleep disturbance to poor health, there is further evidence that individuals with low SES not only suffer from periodic sleep deprivation,

sleeping less than seven to nine hours a night, but this disturbance affects their mood, attention span, and ability to concentrate (Moore et al., 2002; Pilcher & Huffcutt, 1996; Pilcher & Walters, 1997). Low socioeconomic status has an adverse effect on health status. It is notably associated with diminished opportunity for sufficient sleep or environmental conditions that may compromise the quality of sleep such as sharing a bed or having a roommate (Moore et al.; Pilcher & Huffcutt; Pilcher & Walters). This phenomenon is observed in Hispanic children who have less Stage 3 and 4 (restorative sleep) and more Stage 2 (light sleep) than Caucasian children, which may also be indicative of racial or ethnic differences in sleep quality (NIH, 2003).

In two studies evaluating the role of sleep quantity and quality (Pilcher et al., 1997; Pilcher & Ott, 1998), sleep quality was a strong predictor of mental and physical health. This was corroborated in Moore et al. (2002) where they found that "...while poor sleep quality may well lead to poorer health, poor health may also contribute to poor sleep quality, and either (or both) may lead to lower income" (p. 342). Ultimately, it was found that sleep was suspected "...to play a significant role in translating socioeconomic status into health..." (Moore et al., p. 343).

Gellis and colleagues (2005) make a case for relating disparities in health as existing on a continuum. Those in lower SES groups tend to have more health problems than those in middle SES groups. As a corollary, middle SES groups have more problems than higher groups. The authors also noted that ethnicity appeared unrelated to insomnia (Gellis et al.). Nevertheless, continued growth in the field of sleep medicine research provides an opportunity for gathering comprehensive information about sleep

and its interactions with various aspects of life, most notably, socioeconomic status and health (Moore et al., 2002).

Ethnicity

As research continues to examine health disparities and the impact they have on access to care, there is still limited data on the genetics of sleep and its effect on various ethnicities (Durrence & Lichstein, 2006). The National Sleep Disorders Research Committee (NIH, 2003) noted that since the Sleep Disorders Research Plan of 1996 was completed, "...studies across ethnically diverse populations have identified the significant differences in the prevalence of sleep disordered breathing in African Americans (AA) and have suggested distinct pathophysiological mechanisms" (p. 57). Young African Americans are twice as likely as young Caucasian Americans (CA) to develop sleep disordered breathing (NIH, 2003).

In Durrence and Lichstein's (2006) comparative review of African Americans' sleep, they found that there was enough data to suggest that AAs sleep worse than CAs. They appear to take longer to fall asleep, with that sleep noted to be of poor quality. They also sleep lighter than CAs, and nap more and longer than their counterparts (Durrence & Lichstein, 2006). This is also true of Hispanic women who reported that they slept less than European-American women (Kripke et al., 2004; Lee et al., 1999; Rao et al., 1999). In an ancillary study to the Women's Health Initiative, Kripke et al. (2004) found that curtailed sleep and poor mood were significantly related to ethnicity. In addition, Hispanic, African American, and Native American women who experienced less daily illumination (imposing a negative effect on circadian rhythm) were more

depressed, had poorer global functioning, and longer but more disturbed sleep (Kripke et al.)

Gender Differences

There is significant evidence demonstrating that sleep disturbances are more common in women than men (Lee, et al., 1999; Lundt, 2006; Moline, Broch, & Zak, 2004; NIH, 2003; NSF, 2007). Starting in adolescence and continuing after menopause, women's reproductive physiology and life events make them specifically prone to insomnia affecting their overall health and quality of life (Lundt; Moline et al., 2004; NIH, 2003; NSF, 2007). In research examining gender differences in sleep patterns of early adolescents, Lee and coworkers (1999) found that difficulty in falling asleep was the most common complaint in adolescents. Furthermore, at the root of this problem was "physiological development, a shift in circadian rhythms, and psychosocial, familial, or environmental factors" (Lee et al., 1999, p.16). They reported a trend indicating that girls had longer sleep latency than boys and experienced more daytime sleepiness than boys experienced (Lee et al., 1999).

Daytime sleepiness in adolescents is a consequence of attempting to synchronize school schedules with the need for increased hours of sleep (Calamaro et al., 2009). This problem coincides with an increase in social and academic issues in this age group. Carskadon (1990) noted that parental values, curfews, and work schedules also conflict with the adolescent's need for sleep. Evaluation of morningness and eveningness (a look at circadian rhythms) has found that women, with the exception of college students, tend toward morningness and this tendency increases as they age (Chelminski et al., 1997).

There continues to be a difference in weekday and weekend sleep habits. Girls tended to wake earlier than boys did during the week, but slept in later than boys slept on the weekends (Lee et al., 1999). Caffeine consumption in this eleven to fourteen year old group is significantly greater in boys than in girls. The researchers noted that 300 mg of caffeine could cause the child to lose almost two hours of sleep and double the wakefulness. These habits persist as adolescents become young adults (Lee et al.). In fact, data supports that women have more sleep complaints and increasingly use caffeine to compensate for their sleep disturbances. The NSF (2007) reports that more than 65% of women self-medicate with caffeine, with 37% drinking more than three caffeinated beverages a day.

As a whole, literature supports the view that women's sleep is different from men's on many levels. Regular menstrual cycles, birth control, pregnancy, lactation, and menopause all have differing effects on women's sleep patterns. Depression, anxiety, and other life events are often at the root of the difference between the sexes (Epstein & Mardon, 2007; Li, Wing, Ho, & Fong, 2002, Lundt, 2006; Moline et al., 2004; NIH, 2003; NSF, 2007).

A significant amount of research done over the last decade in relation to women's sleep across the lifespan have shown that insomnia, including chronic insomnia, is much more common in women than men (Lundt, 2006; Moline et al., 2004). Li et al (2002) found that females were 1.6 times more likely to experience insomnia than males. Brown, et al. (2001), found that females had a higher incidence of the circadian rhythm disorder, DSPD than men did. Women consistently reported more difficulty in sleep

maintenance, morning tiredness, and daytime napping than men did. There was also a notable relationship between somatic complaints, depression, anxiety, and sleep among females in their study (Brown et al.).

Subjective sleep in women was most often disturbed during the premenstrual period (Lundt, 2006; Moline et al., 2004; Tworoger, Davis, Vitiello, Lentz & McTiernan, 2005). During this time, women displayed longer sleep latency, lower sleep efficiency, and lower sleep quality than during menstruation. There was no correlation to the severity of symptoms, but daytime sleepiness was greater during the premenstrual phase. This phase seems to coincide with increased complaints associated with the Premenstrual Dysmophic Disorder (PMDD; Lundt, 2006; Moline et al., 2004). More research into the sleep effects of this disorder is necessary. However, the sleep complaints most commonly associated with the menstrual cycle are generally related to the usual premenstrual symptoms of cramps, headache, and/or bloating (Lundt, 2006; Moline et al.; Tworoger et al., 2005). Additionally, any anxiety or mood disorders already present will frequently aggravate the situation during the premenstrual phase. Suggestions for treatment include prescribing selective serotonin reuptake inhibitors (SSRIs) which may significantly improve psychiatric symptoms, including insomnia, in this cohort (Lundt; Moline et al.; Tworoger et al.).

Women's sleep is noticeably affected during pregnancy and postpartum periods of their lives. Anatomic and physiologic changes at various stages of reproduction cause increasing complaints of fatigue, mood changes, and general discomfort can occur. The waxing and waning of estrogen and progesterone can have a tremendous effect causing

fragmentation of sleep. In addition, the caveat of increased role responsibilities as mother can cause women to go to bed later and get up earlier to address issues often outside of their control, such as feeding and caring for a newborn infant or taking care of a sick child or family member during the night. Unfortunately, all of this occurs without an opportunity to make up for the lost sleep on weekends or days off (Lee, 2006; Li et al., 2002; Lundt, 2006; Moline et al., 2004; NSF, 2007).

Miscellaneous Factors

Laboratory evaluation of excessive sleepiness and sleep deprivation support data linking these issues to attention-deficit/hyperactivity disorder (ADHD). This disorder affects 5-10% of school-aged population growing to 60% of this population by the time they reach young adulthood (Millman et al., 2005). While there have been numerous studies conducted evaluating the relationship between ADHD and sleep, most research has been done with children rather than adolescents or young adults. In Millman et al., the working group documented studies that used polysomonography along with survey data collection to evaluate for possible relationships between sleep disturbances and ADHD. This query raised the question as to what degree the PSG represents the "real world?"

In studies evaluating ADHD and sleep, there is support for an association between the psychostimulants or other psychiatrics even though there was no clear cut evidence tying the two together (Mick, Biederman, Jetton, & Faraone, 2000; Millman et al., 2005). However, increasing evidence shows "...not only that sleep-disordered breathing (SDB) is strongly associated with inattention, hyperactivity, impaired 'executive' cognitive

functioning, and disruptive behaviors in children but also that treatment of SDB results in significant improvement or even complete amelioration of ADHD-related symptoms" (Millman et al., 2005, p. 1778).

In addition to ADHD's link to sleep issues, obesity plays a role as previously discussed. In a review of the data from the National Health and Nutrition Examination Survey I: Epidemiologic Follow-up Study, 1982-1984 (NHANES I), Gangwisch, Malaspina, Bolden-Albala, and Heymsfeld (2005) suggested that sleep deprivation may play a role in the etiology of obesity in some individuals. Although their study had some limitations related to self-report of weight and sleep duration, the authors were confident that the data clearly indicated a relationship between sleep deprivation and obesity (Gangwisch et al., 2005). In fact, the authors declared that:

> If metabolic changes resulting from sleep deprivation contribute toward weight gain, then interventions designed to increase the amount and quality of sleep could potentially augment the most common clinical interventions of increasing physical activity and improving nutrition. These interventions could include educating patients about healthier sleep-hygiene practices and helping them to modify maladaptive sleep habits (Gangwisch et al., p. 1296).

Moreover, learning about the consequences of sleep deprivation and sleep-hygiene practices as young adults may have a significant effect as the population ages.

Sleep Deprivation

Sleep deprivation is insidious in American society (Engle-Friedman et al., 2003; NIH, 2003; Van Dongen, Maislin, Mullington, & Dinges, 2003). According to the NIH (2003) *Sleep Disorders Plan*, evaluations of the consequences of restricted sleep are numerous, especially as they related to total sleep deprivation. Assessment of the effect of sleep loss on neurocognitive functions present scientists with two primary emphases (NIH, 2003, p. 25):

1. Specification of the properties of tasks (e.g., cognitive versus physical; long versus short duration) that make them sensitive to sleep loss; and
2. Specification of the aspects of performance (e.g., cognitive processing speed versus accuracy, declarative versus implicit memory processes) that are impacted by sleep loss.

According to the NIH (2003), the trend toward 24-hour-per-day operations makes sleep restriction an inevitable consequence of the obligatory shift work.

However, shift work is not the only thief in the night. Short sleep is experienced by teenagers due to their variable sleep schedules, going to bed late and getting up early, shifting themselves into DSPD with poor academic performance as a result (Brown, et al., 2001; LeBourgeois, Giannotti, Cortesi, Wolfson & Carskadon, 2005). LeBourgeois et al. (2005), document that between 6-37% of adolescents have problems with inadequate sleep hygiene issues, 16% report having clinically significant insomnia. In fact, Healthy People 2010 (U.S. Department of Health and Human Services [DHHS],

2000 identified lack of sufficient sleep as a priority for action. Students as well as shift workers are members of the sleep deficient groups being targeted for improvement. Reduction of drowsy driving and circadian rhythm disorders are high on the list to be addressed (DHHS).

Van Dongen and colleagues (2003) added up the cumulative cost of additional wakefulness due to chronic or partial sleep deprivation. In chronic sleep restriction (sleeping 6 hours or less per night), cognitive performance shows impairment similar to 2 nights of total sleep deprivation. In other words, sleeping short on a regular basis for work or for school creates a sleep debt similar to total sleep deprivation. The average daily sleep requirement for healthy adults is approximately 8.16 hours. Any time spent awake over 16 hours per day builds a chronic sleep debt. In order to return neurocognitive performance to baseline, the sleep debt must be repaid (Van Dongen et al.). In identifying the hazards of sleep debt, Dinges (1995) highlighted the danger clearly stating that, "In a world of congested highways, nuclear power plants, jumbo jets, super tankers, hazardous materials, and 24 hour operations, sleep is ignored at our peril" (p. 12).

Philip et al. (2004) studied reaction time as a measurement of the sustained attention required for cognitive tasks and found that younger people (20-25) were more affected by sleep deprivation than older people (52-63) years old. When reaction time was tested after a full night awake, the younger subjects had a significant decline in relation to their reaction time after a full night's sleep, the older participants maintained their levels. These results suggest that reaction time in "real world" situations such as

driving may be sensitive to sleep loss and/or an overestimation of ability to perform (Philip et al.).

Risk Taking Behavior/Drowsy Driving

Discussion of sleep deprivation's relationship to academic performance or ability to perform cognitive tasks is incomplete without a review of the link between the associated fatigue and risk taking behavior. As discussed earlier, a myriad of conditions can result in being overcome by fatigue. However, fatigue itself is situational; it is most likely to occur when the quality or quantity of sleep is significantly affected (NIH, 2003; Philip et al, 2004; Van Dongen et al., 2003). More than 100,000 traffic accidents a year are attributed to drowsiness and fatigue with more than 50% of them involving young drivers. Moreover, in 2006, approximately 1,480 (3%) of all fatal vehicle and motorcycle crashes in the United States were the result of what is known as drowsy driving (National Highway Transportation Safety Administration [NHTSA], 2008).

Sleepiness and Fatigue

Sleepiness and fatigue may seem to be one in the same; however, the literature supports a significant difference between the two. The prevalence of sleepiness in the population is not supported by a clear consensus. In operationalizing it as "one's tendency to fall asleep also referred to as sleep propensity" (Shen, Barbera, & Shapiro, 2006, p. 64) it can be measured objectively using the MSLT. Sleepiness is different from being somnolent or drowsy; it is the state between being awake or asleep and is typically identified as subjective sleepiness (Shen et al., 2006).

Johns (1991), describes a four-process model of sleep and wakefulness that clearly defines the interaction between the sleep and wake drive. Subjective sleepiness manifests itself in each of the drives accounting for different phases. Primary sleep and wake drives work within the central nervous system's (CNS) circadian and ultradian rhythms. The secondary drives are influenced by homeostatic, environmental, and behavioral factors. Each is a distinct step moving one from sleep to wake and vice-versa (Johns, 1991).

Several scales are available to measure subjective sleepiness. The Stanford Sleepiness Scale (SSS) is frequently used, but researchers note its inability to measure sleep propensity directly while giving the user "insight into a more global measure of sleepiness" (Shen et al., 2006, p.65). The Karolinska Sleepiness scale (KSS), allows the opportunity for a multi-factorial look at "subjective sleepiness" similar to the SSS. The Epworth Sleepiness Scale (ESS), created by Johns in 1991, is more precise in predicting one's propensity toward sleep onset at inappropriate times. A self-administered questionnaire, the ESS asks participants "...to rate their chances of falling asleep or dozing on a scale of 0-3 in eight soporific situations, ranging from "lying down to rest in the afternoon when circumstances permit," to "in a car while stopped for a few minutes in traffic" (Shen et al., 2006, p. 65). The ESS is one of the most widely used tools for assessing subjective sleepiness mainly due to its ease of use and cost effectiveness in comparison to other tools (Shen et al.). However, some question its continued use as a tool to identify "pathological" sleepiness (Tachinaba & Taniguchi, 2007).

Alternately, fatigue is common in those who suffer with physical and psychosocial ailments. In diseases such as chronic fatigue syndrome (CFS), rheumatoid arthritis, cancer and multiple sclerosis and their treatments, fatigue is often identified as the chief complaint and source of disablement in those with significant health issues (Shen et al., 2006). Yet, fatigue may be difficult to identify since many of its characteristics overlap those of excessive daytime sleepiness (EDS). Many complain of just being "tired" making it difficult to pinpoint whether fatigue or EDS is at the root of their problem. In the end, fatigue is a subjective complaint without a gold standard measurement (Lavidor et al., 2003; Shen et al., 2006). Sleepiness and fatigue remain difficult to quantify due to their subjective natures. However, they are each a significant component in the assessment of sleep deprivation and other sleep disorders despite these facts (Millman et al., 2005).

Theoretical Framework

The Theory of Planned Behavior (TPB) provides a framework for this research. The theory is used to evaluate and explain motivating factors to predict intention to perform a specific behavior. In this effort, it is expected that TPB will elucidate the findings in an assessment of North Texas female college students' perceived behavioral control as it relates to sleep and sleep related behaviors in general. Through identification of their control or lack of control in association with sleep behaviors, coupled with assessment of their caffeine use, knowledge of sleep hygiene and attitudes toward sleep quality, it may also provide insight into students' intent to incorporate these behaviors in relationship to their academic performance (Azjen, 2006).

Many of the behaviors that are performed as part of everyday life such as whether to go to bed or forgo sleep in order to accomplish a defined task are what Azjen (2005) calls willful behavior or, behavior that is under volitional control. Whatever the person decides to do – they will. When they make the decision to change their behavior as it relates to a specific intention – they will. Azjen (2005) posits that this decision can accurately predict a wide range of actual intentions. He notes that if it is true, then it may also be true that the predictive validity of intentions may be found to be significantly greater than that of attitudes toward the behavior (Azjen, 2005).

Stability of behavior over time can be an issue. In a study evaluating the intention-behavior correlation in undergraduate students, Sherrhan, Abraham and Orbell (1999) asked students to indicate their intentions to study over the break. They took two measurements five weeks apart. After returning from break it was found that those whose intentions were stable in the 5 week measurements showed a correlation of 0.58 and those who did not study showed a correlation of 0.08 (Azjen, 2005).

Various internal factors can influence the level of success that a person will attain with relationship to an intended action (Azjen 1991; Azjen, 2005). Firstly, if a person is lacking information, skills or ability making an intended change may be beyond their reach. In other words, the intent may be present but the knowledge base or ability is not present, however, these drawbacks can be overcome (Azjen, 2005). Secondly, emotions and compulsions can play a role in accomplishing intended goals. In the presence of these factors that demonstrate incomplete volitional control, intense emotions, stress, or

compulsions, are more complex and difficult to neutralize. Azjen (2005) suggests that the concepts of volitional or incomplete volitional control be viewed on a continuum. On one hand, the person may have complete control over choices and behaviors. Conversely, on the opposite extreme, they may have very little control over the intended action. In addition, opportunity and dependence on others may cause unforeseen circumstances that prevent a person's ability to perform an intended behavior (Azjen, 2005; Azjen & Fishbein, 1970).

Theory of Planned Behavior

The Theory of Planned Behavior (TPB) was designed to predict and explain behavior in specific contexts (Azjen, 1991). Different from the Theory of Reasoned Action (TRA) (Fishbein & Azjen, 1975) which posits that person's behavioral intention depends on the person's attitude about the behavior and subjective norms when that behavior is under volitional control (Azjen, 1991), TPB is outlined by "...three basic determinants, one personal in nature, one reflecting social influence, and a third dealing with issues of control" (Azjen, 2005). The personal factor is defined by the person's attitude toward a behavior, how that person *feels* either positively or negatively, about performing the given behavior. In relation to social influence, the second determining factor of a person's intention is how much social pressure the person feels to perform or not perform a given behavior (Azjen, 2005). This social influence is described as the *subjective norm*, identifying the impact that social mores, taboos, and fundamental values effect the person's perception. Lastly, the third factor of control is the sense of self-efficacy or a person's ability to perform the chosen behavior – perceived behavioral

control. It is important to note that TPB does not suggest the amount of control a person has in a situation, but it does help to look at the possible effects that perceived behavioral control could have on accomplishing the goal (Azjen, 2005).

One might ask why use TPB? Noar and Zimmerman (2005) evaluated health behavior theory (HBT) and found that TRA/TPB was one of the most frequently used theories in explaining health behavior. In their discussion of addressing the importance of developing a consensus, they identified TPB as a theory that may be more useful for health behaviors that are "...more rational in nature and in which the intention – behavior link is strong..." (Noar & Zimmerman, p. 280).

In contrast, Hardeman et al. (2002), reviewed studies that applied TPB in behavior change interventions. They found that "...TPB was often used to measure process and outcome variables and to predict intention or behavior change and less often to develop the interventions [under study]..." (Hardeman et al., 2002, p. 148). Although they did not find many studies that applied TPB to the development or evaluation of interventions, they did find several studies that used TPB to predict intention to take part in an intervention. In answering the research question related to the type of behavior change methods that were used to alter TPB components, it was found that "...information, persuasion, increasing skills, goal setting, rehearsal of skills, modeling, planning/implementation and social encouragement/support..." were most often used (Hardeman et al., p.148).

Behavioral, normative and control beliefs significantly affect the theory and its results. However, many variables influence each of these constructs. Age, gender,

ethnicity, SES, education, personality, mood, emotions, group membership, past experience, coping skills, exposure to information, etc. (Azjen, 2005). Where people live, the number of people in a household or even social environment can affect a person's basis for their beliefs as related to behavior and behavioral consequences. In this study, North Texas female college students identify a specific group with a background that may be affected by the variables listed above or those outside of the scope of this research. In that context, it is important to realize that any one of these factors can therefore affect behavioral, normative, and control beliefs and, as a result, influence intentions and actions as it relates to their sleep difficulties and academic performance (Azjen, 2005).

Perceived Behavioral Control

In *Attitudes, Personality and Behavior* Icek Azjen (2005) identifies perceived behavioral control as "...a behavioral intention can best be interpreted as an intention to try performing a certain behavior" (p. 110). He posits that when people have strong volitional control over a behavior that behavior is more likely to occur. The intention itself should provide a good prediction of the likelihood someone will perform a given behavior (Azjen, 2005).

In 1992, Madden, Ellen and Azjen had college students rate their likely control over carrying out common daily activities such as getting a good night's sleep, shopping with friends and doing the laundry. In the second phase, a new student group was asked about their intentions and perceived control over performing the selected activities in the next two weeks. Lastly, they were asked two weeks later how often they had performed

the selected activities. The researchers used multiple regression analysis to look at the accuracy of prediction. It was noted that accuracy increased from a correlation of 0.53 to a correlation of 0.62 by adding the perceived behavioral control to the prediction of the students' behaviors (Azjen, 2005; Madden et al., 1992). Perception of control is a significant predictor of behavioral outcomes that are considered to be under volitional control. Azjen (2005) reiterates that:

> When a behavior is not under complete volitional control, factors internal or external to the individual can prevent performance of an intended behavior. Although objective measures of actual control are usually not available, we can assess perceptions of behavioral control. To the extent that people are reasonably realistic in their assessments of control, such measures can serve as proxies for actual control and help improve prediction of behavior (p.115).

Improving Sleep Among College Students

Returning to the results of the of the ACHA National College Health Assessment (NCHA) of College Students it is worth mentioning that female students, in particular, (26.6%) identified sleep difficulties as the third most common health impediment to students' academic performance above depression (6), relationship difficulties (7) and alcohol use (10; ACHA, 2009). When asked about how many days in the last week they got enough sleep to feel rested, 63.5% reported that they did not get enough sleep on four days or less per week. Moreover, 48% of students reported that they had a "little problem with sleepiness" while performing daily activities. An additional 25.3% reported having more than a "little problem with sleepiness" and 12.3% had a "big problem" with

sleepiness during the daytime. As pervasive as this problem seems, when asked, only 20% of females noted that they had received any information on the topic of sleep difficulties (ACHA, 2009). Nevertheless, with 55% of females reporting they would be open to receiving information related to sleep difficulties (ACHA, 2009), determining the specific issues to target may beneficial to health educators in developing health promotion programs to address problem sleepiness, sleep deprivation and its treatment (ACHA, 2009; Brown et al., 2002; Brown et al., 2006).

In 2006, Brown et al. acknowledged that when changing sleep habits of college students, practicing good sleep hygiene habits changes first, then the quality of sleep improves, and consequently academic success may improve. Conversely, chronic problems with sleep cannot only affect academics, but can lead to "...depression, anxiety, reduced physical health, general cognitive difficulties (poor problem solving and attention difficulties), and [an] increase in the use of drugs and alcohol" (Brown et al., 2002, p. 33). A sleep treatment and education plan for students (STEPS) was developed by Brown et al. (2006) and implemented using an experimental design. They found that improving sleep hygiene practices through education had an impact by decreasing stress, improving sleep onset time, decreasing sleep disturbances and improving overall sleep quality. Using programs like STEPS can help to develop sleep hygiene practices in college students and prevent the deterioration of sleep quality as the semester progresses.

It is clear that addressing sleep hygiene practices is essential to improving the quality of college students sleep (Brown et al, 2001; Brown et al., 2006; Mastin, et al., 2006; Stepanski & Wyatt, 2003), however, it is equally important to understand "...that

sleep hygiene does not exist in isolation and may be better understood when considering the psychosocial context of the [student alone]" (Mastin et al., 2006). While Brown et al. (2006) suggest the development of this type of psychoeducational program for university orientation classes, and rightly so, others suggest that examination of sleep hygiene behaviors independently will improve researchers' understanding the relative contribution of each construct (Mastin et al., 2006; Stepanski & Wyatt, 2003). Additionally, Stepankski and Wyatt (2003) recommend further sleep hygiene research that:

1. Identifies the contribution of specific behavior in the maintenance of insomnia in individual cases who violate a specific [sleep hygiene] rule.
2. Evaluate the underlying mechanisms whereby sleep hygiene factors influence sleep.
3. Find predictor variables that indicate when sleep hygiene rules may be an effective treatment or treatment component for a given patient with insomnia (p.223)

Targeting a specific sleep hygiene variable may help to understand why sleep disturbance is higher in college students than in non-students their age (Buboltz et al., 2002; Fukada & Ishihara, 2001; Stepanski & Wyatt, 2003).

Although sleep patterns of college students are frequently the target of clinical and non-clinical research studies as noted previously in this review, reports on gender differences in college students have been inconsistent (Brown et al., 2001; Ohayon & Zulley, 2001).

The intent in this study was to evaluate sleep habits, sleepiness, sleep hygiene, and caffeine use in the female population of a midsize North Texas University and their relationship to academic performance. Although there is literature addressing sleep hygiene and its overall effect on sleep quality in university students, evaluation of the singular construct of caffeine use in the female population is deficient. Increased data on the caffeine's role as a component of sleep hygiene will add significant depth to the literature and provide Health Educators with precise data to translate to their practice and assist in the management of sleep quality in female college students.

CHAPTER III

METHODOLOGY

The process used for data collection is described in this section. This predictive study utilized survey design. The sample was drawn from college women attending Texas Woman's University (TWU) in North Texas. In their recently completed *Sleep in America poll*, the NSF (2009) noted that the number of Americans reporting sleep difficulties continues to increase with 64% of those surveyed experiencing sleep problems several nights per week. Almost 60% report the use of caffeinated beverages as a possible solution to help them make it through the day when they are sleepy (NSF). This behavior is also seen among college students. The average college student sleeps less than seven hours per night and is generally dissatisfied with his/her sleep habits (Brown et al, 2006, Tsai and Li, 2004). Women continue to have more difficulties falling and staying asleep than men (ACHA, 2009; NSF, 2005). The current study will evaluate sleep issues among females using a diverse North Texas sample from a public university predominantly for women. Currently, this is lacking in the literature.

Protection of Human Participants

Institutional Review Board (IRB) approval was obtained from Texas Woman's University (TWU). The IRB determined the study to be exempt from further review. The researcher successfully completed the National Cancer Institute's Human Participants Protection Education for Research Teams online module in compliance with

TWU's requirements. In order to guarantee the protection of all participants and comply with IRB guidelines, the introductory letter described the type of participants needed and was followed by the statement: *"Completion of the survey will signify your informed consent to participate in this research study, which is voluntary, and you may withdraw your participation at anytime."* Explanation of the study's purpose, duration, procedures, possible risks and benefits, confidentiality, and right to discontinue participation were provided to all participants. The consent form concluded with the following statement: *"The return of your completed questionnaire constitutes your informed consent to act as a participant in this research."* (see Appendix A).

Sampling Procedures

Texas Woman's University Institutional Research Board (IRB) allowed participant recruitment during the last six weeks of the Fall 2008 semester and the first four weeks of the Spring 2009 semester. A convenience sample of participants were recruited via email, classroom announcement and intranet (announcements on the TWU Portal) to complete electronic surveys relating to sleep hygiene, sleep quality and caffeine consumption. The electronic announcements contained a link to the online survey. Volunteers who participated in the research study had the opportunity to participate in a drawing to win one of four prizes ($25 gift cards from Amazon.com). The link to enter the drawing was included at the end of the electronic survey. Participants were not required to include their names on any part of the survey. If they wanted to participate in the gift card drawing, the participants were directed to a separate link to enter their email in order to maintain their anonymity.

Instrumentation

An electronic version of the Sleep Hygiene Index (SHI), the Epworth Sleepiness Scale (ESS), the Caffeine Consumption Questionnaire (CCQ), the Pittsburgh Sleep Quality Index (PSQI), and the Insomniacs' Perceived Control over Sleep Questionnaire were deployed along with a general demographic questionnaire to collect data.

The Sleep Hygiene Index

The SHI is a relatively new 13-item self-administered index designed to assess the presence of behaviors thought to compromise sleep hygiene. While the Chronbach's alpha (0.66) is relatively low in this validated instrument, is has been found to have good test-retest reliability ($r = (139) = 0.71, p < 0.01$) (Mastin et al., 2006). In this survey, higher scores are related to poor sleep hygiene. This survey was developed to provide a global assessment of sleep hygiene. As a result, higher scores are indicative of more maladaptive sleep hygiene status (Mastin et al.)

The Epworth Sleepiness Scale

The ESS is an 8-item questionnaire producing scores from 0-24. Scores greater than 10 suggest significant daytime sleepiness, and it has a Chronbach's alpha = 0.88. Respondents reporting scores greater than 18 should be evaluated by a physician as they suggest a severe sleep disorder (Johns, 1991).

The Caffeine Consumption Questionnaire

The CCQ provides a valid and reliable standardized measurement of caffeine intake. It allows the participant to record caffeine use over a week's time with a

normative data set for comparison (Landrum, 1992). The measurement was modified to include the consumption of energy drinks and popular Starbuck's® beverages.

The Pittsburgh Sleep Quality Index

The PSQI has been used to assess sleep quality and sleep disturbance over a 1-month period in clinical and non-clinical populations and it has good internal constancy with a Chronbach's alpha of 0.83 (Buysee et al., 1989). The PSQI has 19 items, rating the respondents report on seven subscales: sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. The total PSQI scores can range from 0–21 with high scores reflecting poor sleep quality. A score above 5 is generally considered poor sleep (Buysee et al.).

The Insomniacs' Perceived Control over Sleep

The Insomniacs' Perceived Control over Sleep Questionnaire provides a valid and reliable assessment of one's control or lack of control over sleep (Watts, East & Coyle, 1995). This 18-question survey looks at perceived control over four subscales, sleep and pre-sleep states as well as the onset and maintenance of sleep (Watts et al.). Scores range from one to four on each of the subscales with higher scores meaning lack of control (Watts et al.).

General Demographic Questionnaire

In addition, a general demographic questionnaire was used to describe the group under evaluation. The final pages of the online survey included the demographic profile. Participants were asked to self-report their age, gender, current GPA, student and relationship status, race, and residence. Respondents were asked report their household

income and employment status, number of occupants and number of children under the age of 18 (see Appendix B).

The participants were asked to complete the six short surveys (online) with an approximate completion time of 20-25 minutes. They were given the opportunity to ask questions following the completion of the surveys to address any concerns that they may have related to the study. Participants were directed to the National Sleep Foundation website at www.sleepfoundation.org where they could obtain information discussing the practice and benefits of good sleep hygiene.

CHAPTER IV

RESULTS

Sample Description

The current study was a predictive study that utilized six survey instruments to describe whether caffeine consumption was a predictive factor of sleep quality, sleep hygiene, and academic performance among female college students in North Texas. Descriptive statistics were used to illustrate the characteristics of the sample population. Inferential statistics were used to test the hypotheses under study. Pearson's Product Moment Correlations were computed to test for significant relationships between the dependent variables, and between the dependent variables of the Perceived Control subscales, Sleep Hygiene, Sleepiness, GPA, and the PSQI. One way ANOVA and two-way MANOVA were conducted to test for significant differences between the dependent variables. Multiple regression models were used in order to determine whether any of the demographic variables predicted the continuous dependent variables (Perceived Control subscales, Sleepiness Score, Sleep Hygiene, GPA, and the PSQI subscales).

Demographic Characteristics

The sample for the current study included 185 female college students. As shown in Table 1, a majority of the respondents were Caucasian (64.3%). The remainder of the sample was comprised of African Americans (16.2%), Latin Americans (11.4%), Asian Americans (7.6%), and American Indians (0.5%). The college is 93% female with 52.1%

of the females described as White, non-Hispanic, 21% are AA and 17.2% Hispanic and 6.8% being Asian or Pacific Islander (National Center for Education Statistics, 2009). Due to the large proportion of Caucasian respondents, race was recoded into a dichotomous variable reflecting Caucasian (64.3%) vs. other race (35.7%) for use in subsequent analyses. Respondents ranged in age from 17 years to 56 years, with an average age of 25 years ($M = 25.75$, SD=8.56; see Table 2). Nearly two-thirds of the students were single or never married (63.2%) and smaller proportions of the sample were married (21.6%), co-habitating (7.6%), divorced (4.9%), separated (1.1%) or classified as another marital status (1.6%; see Table 1). For the remainder of the analysis, marital status was recoded into two groups, reflecting single or never married (63.2%) vs. another marital status (36.8%). In terms of income, over half of the respondents had household incomes of $30,000 or less (55.4%), approximately 20% reported household incomes between $30,001 and $60,000 (21.6%), and 23.0% had household incomes of $60,001 or more. Due to the small proportion of respondents with higher incomes, the income categories were collapsed for use in further analysis. More specifically, income was recoded to reflect two income groups: $30,000 or less (55.1%) vs. more than $30,000 (44.2%).

The sample included both undergraduate and graduate students, with roughly half of the respondents reporting that they were either in their junior year (27.0%) or in senior year (28.1%) of school (see Table 1). The remaining respondents were either in their freshman year (14.6%), sophomore year (11.9%), or graduate students (18.4%). A majority of the

Table 1

Frequencies and Percentages for Categorical Demographic Variables

	N	%
Race		
Caucasian	119	64.3
African American	30	16.2
Asian/Pacific Islander	14	7.6
Hispanic/Latino	21	11.4
American Indian	1	0.5
Marital Status		
Married	40	21.6
Single, never married	117	63.2
Divorced	9	4.9
Separated	2	1.1
Co-habitating	14	7.6
Other	3	1.6
Household Income		
0-10,000	64	34.6
10,001-20,000	22	11.9
20001-30,000	16	8.6
30001-40,000	17	9.2
40,001-50,000	15	8.1
50,001-60,000	8	4.3
60,001-70,000	11	5.9
70,001-80,000	16	8.6
more than 80,000	15	8.1

Table 1, continued

Frequencies and Percentages for Categorical Demographic Variables

	N	%
Education Level		
Freshman	27	14.6
Sophomore	22	11.9
Junior	50	27.0
Senior	52	28.1
Graduate level	34	18.4
Current Employment Status		
Work study	18	9.7
Part time	78	42.2
Full time	34	18.4
Unemployed	55	29.7
Number of hours enrolled		
Part time or other	51	27.6
Full time	134	72.4
Number of people in household		
1 person	30	16.2
2 people	59	31.9
3 people	45	24.3
4 people	34	18.4
5 or more people	17	9.2
Number of children in household		
0 children	123	66.5
1 child	37	20.0
2 or more children	25	13.5
Number of daily commuting hours		
Less than 1 hour	115	62.2
1 hour	30	16.2
2 or more hours	40	21.6

students reported that they were employed, with 42.2% reporting part-time employment, 18.4% reporting full-time employment, and 9.7% having a work-study job. In contrast, nearly 30% of the students reported that they were unemployed (29.7%). In terms of their student status, approximately three-quarters of the sample were enrolled in school full-time (72.4%) and the remainder of the sample was enrolled in school part-time (27.6%).

As part of the survey, respondents were also asked to indicate the number of adults and the number of children living in their household. Less than 20% of the students reported that one person lived in their household (16.2%), 31.9% had two people living in their household, 24.3% reported three people, 18.4% reported four people, and 9.2% had five or more people living in their household (see Table 1). A majority of the students reported that they had no children living with them (66.5%), 20% had one child and 13.5% had two or more children. Finally, respondents were also asked to report the number of hours they spent commuting each day. Over half of the students indicated that they commuted less than one hour per day (62.2%) and the remaining students reported that their daily commute was one hour (16.2%) or two or more hours (21.6%).

The CCQ was also given to the students as part of the survey to provide a validated method for describing individual caffeine consumption. Respondents were asked to indicate the number of servings of various caffeine products that they consumed each day. The number of servings were converted to milligrams of caffeine per serving and totaled to reflect the total number of milligrams of caffeine. On average, respondents reported consuming 426.90 milligrams (SD = 462.04) and ranged from 0 to 4042.64

ounces (see Table 2). The results revealed the presence of 10 outliers (≥ 160), thus, the total amount of caffeine intake was capped at 1357 milligrams.

Table 2

Means and Standard Deviations for Age and Total Caffeine Intake

	N	Mean	*SD*	Minimum	Maximum
Age	185	25.75	8.56	17	56
Milligrams of Caffeine	185	426.90	462.04	0	4042.64

Epworth Sleepiness Scale

The individual items of the Epworth Sleepiness Scale were summed to create an overall Sleepiness score. The average Sleepiness score was 7.92 (*SD* = 3.56) and scores ranged from 1.00 to 19.00 (see Table 3). The Sleepiness score was split into two groups, with scores of 9.00 or less reflecting a normal amount of sleepiness and scores of 10.00 or greater reflecting a significant amount of sleepiness. The majority of students fell into the normal sleep category (69.2%) and 30.8% fell into the significant sleepiness category.

Perceived Control

The means and standard deviations for Perceived Control subscales, Sleep Hygiene, GPA, and the PSQI subscales are displayed in Table 3. The average score on

the Perceived Control survey, which indicates the control or lack of control an individual has over their sleep, was 2.50 (*SD* = .32) with higher scores indicating less perceived control over sleep issues. The average score on the Perceived Control: Getting to Sleep subscale was 9.29 (*SD*=1.46), suggesting that students identified that getting to sleep was somewhat problematic for them.

Many factors are involved the prediction of sleep. As a result, evaluating the Perceived Control of Sleep included measurements of pre-sleep activity, mental processes, onset of sleep, tension, and maintenance. The average score on the Perceived Control: Pre-sleep subscale was 9.11 (*SD*=1.75). The Perceived Control: Pre-sleep measure is indicative of the ability to exercise control over their ability to relax both mentally and physically to the point where the mind is not excessively occupied by racing thoughts. The average score on the Perceived Control: Mental Processes subscale was 7.86 (*SD*=1.66) and the average score on the Perceived Control: Physical Tension/Relaxation subscale was 7.92 (*SD*=1.17). The average score for the Perceived Control: Onset of Sleep subscale was 5.65 (*SD*=1.49) and ranged from 2.0 and 8.0, suggesting that the group under study may feel that to some extent they are helpless in controlling this attribute of sleep. Similarly, the

Table 3

Means and Standard Deviations for Perceived Control Subscales, Sleepiness Scores, Sleep Hygiene, GPA, and PSQI Subscales

	N	Mean	*SD*	Minimum	Maximum
Perceived Control	185	2.50	.32	1.56	4.00
PC: Getting to Sleep	184	9.29	1.46	5.00	15.00
PC: Presleep	184	9.11	1.75	4.00	13.00
PC: Mental Processes	184	7.86	1.66	4.00	12.00
PC: Onset	184	7.92	1.17	3.00	11.00
PC: Tension	184	5.65	1.49	2.00	8.00
PC: Maintenance	184	5.17	1.73	2.00	8.00
ESS: Sleepiness Score	185	7.92	3.56	1.00	19.00
Sleep Hygiene Index	185	34.78	5.89	18.00	55.00
GPA	181	3.43	.44	2.00	4.00
PSQI: Sleep Duration	144	1.01	1.06	.00	3.00
PSQI:Sleep Disturbance	185	2.15	.55	1.00	3.00
PSQI:Sleep Latency	185	1.34	1.00	.00	3.00

Table 3, continued

Means and Standard Deviations for Perceived Control Subscales, Sleepiness Scores, Sleep Hygiene, GPA, and PSQI Subscales

	N	Mean	*SD*	Minimum	Maximum
PSQI: Day Dysfunction Due to Sleepiness	170	2.13	.57	1.00	3.00
PSQI: Subjective Sleep Quality	185	1.26	.69	.00	3.00
PSQI: Need Meds to Sleep	185	.49	.91	.00	3.00
PSQI: Sleep Efficiency	144	1.06	1.42	.00	3.00
Overall PSQI Score	185	8.81	2.61	3.00	16.00

average score for Perceived Control: Maintaining Sleep subscale was 5.17 (*SD*=1.73). Thus, there is some indication that respondents had an external locus of control as it related to their control over sleep. In general, the higher scores reflect less perceived control over items measured.

Sleep Hygiene and Academic Performance

The average Sleep Hygiene sum was 34.78 (*SD* = 5.89). The average GPA was 3.43 on a scale of 1.00 to 4.00 (*SD* = .44).

PSQI

The PSQI is comprised of seven separate subscales and an overall score. Low values reflect "better" scores and high values reflect an inability to control those aspects that can affect the quality of their sleep. The results revealed that the average values for Sleep Duration ($M = 1.01$, $SD = 1.06$), Sleep Latency ($M = 1.34$, $SD = 1.00$), Sleep Efficiency ($M = 1.06$, $SD = 1.42$) and Need Meds to Sleep ($M = .49$, $SD = .91$) appeared to be within a normal range. However, the average measurements of Sleep Disturbances ($M = 2.15$, $SD = .55$), Daytime Dysfunction Due to Sleepiness ($M = 2.13$, $SD = .57$), and Subjective Sleep Quality ($M = 2.13$, $SD = .57$) were greater. Finally, the overall score on the Total PSQI scale suggests that the group under study may be somewhat impacted by sleep disturbances ($M = 8.81$, $SD = 2.61$).

Sleep Analysis

Relationships among Dependent Measures

Pearson's product moment correlations were conducted to examine the relationship among the scores for Perceived Control subscales, Sleep Hygiene, Sleepiness, GPA, and the PSQI subscales.

PSQI subscales. In evaluating the PSQI (see Table 4), a significant correlation was noted between sleep duration and sleep disturbances. Shorter sleep durations were associated with greater sleep disturbances, $r\ (142) = .19, p < .05$. In addition, sleep duration was correlated with sleep latency, $r\ (142) = .19, p < .05$; shorter sleep durations were associated with more sleep latency. Sleep duration was also significantly positively correlated with daytime dysfunction due to sleepiness ($p < .01$), along with Subjective

Sleep Quality, and Sleep Efficiency (both at $p < .001$). Finally, as shown in Table 4, there was a significant positive correlation between Sleep Duration and Total PSQI Score, $r\ (142) = .48$, $p < .001$, indicating that respondents who reported sleeping less also reported worse overall sleep quality.

Furthermore, overall sleep quality as measured by the Total PSQI score and Subjective Sleep Quality were significantly correlated with the remaining subscale scores of Sleep Duration, Daytime Dysfunction due to Sleepiness, Subjective Sleep Quality, Need Meds to Sleep and Sleep Efficiency (see Table 4).

Table 4

Pearson's Product Moment Correlations between PSQI Subscales

	Sleep Duration	Sleep Disturbance	Sleep Latency	Day Dysfunction Due to Sleepiness	Subjective Sleep Quality	Need Meds to Sleep	Sleep Efficiency	Total PSQI Score
Sleep Duration	1.00	–	–	–	–	–	–	–
Sleep Disturbance	.18*	1.00	–	–	–	–	–	–
Sleep Latency	.19*	.27**	1.00	–	–	–	–	–
Day Dysfunction	.24**	.21**	.17*	1.00	–	–	–	–
Sleep Quality	.34**	.38**	.45**	.37**	1.00	–	–	–
Need Meds to Sleep	-.04	.19*	.27**	.14	.22**	1.00	–	–
Sleep Efficiency	-.29**	-.22**	-.37**	-.18*	-.38**	-.19*	1.00	–
Total PSQI Score	.48**	.44**	.59**	.49**	.53**	.48**	.01	1.00

Note: * $p < .05$, ** $p < .01$.

Also of note in these results was the significant positive correlation between Sleep Disturbances and Need Meds to Sleep, r (183) = .19, $p < .05$, suggesting that more sleep disturbances were associated with greater use of sleep medication to sleep. Similarly, there was a relationship between Sleep Latency and Need Meds to Sleep, r (183) = .27, $p < .01$. Finally, the results revealed a significant positive correlation between Sleep Latency and Total PSQI Score, r (183) = .59, $p < .001$, suggesting that greater sleep latency was associated with worse overall sleep quality. Each of the subscales on the PSQI showed a significant correlation ($p < .001$) with the Total PSQI reflecting their relationship with sleep quality (see Table 4).

Perceived control subscales. The correlations between Perceived Control subscales, Sleepiness, Sleep Hygiene, and GPA are displayed in Table 5. Most of the Perceived Control subscales were significantly correlated with the other measures. The results revealed a significant positive correlation between overall Perceived Control and Getting to Sleep, Pre-sleep, Mental Processes, Onset of Sleep, and Sleep Maintenance (all $p < .001$) suggesting that participants that had less perceived control had more trouble getting to sleep, difficulties with pre-sleep, mental processing, onset of sleep and maintaining sleep (see Table 5).

Further, there was a significant relationship between the Sleepiness scale and the Perceived Control: Getting to Sleep subscale, r (182) = -.16, $p < .05$. Participants who had more subjective sleepiness (were sleepier) had more problems getting to sleep. The results also revealed a significant relationship between Sleep Hygiene and the Perceived Control: Mental Processes subscale, r (182) = .15, $p < .05$.

Table 5

Pearson's Product Moment Correlations Between Scaled Measures

	PC	Getting to Sleep	Presleep	Mental Processes	Tension	Onset	Maintenance	Sleepy	Sleep Hygiene
Perceived Control	1.00	–	–	–	–	–	–	–	–
Getting to Sleep	.47**	1.00	–	–	–	–	–	–	–
Presleep	.52**	.12	1.00	–	–	–	–	–	–
Mental Processes	.61**	.07	.18**	1.00	–	–	–	–	–
Tension	.62**	.29**	.16*	.36**	1.00	–	–	–	–
Onset	.67**	.16*	.21**	.21**	.33**	1.00	–	–	–
Maintenance	.68**	.18*	.10	.33**	.29**	.55**	1.00	–	–
Sleepiness Scores	-.02	-.16*	-.04	.05	-.03	.05	.03	1.00	–
Sleep Hygiene	.12	.02	.11	.15*	-.05	.07	.03	.25**	1.00
GPA	.03	.01	.07	.05	.06	-.11	-.05	-.18**	-.11

Note: * $p < .05$, ** $p < .01$.

In other words, better sleep hygiene was associated with less difficulty in controlly their mental processes related to sleep. The results failed to reveal any other significant correlations between Perceived Control and the other dependent variables (all *ns*).

Sleepiness, sleep hygiene and academic performance. The sleep analysis revealed a significant negative correlation between Sleepiness Scores and GPA, r (179) = -.18, $p <$ .01. More sleepiness was related to lower GPAs. In addition, those who had higher Sleepiness Scores also had higher scores on the SHI, r (183) = .25, $p < .001$, indicating greater sleepiness was associated with greater sleep hygiene.

PSQI subscales and perceived control subscales, As shown in Table 6, the results revealed a significant negative relationship between Perceived Control: Mental Processes and PSQI: Sleep Latency, r (182) = -.25, $p < .001$. This indicates that greater sleep latency was related to more difficulty in controlling mental processes. Furthermore, the results revealed a significant negative correlation between Perceived Control: Getting to Sleep and PSQI: Sleep Disturbances, r (182) = -.16, $p < .05$, indicating that participants that had more difficulty getting to sleep also had more sleep disturbances. In addition, there was a significant negative correlation between Perceived Control: Getting to Sleep and PSQI: Sleep Quality, r (182) = -.15, $p < .05$, indicating that participants that had more difficulty getting to sleep also had lower quality sleep. There was also a significant correlation between Perceived Control: Getting to Sleep and PSQI: Sleep Efficiency, r (182) = .17, $p < .05$. Participants that had more difficulty getting to sleep also slept less efficiently. The results also revealed that PSQI: Use of Medications was significantly negatively related to Perceived Control: Onset of Sleep, r (182) = -.22, $p < .01$. Greater

scores on the Use of Medications scale were associated with greater scores on the onset of sleep scale.

There was also a significant negative relationship between PSQI: Sleep Latency and Perceived Control: Onset of Sleep. Participants with lower Sleep Latency had more difficulty falling asleep, r (182) = -.16, $p < .05$. The results revealed a significant correlation between Perceived Control: Onset and Overall PSQI, r (182) = -.16, $p < .05$, indicating that greater scores on onset of sleep were related to more overall Sleep Quality problems. Furthermore, the results revealed a significant negative correlation between Perceived Control: Physical Tension/Relaxation and Sleep Latency, r (142) = -.17, $p < .05$, indicating that participants that had more tension also had lower Sleep Latency scores (see Table 6). There was a significant negative correlation between Perceived Control: Physical Tension/Relaxation and Subjective Sleep Quality, r (183) = -.15, $p < .05$, suggesting that participants that had more problems with Physical Tension also had poor Overall Sleep Quality.

PSQI subscales and sleepiness. The results also revealed a significant positive correlation between Sleepiness Scores and the Duration of Sleep Subscale, r (142) = .29, $p < .001$, indicating that more sleepiness was related to less sleep. The results revealed a significant positive correlation between Sleepiness Score and Sleep Disturbances, r (183) = .25, $p < .001$, indicating that more sleepiness was associated with more sleep disturbances. Moreover, there was a significant positive correlation between Sleepiness Scores and Daytime Dysfunction Due to Sleepiness, r (168) = .39, $p < .001$, demonstrating that respondents who were sleepier also had more daytime dysfunction

due to feeling sleepy. In addition, the results revealed a significant positive correlation between Sleepiness Scores and Subjective Sleep Quality, r (183) = .25, $p < .001$, indicating that greater sleepiness was related to worse overall subjective sleep quality. Finally, there was a significant positive correlation between Sleepiness Scores and the Total PSQI Score, r (183) = .17, $p < .05$, suggesting that higher levels of sleepiness were associated with worse total sleep quality.

Table 6

Pearson's Product Moment Correlations Between Perceived Control subscales, Sleepiness, Sleep Hygiene, GPA, and the PSQI Subscales

	PC	Getting to Sleep	Presleep	Mental Processes	Tension	Onset	Main.	Sleepy	Hygiene	GPA
Sleep Duration	-.04	-.02	.04	-.06	-.03	.05	-.03	.29**	.26**	-.19*
Sleep Disturbance	-.02	-.16*	.07	.12	-.17*	-.10	-.08	.25**	.28**	-.20**
Sleep Latency	.05	-.06	.00	.25**	-.08	-.16*	.01	-.08	.16*	-.03
Day Dysfunction	.09	-.06	.01	.14	-.02	.06	.00	.39**	.30**	-.03
Sleep Quality	-.04	-.15*	.11	.01	-.15*	-.07	-.08	.25**	.31**	-.15*
Med Use	.04	.03	.09	.07	-.06	-.22**	-.03	-.05	.12	.04
Sleep Efficiency	.03	.17*	.07	-.09	.09	.07	-.03	.01	-.16*	.16*
Total PSQI Score	.01	-.03	.10	.09	-.13	-.16*	-.10	.17*	.27**	.00

*$p = < .05$ **$p = .01$

Sleep hygiene and PSQI subscales. The results revealed a significant positive correlation between Sleep Hygiene scores and the Duration of Sleep Subscale, r (142) = .26, $p < .001$. This indicates that poorer sleep hygiene was related to sleeping less (see Table 6). There was also a significant positive correlation between Sleep Hygiene scores and Sleep Disturbances, r (183) = .28, $p < .001$, suggesting that poorer sleep hygiene was related to more sleep disturbances.

Similarly, there was a significant positive correlation between Sleep Hygiene scores and Daytime Dysfunction Due to Sleepiness, r (168) = .30, $p < .001$, indicating that respondents with poor sleep hygiene also had more daytime dysfunction due to feeling sleepy. There was also a significant positive correlation between Sleep Hygiene scores and Subjective Sleep Quality, r (183) = .31, $p < .001$, indicating that respondents that had poor sleep hygiene also had worse subjective sleep quality. Further, there was a significant negative correlation between Sleep Hygiene scores and Sleep Efficiency, r (183) = -.16, $p < .05$, indicating that respondents with poor sleep hygiene also slept less efficiently. Finally, the results revealed a significant positive correlation between Sleep Hygiene scores and Total PSQI scores, r (183) = .27, $p < .001$, suggesting that poor sleep hygiene was associated with worse overall sleep quality.

Academic performance and PSQI subscales. The results also revealed a significant negative correlation between GPA and Duration of Sleep, r (138) = -.19, $p < .05$, suggesting that higher GPA was related to getting more sleep (see Table 6). In addition, there was a significant negative correlation between GPA and Sleep Disturbances, r (179) = -.20, $p < .01$, indicating that respondents with higher GPAs also

had fewer sleep disturbances. Finally, the results revealed a significant negative correlation between GPA and Subjective Sleep Quality, r (179) = -.15, $p < .05$, suggesting that higher GPA was related to better subjective sleep quality. There was also a significant positive correlation between GPA and Sleep Efficiency, r (183) =.16, $p <$ .05, indicating that respondents with a higher GPA also slept more efficiently.

Relationships between Demographic Variables and Dependent Measures

Ethnicity. The relationship between the Sleepiness categories (normal vs. significant sleepiness) and ethnicity failed to reveal significant relationships. However, when independent samples *t*-tests were conducted to examine differences between ethnicity on overall Perceived Control, Sleepiness Scores, Sleep Hygiene, GPA, and the PSQI total score, the results revealed significant differences for ethnicity on GPA, t (179) = -5.28, $p < .001$. Of note, Caucasian participants had significantly higher GPA scores ($M = 3.56$, $SD = .34$) than participants of other ethnicities ($M = 3.22$, $SD = .51$). A MANOVA was conducted to examine any effects of ethnicity on the Perceived Control subscales and PSQI subscales. The results failed to reveal any significant differences between Caucasians and those of other ethnicities on either the Perceived Control or the PSQI subscales (all *ns*).

Year in school. The relationships between Sleepiness category and year in school are displayed in Table 7. The results revealed a significant relationship between Sleepiness category and education, χ^2 (4) = 13.77, $p < .01$, Cramer's $V = .27$. A greater proportion of participants in their sophomore year report significant sleepiness (50%) compared to those in their freshman year (18.5%), junior year (32.0%), or senior year

(40.4%). Further analysis revealed that those participants at the graduate level (11.8%) report less sleepiness as well.

In addition, a one-way ANOVA revealed a significant effect for Year in School on Sleepiness scores, $F(4, 184) = 3.73$, $p < .01$ (see Table 8). Post hoc comparisons using Tukey's HSD test revealed that graduate students had significantly lower Sleepiness scores ($M = 6.32$, $SD = 3.38$) than students in their sophomore year ($M = 9.59$, $SD = 4.19$, $p < .05$). In addition, graduate students had marginally lower Sleepiness scores ($M = 6.32$, $SD = 3.38$) than those in their senior year ($M = 8.42$, $SD = 3.16$, $p = .051$). A one-way MANOVA was conducted to examine any effects of year in school on Perceived Control subscales. The overall multivariate effect was significant, $F(6, 177) = 2.60$, $p < .05$. The results revealed a significant effect for year in school on Perceived Control: Mental Processes, $F(4, 183) = 2.44$, $p < .05$. Post hoc comparisons using Tukey's HSD test revealed that juniors had marginally significantly higher scores on the Perceived Control: Mental Processes subscale ($M = 8.38$, $SD = 1.82$) than students in their senior year ($M = 7.50$, $SD = 1.73$, $p = .056$). The results failed to reveal significant effects for Year in School on all other Perceived Control subscales (all *ns*).

Table 7

Frequencies and Percentages for Epworth Sleepiness Scale Category by Year in School

	Freshman		Sophomore		Junior		Senior		Graduate level			
	N	%	*N*	%	*N*	%	*N*	%	*N*	%	χ^2	*p*
Sleepiness Category											13.77	.008
Normal Sleep	22	81.5	11	50.0	34	68.0	31	59.6	30	88.2		
Significant Sleepiness	5	18.5	11	50.0	16	32.0	21	40.4	4	11.8		

Table 8

Means and Standard Deviations for Overall Perceived Control, Sleepiness Scores, Sleep Hygiene, GPA, and PSQI Total by Education

	N	Mean	*SD*	*F*	*p*
Perceived Control				2.06	.088
Freshman	27	2.44	.23		
Sophomore	22	2.43	.33		
Junior	50	2.57	.32		
Senior	52	2.44	.32		
Graduate	34	2.58	.38		
Sleepiness Scores				3.73	.006
Freshman	27	7.19	3.70		
Sophomore	22	9.59	4.19		
Junior	50	8.16	3.33		
Senior	52	8.42	3.16		
Graduate	34	6.32	3.37		
Sleep Hygiene				.56	.694
Freshman	27	2.75	.53		
Sophomore	22	2.63	.54		
Junior	50	2.68	.44		
Senior	52	2.70	.41		
Graduate	34	2.59	.41		
GPA				4.93	.001
Freshman	24	3.44^{ab}	.39		
Sophomore	21	3.26^{a}	.56		
Junior	50	3.34^{a}	.46		
Senior	52	3.41^{a}	.39		
Graduate	34	3.70^{b}	.34		

Note: Means with differing superscripts differed significantly by Tukey's HSD.

Table 8, continued

Means and Standard Deviations for Overall Perceived Control, Sleepiness Scores, Sleep Hygiene, GPA, and PSQI Total by Education

	N	Mean	*SD*	*F*	*p*
Total PSQI Score				.38	.822
Freshman	27	9.19	2.22		
Sophomore	22	8.82	2.24		
Junior	50	8.50	2.89		
Senior	52	8.98	2.41		
Graduate	34	8.71	3.01		

Marital status. A one-way MANOVA was conducted to examine the effects of marital status on the PSQI subscales. The overall multivariate effect was significant, $F(6, 126) = 2.45$, $p < .05$. There was a significant effect for marital status on Medication Use, $F(1, 129) = 5.24$, $p < .05$. Married respondents used more medication ($M = .72$, $SD = 1.09$) than participants who were not married ($M = .35$, $SD = .74$). The results failed to reveal any significant differences between those who were single or never married and those who were married on any of the other PSQI subscales (all *ns*).

Household size. The relationships between the Sleepiness categories and number of people living in the household are displayed in Table 9. The results failed to reveal a significant relationship between Sleepiness categories and the number of people living in the household. One-way ANOVAs were also conducted to examine the data for any

effects of the number of people living in the household on overall Perceived Control, Sleepiness Scores, Sleep Hygiene, GPA, and the PSQI total score. The results revealed significant results for number of people in the household on Sleepiness Scores, F (4, 180) = 3.44, $p < .05$. Post hoc comparisons using Tukey's HSD test were performed and revealed that students with five or more people in their household had significantly greater Sleepiness scores ($M = 9.94$, $SD = 3.33$) compared to those with only one person in their household ($M = 6.93$, $SD = 3.84$, $p < .05$) and those with four people in their household ($M = 6.94$, $SD = 2.63$, $p < .05$).

Table 9

Frequencies and Percentages for Epworth Sleepiness Category by Number of People in the Household

	1 person		2 people		3 people		4 people		5 or more people			
	N	%	*N*	%	*N*	%	*N*	%	*N*	%	χ^2	*p*
Sleepiness Category											6.14	.189
Normal Sleep	22	73.3	41	69.5	28	62.2	28	82.4	9	52.9		
Significant Sleepiness	8	26.7	18	30.5	17	37.8	6	17.6	8	47.1		

Number of children. The relationship between the Sleepiness categories and the number of children living in the household failed to reveal significance, $\chi^2(2) = .04, p = .982$, Cramer's $V = .01$. A one-way MANOVA was also conducted to examine any effects of number of children living in the household on PSQI subscales. The overall multivariate effect was not significant, $F(6, 126) = 1.79, p = .095$. However, due to the exploratory nature of the current study, the univariate effects were examined. There was a significant effect for the number of children in the household on Subjective Sleep Quality, $F(2, 182) = 3.76, p < .05$. Post hoc comparisons using Tukey's HSD test revealed that students with two or more children in their household had significantly higher scores on Subjective Sleep Quality (worse quality) ($M = 1.59$, $SD = .80$) than those with no children in their household ($M = 1.10$, $SD = .63, p < .05$).

Daily commute. Because TWU is a commuter school, data was collected to determine if there was a significant effect on sleep or other variables. A MANOVA was conducted to examine any effects of the number of hours commuting on the Perceived Control subscales (see Table 10). The overall multivariate effect was not significant. However, univariate effects revealed that there was a significant effect for the number of hours commuting on Perceived Control: Mental Processes, $F(2, 184) = 5.05, p < .05$. A post hoc Tukey's HSD test revealed that students commuting two or more hours had significantly lower scores on Perceived Control: Mental Processes ($M = 7.15$, $SD = 1.58$) than those commuting one hour or less ($M = 8.10$, $SD = 1.60, p < .01$).

Table 10

Means and Standard Deviations for Perceived Control Subscales by Commute Hours

	N	Mean	*SD*	*F*	*P*
PC: Mental Processes				5.05	.007
Less than 1 hour	114	8.10[a]	1.60		
1 hour	30	7.93[ab]	1.80		
2 or more hours	40	7.15[b]	1.58		

Note: Means with differing superscripts differed significantly by Tukey's HSD.

Age. Pearson's product moment correlations were conducted to examine the relationships between age and the measures of Perceived Control, Sleep Hygiene, Sleepiness Scores, GPA, Academic Performance, and the PSQI subscales (see Table 11). The results revealed a significant positive correlation between age and Perceived Control: Pre-sleep, $r\ (182) = .17, p < .05$. Notably, older age was associated with greater pre-sleep difficulties.

Total caffeine intake. Pearson's product moment correlations were conducted to evaluate the relationships between total caffeine intake (milligrams) and the Perceived Control subscales, Sleep Hygiene, Sleepiness Scores, GPA, and the PSQI subscales (see Table 11). The results failed to reveal any significant correlations between caffeine (all *ns*).

Table 11

Pearson's Product Moment Correlations between Age and Dependent Measures

	Age	Caffeine
Perceived Control	-.01	.01
PC: Getting to Sleep	-.10	-.03
PC: Presleep	.17*	.08
PC: Mental Processes	.03	-.06
PC: Onset	-.09	-.03
PC: Tension	.02	.00
PC: Maintenance	-.09	.04
ESS: Sleepiness Scores	-.11	.05
Sleep Hygiene	-.14	.03
GPA	.12	-.02
PSQI: Duration of Sleep	.01	.13
PSQI: Sleep Disturbance	-.01	.04
PSQI: Sleep Latency	-.04	.05
PSQI: Day Dysfunction Due to Sleepiness	.04	.05
PSQI: Subjective Sleep Quality	.05	-.01
PSQI: Need Meds to Sleep	.10	.02
PSQI: Sleep Efficiency	-.11	-.12
Total PSQI Score	-.04	.02

Note: * $p < .05$.

Primary Analysis of Caffeine Consumption

Multiple regression models were used in order to determine whether any of the demographic variables predicted the continuous dependent variables (Perceived Control subscales, Sleepiness Score, Sleep Hygiene, GPA, and the PSQI subscales). Caffeine intake was divided into four categories with an equal number of participants (25.0% of the sample in each group) for the remainder of analysis. The categories were labeled low caffeine consumption (0 to 125 milligrams of caffeine), medium-low caffeine consumption (126 to 305 milligrams of caffeine), medium-high caffeine consumption (306 to 484 milligrams of caffeine), and high caffeine consumption (485 to 1357 milligrams of caffeine).

Perceived Control

In the multiple regression analysis conducted to predict overall Perceived Control using caffeine intake and demographic variables as the predictors, the model was significant, F (16, 175) = 1.77, $p < .05$, and accounted for 15.1% of the variance (R^2 = .15). As shown in Table 12, medium-high caffeine intake was also a significant predictor of overall Perceived Control (*Beta* = .198, $p < .05$). In other words, medium-high caffeine consumption predicted greater Perceived Control scores, demonstrating that respondents at this level felt they had less control over their sleep. Further, the results revealed that working part-time or as a work-study was a significant predictor of Perceived Control (*Beta* = .218, $p < .01$). Students reporting that they either worked part-time or in a work-study program perceived that they had less control over their sleep.

Table 12

Summary of Multiple Regression Analysis Predicting Overall Perceived Control Scores

	Unstandardized B	*SE*	*Beta*	*t*	*p*
Medium Low Caffeine Use	.074	.07	.096	1.05	.295
Medium High Caffeine Use	.148	.07	.198	2.18	.031
High Caffeine Use	.087	.07	.115	1.23	.221
Caucasian	.054	.05	.079	1.06	.292
Married or Other	.004	.06	.007	.07	.943
More Than $30,000	-.033	.05	-.050	-.62	.539
Full-time Student	-.002	.07	-.002	-.02	.981
Full-time Work	-.003	.08	-.004	-.04	.966
Part-time Work/Work Study	.142	.06	.218	2.40	.018
Children	-.070	.06	-.101	-1.14	.258
One Hour or More Commute	-.059	.05	-.087	-1.10	.271
Graduate Student	.139	.11	.164	1.28	.204
Sophomore	-.004	.10	-.004	-.04	.967
Junior	.135	.08	.182	1.61	.109
Senior	.010	.09	.014	.11	.911
Age	.002	.00	.048	.47	.638

Perceived Control: Getting to Sleep

A multiple regression analysis was conducted to predict Perceived Control: Getting to Sleep using caffeine intake and demographic variables as the predictors. The model was not significant, $F(16, 174) = 1.52$, $p = .098$, and accounted for only 13.3% of the variance ($R^2 = .13$). However, as shown in Table 13, medium-high and high caffeine intake was a marginally significant predictor of Perceived Control: Getting to Sleep (*Beta* = .198, $p = .070$; *Beta* = .183, $p = .056$). These results link higher caffeine use to a lack of perceived control in relation to getting to sleep. In addition, working part-time or in a work study program was a marginally significant predictor, demonstrating a lack of Perceived Control in Getting to Sleep (*Beta* = .170, $p = .067$).

Perceived Control: Presleep

A multiple regression analysis was conducted to predict Perceived Control: Presleep using overall caffeine intake and demographic variables as the predictors. The model was significant, $F(16, 174) = 1.86$, $p < .05$, and accounted for 15.8% of the variance ($R^2 = .16$). In addition, medium-high caffeine intake (Table 14) was a significant predictor of Perceived Control (*Beta* = .292, $p < .01$) affecting presleep. Moreover, age was a significant predictor of Perceived Control: Presleep (*Beta* = .308, $p < .01$). Being older predicted a lack of control during the pre-sleep phase.

Perceived Control: Mental Processes

A multiple regression analysis was conducted to predict Perceived Control: Mental Processes using caffeine intake and demographic variables as the predictors. The

Table 13

Summary of Multiple Regression Analysis Predicting Perceived Control: Getting to Sleep

	Unstandardized				
	B	*SE*	*Beta*	*t*	*p*
Medium Low Caffeine Use	.207	.32	.061	.65	.515
Medium High Caffeine Use	.563	.31	.168	1.82	.070
High Caffeine Use	.617	.32	.183	1.93	.056
Caucasian	.189	.23	.062	.81	.417
Married or Other	-.274	.28	-.092	-.98	.327
More Than $30,000	-.019	.24	-.007	-.08	.935
Full-time Student	-.472	.31	-.147	-1.50	.135
Full-time Work	.325	.35	.086	.92	.358
Part-time Work/Work Study	.493	.27	.170	1.85	.067
Children	-.300	.28	-.098	-1.09	.277
One Hour or More Commute	.149	.24	.050	.62	.535
Graduate Student	.365	.50	.096	.73	.465
Sophomore	-.327	.46	-.075	-.71	.476
Junior	.315	.38	.096	.84	.403
Senior	-.070	.39	-.022	-.18	.859
Age	-.026	.02	-.154	-1.48	.140

Table 14

Summary of Multiple Regression Analysis Predicting Perceived Control: Presleep

	Unstandardized				
	B	*SE*	*Beta*	*t*	*p*
Medium Low Caffeine Use	.234	.38	.056	.61	.541
Medium High Caffeine Use	1.196	.37	.292	3.22	.002
High Caffeine Use	.373	.39	.090	.97	.334
Caucasian	.369	.28	.099	1.32	.187
Married or Other	.349	.34	.095	1.04	.300
More Than $30,000	.010	.29	.003	.04	.971
Full-time Student	.397	.38	.101	1.05	.295
Full-time Work	.055	.42	.012	.13	.898
Part-time Work/Work Study	.564	.32	.159	1.76	.081
Children	-.486	.33	-.130	-1.47	.145
One Hour or More Commute	-.241	.29	-.066	-.84	.405
Graduate Student	-.649	.60	-.140	-1.08	.281
Sophomore	-.353	.55	-.066	-.64	.523
Junior	-.421	.45	-.105	-.93	.354
Senior	-.655	.47	-.167	-1.38	.169
Age	.063	.02	.308	3.01	.003

Note: * $p < .05$.

model was not significant, F (16, 174) = 1.39, p = .155, and accounted for only 12.3% of the variance (R^2 = .12). However, the results revealed that commuting for one hour or more was a marginally significant predictor of Mental Processes (*Beta* = -.145, p = .075). In other words, commuting for one hour or more predicted lower Perceived Control: Mental Processes scores. Further, the results revealed that being a junior was a marginally significant predictor of Mental Processes (*Beta* = .226, p = .052).

Perceived Control: Physical Tension/Relaxation

A multiple regression analysis was conducted to predict Perceived Control: Physical Tension/Relaxation using caffeine intake and demographic variables as predictors. The model was not significant, F (16, 174) = 1.17, p = .300, and accounted for only 10.6% of the variance (R^2 = .11). Conversely, the results revealed that having children was a marginally significant predictor of Physical Tension/Relaxation (*Beta* = -.161, p = .079). Respondents with children had increased Perceived Control over Physical Tension/Relaxation.

Perceived Control: Onset

A multiple regression analysis was conducted to predict Perceived Control: Onset using caffeine intake and demographic variables as the predictors. The model was not significant, F (16, 174) = .97, p = .495, and accounted for only 8.9% of the variance (R^2 = .09). However, the results indicated that being a full time student predicted lower Perceived Control: Onset (*Beta* = -.220, $p < .05$) scores. In other words, being a full-time student was linked to more perceived control over the Onset of Sleep.

Perceived Control: Maintenance

A multiple regression analysis was conducted to predict Perceived Control: Maintenance using caffeine intake and demographic variables as the predictors. The model was not significant, $F(16, 174) = .68$, $p = .811$, and accounted for only 6.4% of the variance ($R^2 = .64$). On the other hand, the results showed that working part-time was a significant predictor of Perceived Control: Maintenance (*Beta* = .189, $p < .05$). Being a part-time student predicted better sleep maintenance scores.

Sleepiness

A multiple regression analysis was conducted to predict Sleepiness Score using caffeine intake and demographic variables as the predictors. The results failed to reveal a significant model, $F(16, 175) = 1.29$, $p = .209$, and accounted for only 11.5% of the variance ($R^2 = .12$). However, the results revealed that medium-high caffeine intake was a significant predictor of sleepiness (*Beta* = .186, $p < .05$). Consuming medium-high levels of caffeine predicted more sleepiness. Interestingly, being a sophomore was also a significant predictor of increased sleepiness (*Beta* = .248, $p < .01$).

Sleepiness Category

A multiple logistic regression analysis was conducted to predict the Sleepiness category using caffeine intake and demographic variables as predictors. The model was not significant, $\chi^2 (16) = 25.33$, $p = .064$. The results revealed that medium-high caffeine intake was a significant predictor of greater odds of significant sleepiness (*Odds Ratio* = 6.48, $p < .05$). Consuming medium-high levels of caffeine predicted more sleepiness

and, similar to the above findings, being a sophomore was a significant predictor of greater odds of significant sleepiness (*Odds Ratio* = 4.04, $p < .05$).

Sleep Hygiene

A multiple regression analysis was conducted to predict Sleep Hygiene using caffeine intake and demographic variables as predictors. The overall model was not significant, F (16, 174) =.88, $p = .592$, accounting for only 8.1% of the variance ($R^2 = .08$). Overall, the results failed to reveal any significant predictors of the Sleep Hygiene score.

Academic Performance

To measure academic performance, participants were asked to self-report their GPA. In the multiple regression analysis using caffeine intake and demographic variables to predict GPA, the results revealed a significant model, F (16, 171) = 4.03, $p < .001$ and accounted for 29.4% of the variance ($R^2 = .29$). In addition, as shown in Table 15, ethnicity (being Caucasian) was a significant predictor of GPA (*Beta* = .345, $p < .001$). Furthermore, education level was a significant predictor of GPA (*Beta* = .293, $p < .01$), noting that being a graduate student predicts a higher GPA.

Sleep Duration

A multiple regression analysis was conducted to predict Duration of Sleep using caffeine intake and demographic variables as predictors. Although initial results failed to reveal a significant model, F (16, 136) = 1.26, $p = .234$ and accounted for only 14.4% of the variance ($R^2 = .14$), the results revealed that being a junior was a significant

positive predictor of Sleep Duration (*Beta* = .268, $p < .01$; see Table 16). In addition, being a senior was a significant positive predictor of Sleep Duration (*Beta* = .312, $p < .001$).

Table 15

Summary of Multiple Regression Analysis Predicting Grade Point Average

	Unstandardized				
	B	*SE*	*Beta*	*t*	*p*
Medium Low Caffeine Use	-.043	.09	-.041	-.49	.626
Medium High Caffeine Use	.056	.08	.055	.66	.513
High Caffeine Use	.084	.09	.082	.95	.344
Caucasian	.318	.06	.345	4.95	.000
Married or Other	.033	.08	.037	.43	.666
More Than $30,000	.079	.07	.088	1.18	.238
Full-time Student	.058	.09	.060	.68	.498
Full-time Work	-.010	.10	-.009	-.10	.918
Part-time Work/Work Study	.027	.07	.030	.36	.717
Children	.019	.08	.020	.25	.803
One Hour or More Commute	.028	.07	.030	.41	.682
Graduate Student	.332	.14	.293	2.38	.019
Sophomore	-.200	.13	-.149	-1.54	.126
Junior	-.157	.11	-.159	-1.46	.146
Senior	-.098	.11	-.102	-.87	.388
Age	-.001	.00	-.026	-.28	.779

Note: * $p < .05$.

Table 16

Summary of Multiple Regression Analysis Predicting Sleep Duration

	Unstandardized				
	B	*SE*	*Beta*	*t*	*p*
Medium Low Caffeine Use	.328	.27	.130	1.21	.229
Medium High Caffeine Use	.447	.25	.189	1.76	.081
High Caffeine Use	.347	.27	.145	1.27	.205
Caucasian	-.365	.20	-.161	-1.81	.072
Married or Other	-.070	.24	-.032	-.29	.771
More Than $30,000	.179	.21	.084	.87	.387
Full-time Student	.268	.25	.113	1.07	.289
Full-time Work	-.268	.29	-.098	-.92	.359
Part-time Work/Work Study	-.080	.22	-.038	-.35	.723
Children	.411	.23	.186	1.77	.080
One Hour or More Commute	.061	.20	.029	.31	.757
Graduate Student	.560	.39	.202	1.42	.157
Sophomore	.414	.37	.130	1.12	.267
Junior	.640	.30	.268	2.15	.033
Senior	.741	.32	.312	2.33	.021
Age	-.007	.02	-.050	-.42	.675

Note: * $p < .05$.

These findings indicate that being in the junior or senior year predicted worse sleep duration. Moreover, being Caucasian or having more children predicted marginally significant Sleep Duration scores. The results support race as a marginally significant negative predictor of Sleep Duration (*Beta* = -.161, p = .072). In addition, having children was a marginally significant positive predictor of Sleep Duration (*Beta* = .186, p = .080).

Sleep Disturbances

A multiple regression analysis was conducted to predict Sleep Disturbances using caffeine intake and demographic variables as predictors. The overall model was not significant, F (16, 175) = .62, p = .865 and accounted for only 5.9% of the variance (R^2 = .06). The results failed to reveal any significant predictors of Sleep Disturbance scores.

Sleep Latency

In the multiple regression analysis conducted to predict Sleep Latency using caffeine intake and demographic variables as predictors, the overall model was not significant, F (16, 175) = .56, p = .910. It accounted for only 5.3% of the variance (R^2 = .05). The results failed to reveal any significant predictors.

Daytime Dysfunction Due to Sleepiness

A multiple regression analysis conducted to predict Daytime Dysfunction Due to Sleepiness using caffeine intake and demographic variables as predictors failed to reveal a significant model, F (16, 1622) = .73, p = .764, and accounted for only 7.4% of the variance (R^2 = .07). On the contrary, the results did reveal that Medium-High caffeine intake was a marginally significant predictor of Daytime Dysfunction due to Sleepiness.

(*Beta* = .188, p = .056). Consuming caffeine at a medium-high level predicted significantly higher Daytime Dysfunction scores.

Subjective Sleep Quality

Using caffeine intake and demographic variables as predictors of Subjective Sleep Quality, the multiple regression analysis was not significant, F (16, 175) = 1.52, p = .100, and accounted for only 13.2% of the variance (R^2 =.13). However, having children was a significant predictor of Subjective Sleep Quality (*Beta* = .184, p < .05). Having children predicted poorer Subjective Sleep Quality and furthermore, having an income of more than $30,000 was a marginally significant predictor of better Subjective Sleep Quality (*Beta* = -.148, p = .073).

Need Meds to Sleep

A multiple regression analysis was conducted to predict use of sleep medications using caffeine intake and demographic variables as predictors. The model was not significant, F (16, 175) = .88, p = .594, and accounted for only 8.1% of the variance (R^2 = .08). The results failed to reveal any significant predictors.

Sleep Efficiency

A multiple regression analysis was conducted to predict Sleep Efficiency using caffeine intake and demographic variables as predictors. The model was significant, F (16, 136) = 1.81, p < .05 and accounted for 19.4% of the total variance (R^2 = .19). The results failed to reveal any other significant predictors.

Total PSQI Score

A multiple regression analysis was conducted to predict Total PSQI Scores using caffeine intake and demographic variables as predictors. The results failed to reveal a significant model, $F(16, 126) = 1.14$, $p = .328$, and accounted for only 14.2% of the variance ($R^2 = .14$) (see Table 17).

Table 17

Summary of Multiple Regression Analysis Predicting Total PSQI Score

	Unstandardized				
	B	*SE*	*Beta*	*t*	*p*
Medium Low Caffeine Use	.532	.68	.089	.78	.434
Medium High Caffeine Use	1.544	.62	.269	2.48	.015
High Caffeine Use	.408	.68	.070	.60	.552
Caucasian	-.067	.49	-.012	-.14	.893
Married or Other	-.581	.62	-.111	-.94	.349
More Than $30,000	-.816	.52	-.160	-1.57	.119
Full-time Student	.439	.66	.076	.66	.507
Full-time Work	-.524	.73	-.080	-.72	.474
Part-time Work/Work Study	-1.034	.57	-.206	-1.83	.070
Children	1.377	.59	.256	2.35	.021
One Hour or More Commute	.223	.50	.043	.45	.656
Graduate Student	1.516	.98	.236	1.55	.125
Sophomore	-.108	.98	-.013	-.11	.913
Junior	.417	.74	.074	.56	.573
Senior	1.115	.79	.196	1.41	.161
Age	-.019	.04	-.060	-.47	.637

Note: * $p < .05$.

However, as shown in Table 17, medium-high caffeine intake was a significant predictor of Total PSQI Score (*Beta* = .269, $p < .01$). Drinking medium-high levels of caffeine predicted worse overall sleep quality. Additionally, the results revealed that having children was a significant predictor of worse overall sleep quality reflected in the Total PSQI Score (*Beta* = .256, $p < .05$). Furthermore, working part-time or in a work-study program was a marginally significant predictor of Total PSQI Score (*Beta* = -.206, $p = .070$). In other words, working part-time or in a work-study program actually predicted marginally better quality sleep.

CHAPTER V

DISCUSSION

This chapter will discuss the implications of the findings from the study. It will include the following sections: summary, limitations, conclusions, discussion and implications, and recommendations.

Summary

The purpose of the current study was to determine whether caffeine intake is a significant predictor of sleep quality, sleep hygiene, subjective sleepiness, and academic performance among female college students in North Texas. Additionally, socioeconomic status and ethnicity were examined for differences in caffeine consumption, sleep hygiene, and sleep quality.

This predictive study utilized survey design. A convenience sample drawn from college women attending Texas Woman's University (TWU) in North Texas volunteered for this research study. The participants were asked to complete six short online surveys with an approximate completion time of twenty to twenty-five minutes. This included: ESS, PSQI, SHI, CCQ, PCQ, and a general questionnaire. They were given the opportunity to ask questions following the completion of the surveys to address any concerns that they may have had related to the study. Participants were directed to the National Sleep Foundation website at www.sleepfoundation.org where they could obtain

information discussing the practice and benefits of good sleep hygiene. Data collection took place during the last six weeks of the Fall 2008 and the first four weeks of Spring 2009 semesters. Volunteers were recruited through campus email, classroom announcements, and intranet (TWU portal).

This study reveals that caffeine intake contributes to overall sleepiness, sleep disturbances, poor sleep hygiene, decreased sleep duration, and poor sleep quality. However, caffeine intake itself was not associated with lower academic performance. There were no significant differences found in caffeine intake or sleep hygiene between women in various socioeconomic classes or of varying ethnicities. Overall sleep quality was better for participants in the highest socioeconomic class and the lowest socioeconomic category. In addition, Caucasian students and upper class or graduate students had higher GPAs.

The results support current literature identifying the prevalence of sleep disturbances in university students (ACHA, 2009; Buboltz et al., 2001; McGee et al., 2006). In 2006, Brown et al. developed and evaluated a sleep treatment program for students, which included education on sleep hygiene and the development of good sleep habits in non-clinical populations. They recommended the use of a sleep education program addressing sleep hygiene habits to provide students with information to understand the impact of poor sleep quality. However, Mastin et al. (2006) and Stepanski and Wyatt (2003) suggest that examining sleep hygiene behaviors independently may improve understanding of each component's effect on the constructs of sleep hygiene and how effecting change in one specific behavior may improve overall sleep quality. The

current study enhances the body of knowledge by identifying the relative contribution of caffeine use to inadequate sleep hygiene and poor sleep quality in female college students.

An important finding in this research was the effect that caffeine has as a predictor of sleepiness on the ESS. Participants that consumed more caffeine were noted to have greater odds of significant subjective sleepiness as measured by the ESS and have poorer Overall Sleep Quality on the PSQI. In addition, medium to high caffeine use predicts more daytime dysfunction and is a marginal predictor of Sleep Disturbances on the PSQI.

The use of the PCQ to determine individuals' perceived control over sleep showed a significant relationship between the ESS scale and the PCQ subscale of Getting to Sleep. Those females that reported more subjective sleepiness also have more trouble getting to sleep. Poor Overall Sleep Quality is related to less perceived control over their mental processes related to sleep. In the multivariate regression analysis on the Overall PCQ variables, medium-high caffeine use is associated with participants who report having less control over their sleep. In other words, those participants that were sleepier used more caffeine and therefore had more difficulty going to sleep which results in poor sleep quality. Research shows that perception of control is a significant predictor of behavioral outcomes that are considered to be under volitional control (Azjen, 2005). Making the choice to change these behaviors may have a significant effect on overall sleep quality.

Limitations

Several limitations affect the interpretation of the data within this study and need to be addressed. First, a convenience sample of female college students in North Texas was used, and therefore, this study cannot be generalized to the larger population of college students. Participants who completed the surveys were volunteers and may have been biased by the study topic or the willingness to participate.

Second, this study is limited by the use of the survey design and self-report data, which are subject to several sources of error including recall and social desirability biases. Although self-report surveys are common in studies of this nature and are generally considered reliable, biases can lead to either over- or under-reporting measures, such as caffeine use, Academic Performance (GPA), and amount and quality of sleep, socioeconomic status, and ethnicity. This study also employed a cross-sectional design. The ESS, PSQI, SHI, CCQ, and PCQ used to collect data only provided a snap-shot of a college student's sleep behaviors, sleep quality, and use of caffeine as they are related to their experience at a point in time, as defined by the limitations of each scale.

Finally, this study is limited by the make-up of the university population. Although the university is 93% female, it is important to note that the university is home to one of the largest nursing schools in Texas. It also supports a wide variety of public and allied health degrees and has a large population of doctoral students. This may affect the background knowledge concerning sleep habits and behaviors.

Summary of Hypotheses Rejected or Failed to Reject

The majority of hypotheses in the current study failed to be rejected. Table 18 details the results of each hypothesis.

Table 18

Summary of Hypothesis Rejected or Failed to Reject

Hypothesis	Results	Rejected or Failed to Reject
H1: Caffeine consumption (by level) is a significant predictor of sleep quality among North Texas female college students	Caffeine consumption is a predictor of sleep quality.	Hypothesis: Failed to reject
H2: Caffeine consumption (by level) is a significant predictor of sleep hygiene among North Texas female college students.	Caffeine consumption is a predictor of sleep hygiene.	Hypothesis: Rejected

Table 18, continued

Summary of Hypothesis Rejected or Failed to Reject

Hypothesis	Results	Rejected or Failed to Reject
H3: Caffeine consumption (by level) is a significant predictor of academic performance (by GPA) among North Texas female college students.	Caffeine consumption is not a significant predictor of academic performance.	Hypothesis: Rejected
H4: Caffeine consumption (by level) is a significant predictor of subjective sleepiness among North Texas female college students.	Caffeine consumption is a predictor of subjective sleepiness.	Hypothesis: Failed to reject
H5: Caffeine consumption (by level) is a significant predictor of perceived control of sleep among North Texas female college students.	Caffeine consumption is a significant predictor of perceived control of sleep.	Hypothesis: Failed to reject

Demographic Findings

The sample for the current study consisted of primarily single, Caucasian (64.3%) females in their mid-20's employed part-time, while attending school full-time. It is important to note that in Brown et al., 2002, Forquer et al., 2008, and Pilcher & Ott, 1998, the average age of participants was twenty to twenty-one years old, which is somewhat younger and therefore may have demonstrated different sleeping patterns. In addition, their studies discussed both male and female students who were primarily freshmen. In this study, the participants were mostly junior and senior students and nearly 20% were graduate students with two to three people living in their home, commuting less than one hour to school, and having no children. The participants are equally distributed across socioeconomic class, and the ethnic make-up of the sample was similar to that of TWU allowing results to be generalized to the campus' female population. The selection of an all female sample group was by design. Females are reported to have more sleep problems than males in general (Brown et al., 2001; Lundt, 2006; Moline et al., 2004; Tworoger et al., 2005).

Relationships between Demographic Variables

Epworth Sleepiness Scale categories. Results of the Epworth Sleepiness scale revealed that most participants have normal levels of sleepiness. However, nearly 1/3 of the sample had significant levels of sleepiness scoring a 10 or greater on the ESS. This is consistent with reports of chronic sleep difficulties in 30% of participants studied by

Brown et al., (2001) and the 33% of students reporting being tired during the day in the research done by Forquer et al. (2008). In addition, the data from ACHA (2007) showed similarities in that 27% of women ($N = 11,891$) completing the National College Health Assessment report had sleep difficulties.

One of the findings that was somewhat intriguing revealed that Sophmores are the sleepiest group of students by grade level. The reasons for this are not quite clear. An assumption can be made by looking at those findings that significantly impact sleepiness, such as young children in the home, living with a group of four or more, having a part-time job, or consumption of caffeine at the medium-high level. Both Jensen (2003) and Kelly (2003) suggest that worry should be considered in this equation. It may be at the crux of the time pressures associated with rigors of higher education. In fact, in this study, medium-high caffeine users were 6.5 times more likely to demonstrate EDS than those who consumed less.

More importantly, the study identified the impact of life choices on females' sleep. Participants with two or more children in the home had significantly more sleepiness than other participants. These results are supported by The National Sleep Foundation's *Sleep in America Poll* (2007), where 43% of women with children reported that daytime sleepiness interfered with their daily activities. This sheds light on the findings of this study as it relates to female students who also have children.

Perceived Control Questionnaire (PCQ). The PCQ examined how much control the participants perceived they had over their sleep. The overall PCQ scores indicated that participants did not feel completely helpless or powerless over their sleep, but they

did not perceive total control either. Data pointed to the fact that older participants do have more difficulty falling asleep. However, the current sample ranges in age from 17-56 years old with almost 20% of the participants on the graduate level and therefore were older than other studies that recruited freshman, which may have accounted for the differences in results (Brown et al, 2001; Brown et al., 2002).

Brown and colleagues (2002) provide evidence that addressing caffeine consumption is one of the most important habits to curtail when providing health education programming on sleep hygiene in a college setting. This study reports that medium-high to high (> 306 milligrams/day) caffeine use had a significant effect on participants Overall Perceived Control. Participants in this category felt they had less control over their sleep and as a result may have increased their caffeine use to counteract the daytime sleepiness and set them on a collision course with constant sleep deprivation that may have resulted in poor academic performance.

In the Theory of Planned Behavior (Azjen & Fishbein, 1970) if one does not feel she has control (or if there is a lack of control) over a behavior, then it is difficult to change. Moreover, if a person is lacking information, skills or ability to make a change, that change may be beyond her reach (Azjen, 2005). While the participants completing the PCQ did identify as having some control over their sleep, when the results were evaluated against measurements of sleep quality, students still reported having disturbed sleep and daytime dysfunction. Several facts to consider here in relation to TPB and the PCQ are that most participants did perceive some general control over Mental Processes, Physical Tension/Relaxation, Sleep Onset, and Sleep Maintenance. Since these events

can be considered willful behavior (under volitional control), it can be expected that educational interventions designed to provide students with the information needed to make a change in their sleep habits, and any related caffeine use (Azjen, 2005) may have a significant impact. In addition, if the theory is brought more to light by encouraging a change in attitude using various social influences in the subjective norm as they relate to positive issues around sleep quality and its relationship to improved Academic Performance, students may feel they can exercise a sense of self-efficacy and make the necessary changes.

Sleep Hygiene Index (SHI). The SHI asked participants about their habits and related factors associated with sleep. This index provided a global measurement of sleep hygiene. The higher scores indicated inadequate sleep hygiene. Participants in the current study reported having adequate sleep hygiene. However, there was a significant relationship between sleep hygiene and the PSQ: Mental Processes. Those with good sleep hygiene also had significant control over mental processing that may make quality sleep difficult to attain. However, caffeine consumption did negatively affect sleep hygiene practices of some of the students in the present study. Inadequate sleep hygiene was found to significantly affect academic performance. As a component of good sleep habits, restriction of caffeine use during different phases of the sleep/wake cycle is necessary. Caffeine use beyond 300 milligrams a day is considered in excess. The participants in this study averaged 400+ milligrams per day. Roehrs and Roth (2008) found that caffeine use reduced total sleep time, increased sleep latency, and reduced restorative sleep dependent on the amount of caffeine consumed.

Academic performance (GPA). As shown in the ESS, students reporting EDS had lower GPAs. Overall, GPAs for these study participants were high. In fact, Caucasians had higher GPAs than participants of other ethnicities had. Graduate students had the highest GPAs compared to the lower-class students as expected since they are required to maintain a GPA 3.0 and above. In addition, subjective sleep quality, sleep duration, and disturbance are linked to lower GPAs in this study signifying that interventions linked to improving these components may lead to an improved GPA. Pagel, Forister and Kwiatkowki (2007) noted that GPAs were not only affected by sleep quality issues but also by socioeconomic status. This study also showed an effect by ethnicity.

Pittsburgh Sleep Quality Index (PSQI). Although most students reported adequate sleep quality, sleep duration, and sleep latency, participants still complained of more than average difficulty with sleep disturbances and daytime dysfunction. On the PSQI, students reported average Overall Sleep Quality and above average scores were recorded on the Subjective Sleep Quality. On the other subscales of Sleep Duration and Sleep Latency, participants identified their sleep as adequate. However, participants did report slightly more than average difficulty with Sleep Disturbances and Daytime Dysfunction. Use of Sleep Medication and habitual Sleep Efficiency were low.

Demographics and sleep quality. In the current study, participants in both the highest income category and those in the lowest income category reported the best sleep quality. In addition, those students who worked part-time or in work study showed lower GPAs and less perceived control over their sleep which may be linked to their socioeconomic status (Durrence & Lichstein, 2006; Pagel, et al., 2007).

Analyses were conducted to examine demographic effects (group differences) on the Demographic Variables. The results revealed that there was a significant relationship between Epworth Sleepiness Scale categories and education level. The Senior level participants reported being sleepier than students in other classes. In this study, single participants reported being sleepier than those with five or more people in their household. In addition, participants who live with five or more people in their household reported being sleepier than those living with four people in their household. Participants with two or more children had worse subjective sleep quality than those that had no children.

Hypothesis Testing

Hypothesis #1

Caffeine consumption is a predictor of sleep quality. Caffeine intake was found to be a positive predictor of sleep disturbances, sleepiness, and poor sleep quality (see Table 17). Multiple regression analysis showed that Medium-high intake of caffeine (306-487 mgs/day) predicted worse overall sleep quality as measured by the PSQI. In other words, consuming more caffeine predicted greater odds of significant sleepiness, more sleep disturbances, and poorer overall sleep quality.

Hypothesis #2

Caffeine consumption is a predictor of sleep hygiene. The multiple regression analysis failed to reveal any significant predictors. Therefore the hypothesis is rejected. The overall model was not significant, $F(16, 174) = .88$, $p = .592$ accounting for only

8.1% of the model ($R^2 = .08$). Overall, the results failed to reveal any significant predictors of the Sleep Hygiene score.

Hypothesis #3

Caffeine consumption is a significant predictor of academic performance. Table 15 shows that in the multiple regression analysis using caffeine intake and demographic variables to predict GPA, caffeine consumption was not a significant predictor, and therefore the hypothesis was rejected.

Hypothesis #4

Caffeine consumption is a predictor of subjective sleepiness. Multiple regression analysis results indicated that caffeine consumption is a significant predictor of subjective sleepiness. The results revealed that medium-high caffeine intake is a significant predictor of sleepiness (*Beta* = .186, $p < .05$). In fact, consuming medium-high levels of caffeine intake is a significant predictor of greater odds of significant sleepiness (*Odds Ratio* = 6.48, $p < .05$). Consuming medium-high levels of caffeine predicted more sleepiness and being a sophomore was a significant predictor of greater odds of significance (*Odds Ratio* = 4.04, $p < .05$).

Hypothesis #5

Caffeine consumption is a significant predictor of perceived control of sleep. The multiple regression model was found to be significant, $F(16, 175) = 1.77$, $p < .05$, and accounted for 15.1% of the variance ($R^2 = .15$). As shown in Table 12, medium-high caffeine intake was also a significant predictor of overall Perceived Control (*Beta* = .198, $p < .05$). In other words, medium-high caffeine consumption predicted greater Perceived

Control scores. Tables 13-14 also show individual subscales results the on the perceived control instruments.

Recommendations

In light of the results, several recommendations are proposed. Future research could look at a repeated measures approach of tracking caffeine consumption measurement in a diary format at the beginning of the Fall semester. In an educational intervention, they could address caffeine, the effect on sleep quality and on GPA, and then offer the students suggestions to overcome their poor sleep habits. In the following Spring semester, the caffeine consumption diary could be completed again to determine the effect of educational intervention. Measurement of behavioral intent pre and post the educational intervention could be measured to provide information on participants' attitude toward change and the actual changes made would be valuable in addressing the persistent problem in the college population (ACHA, 2007, 2008a, 2008b, 2009).

Additionally, this study identified caffeine as a major contributor to poor sleep quality. This issue is not only important in college age groups but in the adolescent population that is experiencing the 24/7 lifestyle. Calamaro et al. (2009) reported their findings that 33% of the 12-18 year olds were falling asleep during school. The caffeine consumption of this group was 76% higher than the students who slept 8-10 hours per night. The concern exists that caffeine use at this level in adolescents may spiral out of control by the time these students reach college age. In fact, Pollack and Bright (2003) suggest that adolescents should have limited access to caffeine due to its addictive nature and the effect it has on sixth, seventh, and eighth graders. Further study in this

population is warranted especially as it affects females who are at a disadvantage due to hormonal and other gender related issues.

As a final point, Hardeman et al., (2002) suggested that a wide variety of techniques could be used to change cognitions, thereby affecting behavior. Placing TPB alongside of social cognitive theory (SCT) (Bandura, 1986) showing self-efficacy and its relationship to perceived behavioral control (Azjen, 1998) the authors suggest that the four specific methods for changing self-efficacy and its related behavior may be helpful (Hardeman et al.):

1. Persuasive communication
2. Experience of successfully enacting the behavior
3. Vicarious experience i.e. observing others perform the behavior , and
4. Physiological feedback compatible with successful performance (p. 150).

While the suggestions made by Hardeman et al. (2002) may hold true, Azjen (2005) notes that in the theory of planned behavior:

> Attitude toward a behavior is determined by accessible beliefs about the consequences of the behavior, termed behavioral beliefs. Each behavioral belief links the behavior to a certain outcome, or to some other attribute such as the cost incurred by performing the behavior...the attitude toward the behavior is determined by the person's evaluation of the outcomes associated with the behavior and by the strength of these associations (p. 123).

If this point is evaluated in the context of a person's normative beliefs where specific individuals or groups approve or disapprove of the targeted behavior, then they will

choose to engage or not engage in it based on those beliefs (Azjen, 2005). Ultimately, behavioral beliefs relating to the consequences of a behavior are seen as determining attitudes, normative beliefs are seen as determining subjective norms, and beliefs related to resources and opportunities may be seen as basic to perceived behavioral control. When looking at these beliefs as a whole, control beliefs may create the perception that one either has or does not have the capacity to carry out the behavior, i.e. perceived behavioral control (Azjen, 2005).

The role of health educators and health services in meeting students' need for sleep related interventions is immense. Improving students' access to information through well-coordinated multi-media programs can have a significant impact. In fact, efforts directed at curtailing caffeine use may improve their sleep quality resulting in an increase in learning capacity and academic performance. This is especially important for women who throughout their lifespan are at a disadvantage due to their gender.

Early interventions in adolescence should empower students, particularly females, with the educational tools to exercise control over their sleep habits. Health Educators can assist in changing the attitudes and subjective norm as it relates to sleep; however, colleges and universities should consider incorporating educational information about these issues in their Freshman 101 courses. In addition, social marketing campaigns throughout the semester reflecting the impact that good quality sleep can have on academic performance should be a discussion topic for all instructors.

Finally, in *Sleep Disorders and Sleep Deprivation: An Unmet Public Health Problem,* Colten and Altevogt (2006) discuss the public health burden of chronic sleep

loss. Quality of life was shown to be poorer in those who frequently reported short sleep. In fact, it has been reported that those with higher levels of insomnia also have greater impairments in their day-to-day living and report less satisfaction with their interpersonal relationships (Roth & Ancoli-Israel, 1999).

Goldstein (2009) calls for a paradigm shift in remembering that sleep deprivation decreases one's ability to function, even in day-to-day activities. He proposes that sleep be looked at as a "critical aspect of our well-being [that is] often overlooked because it doesn't appear to be an urgent problem" (¶ 5). The Institute of Medicine supports this point of view stating that:

> The public health burden of chronic sleep loss and sleep disorders coupled with the low awareness among the general population, health care professionals, and policy makers requires a well-coordinated strategy to improve sleep-related health care. Increasing the awareness and improving the diagnosis and treatment of sleep disorders necessitates a multipronged effort that includes three key components: public education, training for health professionals, and surveillance and monitoring...The preeminent goal of this strategy is to create and sustain a broad societal commitment to engaging in proper sleep habits as a primary tenet of health. Such a commitment will involve participation by those individuals and organizations in a position to educate the public at national, state, local, and community levels—including K–12 education, colleges and universities, medical schools and other health profession education programs, hospitals, community clinics, local health departments, private industry (e.g., transportation,

> manufacturing facilities, nursing homes), and entertainment media. It will also require simultaneous investment in public education campaigns for all age groups as well as a sustained effort to integrate sleep-related content into curricula of undergraduate health science programs all the way through continuing education programs for health professionals (Colten & Altevogt, 2006, p. 173-174).

Achieving the optimal amount of sleep will remain an elusive matter for women of every age group. Nevertheless, setting the goal to get the best quality and the right amount can make a difference in how their brains learn new information. It is incumbent upon those who provide health education at any level to ensure that this message becomes the norm rather than the exception. In the end, as many others have said, sleep should be respected.

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APPENDIX A

Consent Cover Letter

Consent Cover Letter

PREDICTORS OF SLEEP QUALITY AND ACADEMIC PERFORMANCE AMONG FEMALE COLLEGE STUDENTS IN NORTH TEXAS

Hello,

Thank you for agreeing to participate in my research. This study explore caffeine use among college students as well as quality of sleep, sleep hygiene, and academic performance. I am recruiting participants in North Texas to answer questions in this survey packet that will include information about your sleep patterns, caffeine consumption, and GPA.

Completion of the survey will signify your informed consent to participate in this research study, which is voluntary, and you may withdraw your participation at anytime. The surveys should take about 15-20 minutes to complete. If you complete all the surveys as directed, you will have the opportunity to participate in a drawing to **win one of four prizes** (Amazon.com gift cards), each approximately $25 in value. The information you provide will remain confidential and protected to the extent that is allowed by law.

Participation in this survey process may help participants identify any issues they may have with the quality of their sleep. Additional information on improving the quality of your sleep can be found at www.sleepfoundation.org . The information collected will be put in Psychdata.com, which uses encryption that has a slight risk of confidentiality loss for those submitting answers to the electronic survey. No identifying information (names, email addresses, IP addresses) will be associated with the survey data collected.

If you have any questions about the research study you may ask me; my contact information is listed below. If you have questions about your rights as a participant in this research or the way this study has been conducted, you may contact the Texas Woman's University Office of Research and Sponsored Programs at 940-898-3378 or via e-mail at IRB@twu.edu.

If you wish to participate in the raffle for a gift card, please click on the last question of the survey, where you can enter your email address. This email address will NOT be linked to your survey responses. At the end of the data collection period, the researcher will randomly draw from the list of emails for multiple winners. The researcher will send the gift certificate to the winner via email or mail it to them. Again, participants will not be required to include any identifying information on the surveys they submit.

Thank you again for agreeing to participate in this research!

The return of your completed questionnaire constitutes your informed consent to act as a participant in this research.

Contact Information:
Investigator: Kathalene M. Harris, MBA, RRT, CHES
Email: kharris4@twu.edu Phone: 469-964-0198

APPENDIX B

Demographic Questionnaire

1. Please indicate your age below
2. Please indicate your gender
    a. Male
    b. Female
3. Please indicate your race
    a. Caucasian
    b. African American
    c. Asian/Pacific Islander
    d. Hispanic/Latino
    e. American Indian
    f. Eastern Indian
4. What is your marital status
    a. Married
    b. Single, never married
    c. Divorced
    d. Separated
    e. Co-habitating
5. What is your educational level
    a. High School/GED
    b. Freshman
    c. Sophomore
    d. Junior
    e. Senior
    f. Graduate level
6. How many hours are you enrolled
    a. 3
    b. 6
    c. 9
    d. 12
    e. 15
    f. 18
7. What is your current GPA
8. What is your Household Income
    a. 0-10,000 (in increments up to 80,000)
9. What is your current employment status
    a. Work study
    b. Part time
    c. Full time
    d. Unemployed

10. How many hours do you commute daily
    a. Less than 1
    b. 1
    c. 2
    d. 3
11. How many persons live in your household
    a. 1
    b. 2
    c. 3
    d. 4
    e. 5 or more
12. How many children under the age of 18
    a. 1
    b. 2
    c. 3
    d. 4
    e. 5 or more

APPENDIX C

Survey Parts I-V

PART 1: Epworth Sleepiness Scale

The Epworth Sleepines Scale is used to determine the level of daytime sleepiness. A score of **10 or more is considered sleepy**. A score of **18 or more** is **very sleepy**. You should consider whether you are getting adequate sleep, need to improve your sleep hygiene and/or need to see a sleep specialist. These issues should be discussed with your personal physician.

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

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

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

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

1)	Sitting and reading ☐ 0=would never doze or sleep ☐ 1=slight chance of dozing or sleeping ☐ 2=moderate chance of dozing or sleeping ☐ 3=high chance of dozing or sleeping
***2)**	Watching TV ☐ 0=would never doze or sleep ☐ 1=slight chance of dozing or sleeping ☐ 2=moderate chance of dozing or sleeping ☐ 3=high chance of dozing or sleeping
***3)**	Sitting inactive in a public place (e.g. a theater or a movie) ☐ 0=would never doze or sleep ☐ 1=slight chance of dozing or sleeping ☐ 2=moderate chance of dozing or sleeping ☐ 3=high chance of dozing or sleeping
***4)**	Being a passenger in a motor vehicle for and hour or more

	☐ 0=would never doze or sleep ☐ 1=slight chance of dozing or sleeping ☐ 2=moderate chance of dozing or sleeping ☐ 3=high chance of dozing or sleeping
***5)**	Lying down in the afternoon ☐ 0=would never doze or sleep ☐ 1=slight chance of dozing or sleeping ☐ 2=moderate chance of dozing or sleeping ☐ 3=high chance of dozing or sleeping
***6)**	Sitting and talking to someone ☐ 0=would never doze or sleep ☐ 1=slight chance of dozing or sleeping ☐ 2=moderate chance of dozing or sleeping ☐ 3=high chance of dozing or sleeping
***7)**	Sitting quietly after lunch (no alcohol) ☐ 0=would never doze or sleep ☐ 1=slight chance of dozing or sleeping ☐ 2=moderate chance of dozing or sleeping ☐ 3=high chance of dozing or sleeping
***8)**	Stopped for a few minutes in traffic while driving ☐ 0=would never doze or sleep ☐ 1=slight chance of dozing or sleeping ☐ 2=moderate chance of dozing or sleeping ☐ 3=high chance of dozing or sleeping

Part II: Pittsburgh Sleep Quality Index

INSTRUCTIONS:

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

9) During the past month, what time have you usually gone to bed at night?

10) During the past month, how long (in minutes) has it usually taken you to fall asleep each night?

11) During the past month, what time have you usually gotten up in the morning?

12) During the past month, how many hours of ACTUAL SLEEP did you get at night? (This may be different than the number of hours you spent in bed.)

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

During the past month, how often yave you had trouble sleeping because you...

13)	Cannot get to sleep within 30 minutes ☐ Not during the last month ☐ Less than once a week ☐ Once or twice a week ☐ Three or more times a week
***14)**	Wake up in the middle of the night or early morning ☐ Not during the last month ☐ Less than once a week ☐ Once or twice a week ☐ Three or more times a week
***15)**	Have to get up to use the bathroom ☐ Not during the last month ☐ Less than once a week ☐ Once or twice a week ☐ Three or more times a week

***16)**	Cannot breathe comfortably ☐ Not during the last month ☐ Less than once a week ☐ Once or twice a week ☐ Three or more times a week
***17)**	Cough or snore loudly ☐ Not during the last month ☐ Less than once a week ☐ Once or twice a week ☐ Three or more times a week
***18)**	Feel too cold ☐ Not during the last month ☐ Less than once a week ☐ Once or twice a week ☐ Three or more times a week
***19)**	Feel too hot ☐ Not during the last month ☐ Less than once a week ☐ Once or twice a week ☐ Three or more times a week
***20)**	Had bad dreams ☐ Not during the last month ☐ Less than once a week ☐ Once or twice a week ☐ Three or more times a week
***21)**	Have pain ☐ Not during the last month ☐ Less than once a week ☐ Once or twice a week ☐ Three or more times a week
22)	Other reason(s), please describe

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

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

24) During the past month, how would you rate your sleep quality overall?

- ☐ Very good
- ☐ Fairly good
- ☐ Fairly bad
- ☐ Very bad

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

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

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

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

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

- ☐ No problem at all
- ☐ Only a very slight problem
- ☐ Somewhat of a problem
- ☐ A very big problem

28) Do you have a bed partner or room mate?

- ☐ No bed partner or room mate
- ☐ Partner/room mate in other room
- ☐ Partner in the same room, but not same bed

	☐ Partner in same bed

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

29)	Loud snoring ☐ Not during the past month ☐ Less than once a week ☐ Once or twice a week ☐ Three or more times a week
30)	Long pauses between breaths while asleep ☐ Not during the past month ☐ Less than once a week ☐ Once or twice a week ☐ Three or more times a week
31)	Legs twitch or jerking while you sleep ☐ Not during the past month ☐ Less than once a week ☐ Once or twice a week ☐ Three or more times a week
32)	Episodes of disorientation or confusion during sleep ☐ Not during the past month ☐ Less than once a week ☐ Once or twice a week ☐ Three or more times a week
33)	Other restlessness while you sleep; please describe
34)	How often during the past month did you experience this? ☐ Not during the past month ☐ Less than once a week ☐ Once or twice a week ☐ Three or more times a week

Part III - Perceived Control Questionnaire

Instructions: For each item, on a scale of 1-4 with 1 being "not at all" and 4 being "to a great extent" how applicable is each of the following items to your sleep habits?

*35)	Do you feel that you have the ability to fall asleep at night largely at will?	☐	☐	☐	☐
*36)	Do you feel that the time taken to fall asleep is under your control?	☐	☐	☐	☐
*37)	Do you feel that you have lost the ability to get yourself to sleep?	☐	☐	☐	☐
*38)	Do you feel that shortening the time taken to fall asleep is out of your hands?	☐	☐	☐	☐
*39)	Do you feel it's in your hands to sleep through until your normal awakening time?	☐	☐	☐	☐
*40)	Do you feel that it's under your control to have a good night's uninterrupted sleep?	☐	☐	☐	☐
*41)	Do you feel that you have lost the ability to remain asleep until morning?	☐	☐	☐	☐
*42)	Do you feel that remaining asleep consistently through the night is out of your hands?	☐	☐	☐	☐
*43)	Can you influence how active your mind is before you sleep?	☐	☐	☐	☐
*44)	When you lie in bed, before sleeping, does it seem that your thought processes are out of control?	☐	☐	☐	☐
*45)	Can you control your physical tension while lying in bed?	☐	☐	☐	☐
*46)	When you lie in bed, does it seem that your bodily tension is uncontrollable?	☐	☐	☐	☐
*47)	Do you expect to be able to control the time it takes to fall asleep?	☐	☐	☐	☐
*48)	Do you feel you ought to be able to get yourself off to sleep quickly?	☐	☐	☐	☐
*49)	Do you expect to be able to influence how long you stay asleep for?	☐	☐	☐	☐
*50)	Do you feel that you ought to be able to prevent yourself from awakening during the night?	☐	☐	☐	☐
*51)	Do you feel you ought to be better able to manage the things you think about?	☐	☐	☐	☐
*52)	Do you feel you ought to have the ability to relax in bed?				

Part IV Sleep Hygiene Index

For each item please indicate how frequently you engage in these specific behaviors (always, frequently, sometimes, rarely, never)

***53)**	I take daytime naps lasting two or more hours. ☐ 1 never ☐ 2 rarely ☐ 3 sometimes ☐ 4 frequently ☐ 5 always
***54)**	I go to bed at different times from day to day. ☐ 1 never ☐ 2 rarely ☐ 3 sometimes ☐ 4 frequently ☐ 5 always
***55)**	I get out of bed at different times from day today. ☐ 1 never ☐ 2 rarely ☐ 3 sometimes ☐ 4 frequently ☐ 5 always
***56)**	I exercise to the point of sweating within 1 h of going to bed. ☐ 1 never ☐ 2 rarely ☐ 3 sometimes ☐ 4 frequently ☐ 5 always
***57)**	I stay in bed longer than I should two or three times a week.

	☐ 1 never ☐ 2 rarely ☐ 3 sometimes ☐ 4 frequently ☐ 5 always
*58)	I use alcohol, tobacco, or caffeine within 4 h of going to bed or after going to bed. ☐ 1 never ☐ 2 rarely ☐ 3 sometimes ☐ 4 frequently ☐ 5 always
*59)	I do something that may wake me up before bedtime (for example: play video games, use the internet, or clean). ☐ 1 never ☐ 2 rarely ☐ 3 sometimes ☐ 4 frequently ☐ 5 always
*60)	I go to bed feeling stressed, angry, upset, or nervous. ☐ 1 never ☐ 2 rarely ☐ 3 sometimes ☐ 4 frequently ☐ 5 always
*61)	I use my bed for things other than sleeping or sex (for example: watch television, read, eat, or study). ☐ 1 never ☐ 2 rarely ☐ 3 sometimes ☐ 4 frequently ☐ 5 always

***62)**	I sleep on an uncomfortable bed (for example: poor mattress or pillow, too much or not enough blankets). ☐ 1 never ☐ 2 rarely ☐ 3 sometimes ☐ 4 frequently ☐ 5 always
***63)**	I sleep in an uncomfortable bedroom (for example: too bright, too stuffy, too hot, too cold, or too noisy). ☐ 1 never ☐ 2 rarely ☐ 3 sometimes ☐ 4 frequently ☐ 5 always
***64)**	I do important work before bedtime (for example: pay bills, schedule, or study). ☐ 1 never ☐ 2 rarely ☐ 3 sometimes ☐ 4 frequently ☐ 5 always
***65)**	I think, plan, or worry when I am in bed. ☐ 1 never ☐ 2 rarely ☐ 3 sometimes ☐ 4 frequently ☐ 5 always

Part V Caffeine Consumption Questionnaire

Please answer the following questions about your caffeine usage. Respond to items that you consume at least once per week. **Pay close attention to the size (in oz) of each product**. For example, if you drink 10 oz of coffee this would count for 2 servings.

Please answer the following questions as completely and honestly as you can. This information is STRICTLY CONFIDENTIAL – do not write your name anywhere on this page. Thank you for your cooperation.

COFFEE

(5 oz servings)

Pay close attention to the size (in oz) of each product. For example, **if you drink 10 oz of coffee this would count for 2 servings**

		Morning 6a - 12n	Afternoon 12n-6p	Evening 6p-2a	Night 2a-6a
66)	Regular brewed	-Select-	-Select-	-Select-	-Select-
67)	Percolated	-Select-	-Select-	-Select-	-Select-
68)	Drip-brewed	-Select-	-Select-	-Select-	-Select-
69)	Espresso shot	-Select-	-Select-	-Select-	-Select-
70)	Regular instant	-Select-	-Select-	-Select-	-Select-
71)	Decaffeinated	-Select-	-Select-	-Select-	-Select-
72)	Brewed	-Select-	-Select-	-Select-	-Select-
73)	Instant	-Select-	-Select-	-Select-	-Select-

Please answer the following questions as they relate to your caffeine usage. Pay close attention to the size (in oz.) of each product. Starbucks is served as follows: Short (8oz - 2 servings), Tall (12 oz-3 servings) Grande (16 0z - 4 servings) Venti (24 oz - 6 servings).

		Morning 6a-12n	Afternoon 12n-6p	Evening 6p-2a	Night 2a-6a
74)	Regular brewed	-Select-	-Select-	-Select-	-Select-
75)	Vanilla latte	-Select-	-Select-	-Select-	-Select-
76)	Expresso dopio	-Select-	-Select-	-Select-	-Select-
77)	Expresso solio	-Select-	-Select-	-Select-	-Select-
78)	Expresso decaf	-Select-	-Select-	-Select-	-Select-
79)	Tazo Chai Tea Latte	-Select-	-Select-	-Select-	-Select-

Please answer the following questions as they relate to your caffeine usage. Pay close attention to the size (in oz.) of each product. 5 oz of tea, cocoa or chocolate would count for 1 serving

5 0z serving

		Morning 6a-12n	Afternoon 12n-6p	Evening 6p-2a	Night 2a-6a
80)	Tea	-Select-	-Select-	-Select-	-Select-
81)	Cocoa	-Select-	-Select-	-Select-	-Select-
82)	Chocolate (serving/week)	-Select-	-Select-	-Select-	-Select-

Please answer the following questions as they relate to your caffeine usage in soft drinks.

12 oz is equal to one serving.

83)	Coca-Cola	-Select-	-Select-	-Select-	-Select-
84)	Diet Coca-Cola	-Select-	-Select-	-Select-	-Select-
85)	Dr. Pepper	-Select-	-Select-	-Select-	-Select-
86)	Diet Dr. Pepper	-Select-	-Select-	-Select-	-Select-
87)	Mountain Dew	-Select-	-Select-	-Select-	-Select-

88)	Diet Mountain Dew	-Select-	-Select-	-Select-	-Select-
89)	Mr. Pibb	-Select-	-Select-	-Select-	-Select-
90)	Diet Mr. Pibb	-Select-	-Select-	-Select-	-Select-
91)	Tab	-Select-	-Select-	-Select-	-Select-
92)	Pepsi Cola	-Select-	-Select-	-Select-	-Select-
93)	Diet Pepsi Cola	-Select-	-Select-	-Select-	-Select-
94)	RC Cola	-Select-	-Select-	-Select-	-Select-
95)	Mello Yello	-Select-	-Select-	-Select-	-Select-
96)	Diet Mello Yello	-Select-	-Select-	-Select-	-Select-
97)	Root Beer	-Select-	-Select-	-Select-	-Select-

Please answer the following questions as they relate to your caffeine usage in energy drinks.

8 oz is equal to one serving

		Morning 6am-12nn	**Afternoon 12nn-6pm**	**Evening 6p-2a**	**Night 2a-6a**
98)	Spike Shooter	-Select-	-Select-	-Select-	-Select-
99)	Cocaine	-Select-	-Select-	-Select-	-Select-
100)	Monster Energy	-Select-	-Select-	-Select-	-Select-
101)	Full Throttle	-Select-	-Select-	-Select-	-Select-
102)	Rip it, all varieties	-Select-	-Select-	-Select-	-Select-
103)	Enviga	-Select-	-Select-	-Select-	-Select-
104)	Tab Energy	-Select-	-Select-	-Select-	-Select-
105)	Sobe No Fear	-Select-	-Select-	-Select-	-Select-
106)	Red Bull regular and sugar free	-Select-	-Select-	-Select-	-Select-

107)	Rockstar Energy Drink	-Select-	-Select-	-Select-	-Select-
108)	SoBe Adrenaline Rush	-Select-	-Select-	-Select-	-Select-
109)	Amp	-Select-	-Select-	-Select-	-Select-
110)	Glaceau Vitamin Water Energy Citrus	-Select-	-Select-	-Select-	-Select-
111)	Sobe Essential Energy, Berry or Orange	-Select-	-Select-	-Select-	-Select-

Please answer the following questions as they relate to your caffeine usage in OTC drugs.

		Morning 6a-12n	**Afternoon 12n-6p**	**Evening 6p-2a**	**Night 2a-6a**
112)	Vivarin	-Select-	-Select-	-Select-	-Select-
113)	NoDoz	-Select-	-Select-	-Select-	-Select-
114)	Excedrin	-Select-	-Select-	-Select-	-Select-
115)	Vanquish	-Select-	-Select-	-Select-	-Select-
116)	Anacin	-Select-	-Select-	-Select-	-Select-
117)	Dristan	-Select-	-Select-	-Select-	-Select-
118)	Dexatrim	-Select-	-Select-	-Select-	-Select-