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A Multi-Ethnic View on The Symptoms of Sleep Deficit, Depression, and Headache in Adolescents

Pamela J. Wessling

A MULTI-ETHNIC VIEW ON THE SYMPTOMS OF SLEEP DEFICIT, DEPRESSION, AND HEADACHE IN ADOLESCENTS

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Pamela J. Wessling

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A MULTI-ETHNIC VIEW ON THE SYMPTOMS OF SLEEP DEFICIT, DEPRESSION, AND HEADACHE IN ADOLESCENTS

DISSERATION

by

Pamela J. Wessling

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APROVED BY:

_____
Andra Hanlon, PhD, ARNP
Chairperson, Dissertation Committee

_____
Jo Ann Kleier, PhD, EdD, ARNP-C
Member, Dissertation Committee

_____
Edward Bernstein, EdD
Member, Dissertation Committee

_____
Claudette Spalding, PhD, ARNP, CNAA
Chair, Division of Nursing

_____
Pegge Bell, PhD, APN
Dean, College of Health Sciences

Abstract

Background: Adolescents frequently present with complaints of headache and depression, and sleep deficit in this age group is prevalent. Currently, no research in adolescents examines a possible symptom cluster of sleep deficit, depression, and headache. In addition, depression, headaches, and sleep problems are reported more frequently in adult racial/ethnic minorities, but research is lacking on the adolescent population in regards to ethnic groups.

Purpose: To investigate the possible symptom cluster or relationship between sleep deficit, headaches, and depression as these conditions occur in adolescents and to explore the demographic variables of ethnicity that may influence the symptom cluster. Additional variables of gender, hours in a work experience, extracurricular activities, and caffeine intake were described.

Theoretical Framework. The Theory of Unpleasant Symptoms (TOUS).

Methods. A non-experimental, retrospective investigation using a purposive convenience sample to study the relationships between sleep deficit, headache, and depression as they occurred in a community-based population of adolescents. The study also explored through a survey the demographic variable of ethnicity as well as descriptive data. Instruments were the Epworth Sleep Scale, the Beck Depression Inventory II, and the Pediatric Migraine-Specific Disability Tool.

Results. In this sample of students within the ages of 16 to 18 years of age in Miami, Florida (N = 156), 47.8% were male and 51.6% were female. The population was primarily Hispanic (74.5%), only 10.2% of students were African-American, another 6.4% were White, non-Hispanic, and a slightly larger group (8.3%) considered their selves none of the preceding categories. Students were evenly divided between those who

worked or had afterschool activities and those who did not. A majority (70.7%) of the students denied using caffeinated drinks on a daily basis. Sleep deficit and depression did not predict headaches within the population, ($p < .05$). The three ethnic groups of Hispanics, African-Americans, and Caucasians did not show a significant correlation with sleep deficit, depression, or headache ($p < .05$), thus there was no association with ethnicity and the symptoms.

Conclusions: Data did not show a symptom cluster for these students between sleep deficit, depression, or headaches. Ethnicity did not correlate with sleep deficit, depression, or headache.

ACKNOWLEDGEMENTS

To my husband who has seen me hold my breath underwater and will appreciate my coming up for air.

To my children, who are my role models.

To Dr. Andra Hanlon, who has my gratitude and respect for helping me through this adventure.

To my parents, who were my first teachers.

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CHAPTER ONE

INTRODUCTION TO THE STUDY

Teenagers in the 21st century lead busy lives, and the pace in their activities consistently accelerates as they progress through high school. Expectations of teachers, coaches, clubs, family, peers, and employers lead them to cram more into 24 hours than their parents did at the same age. This overloaded lifestyle appears to contribute to chronic sleep deficit in a growing number of teenagers (Calamaro, Mason, & Ratcliffe, 2009; Megdal & Schernhammer, 2007; Robert E. Roberts, Roberts, & Duong, 2008; Wolfson & Carskadon, 1998). Sleep deficit is strongly associated with poor academic performance, daytime sleepiness, emotional problems, increased alcohol consumption, smoking, and increased use of medical care (Roberts, Roberts, & Duong, 2008).

Teens are frequently seen in primary healthcare practices for complaints of headache, and these are often the same teens who experience chronic sleep deficit(Rains & Poceta, 2005). In addition, researchers have found a high prevalence of depression in adolescents, and these teens may also be experiencing sleep deficit (Bruni, et al., 2007; Elliott, 2001). All three variables of sleep deficit, headache, and depression have been studied in adolescents as single elements. Likewise, relationships between sleep deficit and headache, sleep deficit and depression, and headache and depression have been studied in adolescent groups. To date, however, the author found no study in which all three symptoms were examined in a high school population.

Prevalence of Sleep Deficit in Adolescents

Sleep deficit problems of daytime sleepiness, insomnia, and delayed sleep phase have been reported in adolescents. A review of recent epidemiological surveys showed a

propensity for sleepiness in adolescents throughout the world. Gibson et al. (2006) conducted a survey of 3,235 high school students in Ontario, Canada, using the Epworth Sleepiness Scale. Seventy percent of the students had less than 8.5 hours of sleep on weeknights, and excessive daytime sleepiness was reported in 41% of these Canadian students. Adolescents are reported to need a minimum of 9 hours of sleep per night (Carskadon, Harvey, & Dement, 1981). Forty-four percent of the students responded that they often found it difficult to wake in the morning.

Smaldone, Honig, and Byrne (2007) analyzed data obtained from the 2003 National Survey of Children's Health. The researchers used the responses of parents of 68,418 American children between the ages of 6 and 17 years. The groups were then stratified into two groups: school-aged children (6 to 11 years) and adolescents (12 to17 years). Of the adolescent group, 39.3% of parents reported that their children received inadequate sleep. Not only has sleep deficit been reported in adolescents, but delay in onset of sleep seems to be a characteristic of this developmental period.

The delayed sleep phase syndrome is defined as a circadian rhythm sleep disorder characterized by the inability to fall asleep when needed at night, resulting in difficulty to easily awaken in the morning (Thorpy, Korman, Spielman, & Giovinsky, 1988). This syndrome is known to occur in adolescents and causes them to be out of sync with their school schedules. A meta-analysis performed by Crowley, Acebo, and Carskadon (2007) placed prevalence estimates of delayed sleep phase syndrome for United States (US) adolescents at 10%, with lower rates of 4% for European adolescents. Megdal and Schernhammer (2007) explored sleep patterns in Los Angeles high school students. Of the students who responded to the online survey, 80% reported a sleep deficit. In a Hong

Kong study, Chung and Cheung (2008) found that students 12 to 18 years of age slept approximately 7.3 hours on school nights, and 41.9% of these students reported excessive daytime sleepiness. Similar studies have found a common sleep delay pattern and a prevalence of sleep deficit problems in adolescents across the globe (Abdel-Khalek, 2004; Chung & Cheung, 2008; Giannotti, Cortesi, Sebastiani, & Ottaviano, 2002; Gibson, et al., 2006; Laberge, Petit, Simard, Vitaro, & Tremblay, 2001; Liu, Uchiyama, Okawa, & Kurita, 2000; Maurice M. Ohayon, Roberts, Zulley, Smirne, & Priest, 2000; Saarenpaa-Heikkila, Laippala, & Koivikko, 2000; ter Wolbeek, van Doornen, Kavelaars, & Heijnen, 2006; Tynjala, Kannas, Levalahti, & Valimaa, 1999; Yang, Kim, Patel, & Lee, 2005).

Prevalence of Headache in Adolescents

The examination of the prevalence of headaches in adolescents is relatively recent, particularly in respect to associated factors. A Canadian survey in 1996 to 1997 found that 26.6% of 2,090 adolescents aged 12 to 13 years experienced headaches at least once a week (Gordon, Dooley, & Wood, 2004). This study also showed that 21% of the Canadian youths who reported having headaches about once a week were depressed. The odds ratio of having frequent headaches and feeling depressed was reported to be 5.77 (95% CI).

Only one study was found in which prevalence of headache in US adolescents in the past decade was examined. Rhee (2000), a nurse practitioner from the University of North Carolina (UNC), used data gathered by the National Longitudinal Study of Adolescent Health (Add Health) conducted by the Carolina Population Center at UNC at Chapel Hill. The data was gathered in two waves: Wave 1 in 1995 and Wave 2 in 1996.

The data showed that 91% of the subjects experienced headaches during the past 12 months. The adolescents further reported 61.5% had headaches just a few times, 22.5% had headaches once a week, 6% had headaches almost every day, and 1.2% every day. When Rhee compared her findings to an earlier survey of 12 to 17 year olds in the US (Linet, Stewart, Celentano, Ziegler, & Sprecher, 1989), the rate of weekly and more frequent headaches had increased from 7% to 30%. Headaches in adolescents had more than tripled in one decade. These epidemiological studies indicate that headaches are becoming more prevalent in adolescents.

Prevalence of Depression in Adolescents

Recent data on depression in youths 12 to 17 years of age show a steady increase in depressive episodes (Office of Applied Studies Substance Abuse and Mental Health Services Administration, 2005). Prevalence reports from the 2004 National Survey on Drug Use and Health estimated 14 % of adolescents (approximately 3.5 million youth) had experienced at least one major depressive episode (MDE) in their lifetime, and 9 percent (2.2 million youth) experienced at least one MDE in the past year. The prevalence increased with age, as 16 to 17-year-olds were twice more likely to experience depression as 12 to 13-year-olds (12.3 % compared to 5.4 %). Among the 12 to 17-year age group who experienced MDE in the past year, the survey showed that only 40.3 % received treatment for depression. In response to an increasing prevalence and potential for suicide, and due to the high sensitivity and specificity of screening tools for depression in adolescents, the United States Preventive Services Task Force now recommends routine primary care screening of teens for major depressive disorder (Williams, O'Connor, Eder, & Whitlock, 2009).

Ethnic and Social Disparities in Sleep Deficit

There is research that suggests ethnic and socioeconomic disparities in the US may lead to increased sleep deficit and resulting pathology (DeSantis, et al., 2007; Stamatakis, Kaplan, & Roberts, 2007). Depression, headaches, and sleep problems are reported more frequently in adult racial/ethnic minorities with low education levels (Buckhalt, El-Sheikh, & Keller, 2007). Although there is no social data on adolescents, study findings indicate shorter sleep duration and more frequent headaches for minority groups (Hagen, Stovner, & Zwart, 2007; Maurice M. Ohayon, et al., 2000; Sanford, et al., 2006; Spilsbury, et al., 2004). Effects related to the triad of sleep deficit, headaches, and depression in adolescents has not been previously reported, in ethnic minorities or whites.

Additional Considerations

Little emphasis has been placed on the importance of sleep by primary healthcare providers as a necessary component of health promotion (Larsson & Zaluha, 2003). Nursing knowledge that identifies the symptoms and patterns of sleep deficit may assist nurses in their work with adolescents and their families. Nurses may be able to improve the health and well-being of adolescents through educating teens and families about the importance of adequate sleep and the consequences of sleep deficit. As nurse practitioners (NPs) often provide primary care to adolescents, they are the frontline for screening adolescents for sleep problems and providing early interventions for associated health problems such as headache and depression found in this age group.

Problem Statement

Adolescents frequently present with complaints of headache and depression, and it is well documented that adolescents do not get enough sleep. Adolescents from

minority races or cultures may have increased sleep deficit, headaches, and depression, but data are not available on this population. As stated by Miaskowski, Dodd, and Lee, "Patients rarely present with a single symptom" (2004, p. 17). Symptoms that occur together may be called a *symptom cluster* (Lenz, Pugh, Milligan, Gift, & Suppe, 1997). When patients present for treatment, current medical therapy generally focuses on a single symptom/problem-at-a-time approach. However, patients/adolescents usually present with a constellation or cluster of symptoms. Currently, no research on the symptom cluster of sleep deficit, headache, and depression in adolescents is available.

Purpose of the Study

The purpose of this study was to investigate the possible symptom cluster or relationship between sleep deficit, headaches, and depression as these conditions occur in adolescents. A second purpose was to explore the demographic variables of ethnicity that may influence the symptom cluster. Additional variables of gender, hours in a work experience, extracurricular activities, and caffeine intake were described.

Definition of Key Terms

The following terms are herein defined by both their theoretical and operational definitions.

Symptom

Theoretical. As defined in the theory of unpleasant symptoms (TOUS), a *symptom* is a subjective experience that reflects physical, psychological, and situational changes for the individual (Lenz, et al., 1997; Miaskowski, et al., 2004). Symptoms in adolescents are based on their self-report and may occur individually or in clusters.

When symptoms occur in clusters, they may be multiplicative in nature and act as catalysts for other symptoms (Armstrong, 2003).

Operational. As symptoms are physical and psychological in nature, they were measured by self-report, both individually as variables and as clustered.

Symptom Cluster

Theoretical. *Symptom clusters* are defined by Dodd, Miaskowski, and Paul (2001) as "three or more concurrent symptoms that are related to each other" (p. 468) .

Operational. Symptom clusters were the concurrent symptoms of sleep deficit, headache, and depression and were operationalized and measured as indicated below.

Sleep Deficit

Theoretical. *Sleep deficit* for adolescents is defined as less than nine hours of sleep, or a self-report of sleepiness during waking hours (Carskadon, Acebo, & Seifer, 2001) .

Operational. Sleep deficit was measured by a score on the Epworth Sleepiness Scale (Johns, 1991).

Headache

Theoretical. According to the glossary of the on-line report International Headache Society, International Headache Classification II, *headache* "is pain located above the orbitiomeatal line" (2004). According to the on-line Oxford English Dictionary, *headache* is "an ache or continuous pain, more or less deep-seated, in the cranial region of the head" ("Headache," 1989). Both definitions were accepted for this study.

Operational. Headache was measured by a score on the Pediatric Migraine Disability Assessment (PedMIDAS) (Hershey, et al., 2001).

Depression

Theoretical. *Depression* is characterized by a pervasive low mood, loss of interest in usual activities and diminished ability to experience pleasure (Rushton, Forcier, & Schectman, 2002). The on-line Diagnostic and Statistical Manual of Mental Disorders, 4th edition, text revision (DSM-IV-TR) defines *major depressive episode* as "a period of 2 weeks or longer during which there is either depressed mood or loss of interest or pleasure and at least four other symptoms that reflect a change in functioning, such as problems with sleep, eating, energy, concentration, and self-image" (American Psychological Association, 2000).

Operational. Depression was measured by a score on the Beck Depression Inventory (Beck & Beck, 1972).

Research Questions and Hypotheses

Research Question One

What is the multiple correlation between a set of two predictors (sleep deficit and depression) and the outcome, headache, in older adolescents?

Hypothesis One

There will be a significant relationship, uniquely and as a linear composite, between the predictor variables of sleep deficit and depression, and the outcome criterion of headache among adolescents between the ages of 16 and 18.

Research Question Two

What is the difference in each of the three ethnic groups of Hispanic, Caucasian, and African-American as to the occurrence of the symptom cluster of sleep deficit, depression, and headache in older adolescents?

Hypothesis Two

There will be a significant difference in the mean scores for symptom cluster (composite score for sleep deficit, depression, and headache) between the three ethnic groups of adolescents between the ages of 16 and 18 representing African-Americans, Caucasians, and Hispanics.

Theoretical Framework

The theoretical framework that supported this study was the theory of unpleasant symptoms (TOUS) (Lenz, et al., 1997). As stated by the theorists, *unpleasant symptoms* are "perceived indicators of change in normal functioning that prompt individuals to seek health care" (1997, p. 14). This theory incorporated the concept of symptom clusters as three or more concurrent symptoms related to each other. The concept of symptom clusters is a relatively recent development in nursing science that has been used to examine symptom presentation in cancer patients (Dodd, Miaskowski, & Paul, 2001; Gift, Stommel, Jablonski, & Given, 2003; Miaskowski, et al., 2004). Although symptom clusters have predominately been studied in cancer patients, parallel work with such clusters (i.e. fatigue and dyspnea in patients with chronic obstructive pulmonary disease [COPD]) has evolved into this middle-range theory.

The TOUS is the result of work between Gift and Pugh (Lenz, Suppe, Gift, Pugh, & Milligan, 1995). Gift and Pugh recognized commonalities in their studies of fatigue in

different patient populations. Pugh had been studying fatigue during childbearing, while Gift was studying fatigue as it occurred with dyspnea in patients with COPD. Pugh and Gift realized they were conceptualizing the two symptoms of fatigue and dyspnea in a similar fashion and commonalities existed between the symptoms. The two researchers developed the theory with collaboration from Lenz, Suppe, and Milligan at the University of California, San Francisco.

The TOUS provided a framework to examine the multidimensional nature of symptoms, which allowed for reciprocal and feedback pathways between influencing factors, the symptoms, and their impact on performance (Gift, 2004). As the symptoms of sleep deficit, depression, and headache may have presented as isolated symptoms or in a cluster, the TOUS served as a nursing framework for this study.

Symptoms are arranged in the TOUS as occurring in isolation or simultaneously. When symptoms are simultaneous, the experience for the patient may be multiplicative rather than simply additive (Lenz, et al., 1997). For instance, when sleep deficit, depression, and headache occur concurrently, the intensity of pain for the headache sufferer may be more intense then a headache occurring in the absence of depression and sleep deprivation. Thus, each symptom may interact or impact other symptoms.

In Figure 1, a representation of the TOUS depicts the influence of physiological, psychological, and situational factors on the symptom cluster of sleep deficit, headache, and depression. The physiological variables associated with puberty, include the delayed sleep pattern of older adolescents. Age and gender are also physiological variables. Examples of psychological variables are the role changes experienced by this age group. Older adolescents tend to take on more responsibility, while growing more independent

from their families. Adolescents find psychological support in peer groups, and this can be assessed by asking adolescents if they have a best friend. Situational variables may include social and cultural influences such as ethnic group, hours in a work experience or extracurricular activities, and caffeine intake. In this study, the psychological factors, such as identifying a best friend or adolescent role changes, will not be examined as additional variables will lead to increasing sample size. These psychological variables would merit examination in a future study.

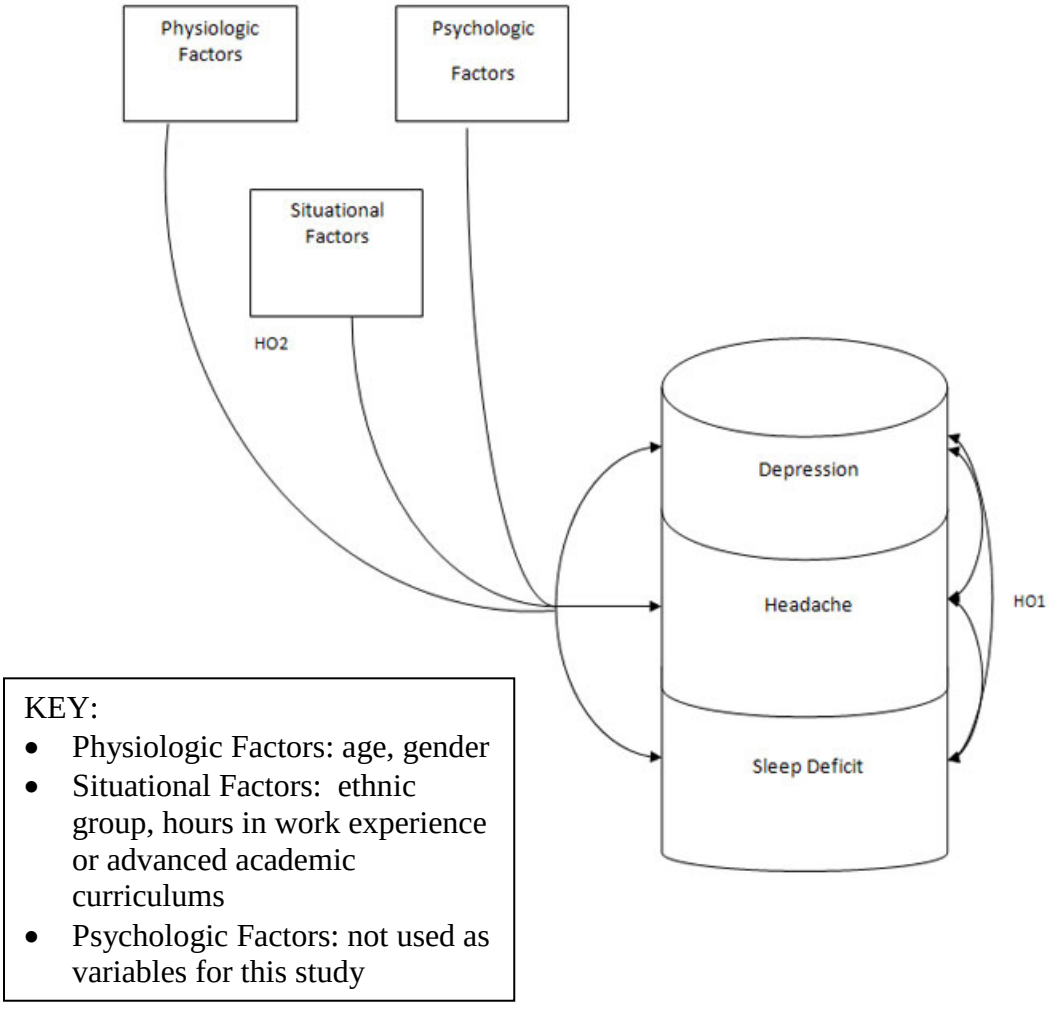

Figure 1. Physiologic and Situational Factors.

Assumptions

Theoretical Assumptions

According to Lenz, Pugh, Milligan, Gift, and Suppe (1997) symptoms are individual subjective phenomena that occur in family and community contexts. Symptoms are critically important in health care, as they are the signals that patients experience to recognize a change in normal health functioning. Rarely occurring alone, symptoms usually occur in multiples. For instance, fatigue and postpartum depression are usually coupled, or shortness of breath, lack of energy, cough, and feelings of nervousness may occur simultaneously in the same patient. Antecedents and outcomes of these symptoms may also be shared. *Antecedents* can be classified as physiologic, psychologic, and situational factors. When symptoms occur together, their total experience is multiplicative rather than simply additive. For instance, pain occurring with nausea or fatigue seems more severe than pain without additional distressing symptoms. Likewise, alleviation of one symptom or antecedent factor may improve all other symptoms. Thus, there is a multidimensional quality to symptom experience, and nurses who understand these symptom clusters and traits are in a better position to address patients' needs.

Research Assumptions

In this study, it was assumed without validation that the adolescents correctly understood what they were asked on the instruments. Additionally, it was assumed the adolescents provided honest assessments of their status at the time of completing the instruments.

Significance of the Study

Recognition of a symptom cluster associated with sleep deficit in adolescents may have long-range implications on the health and well-being of high school students. Strong evidence of the relationship/cluster of the variables of sleep deficit, headache, and depression, plus knowledge of the occurrence in varying ethnic populations may influence nurses to look beyond the single symptom. If these variables are known to occur together as a symptom cluster, then treatment that does not examine and address all three symptoms may be incomplete and result in continued patient distress.

Nurses and health care providers already recognize symptom clusters occurring in other health conditions. Pain and insomnia are often associated with fatigue in cancer patients (Gleason, et al., 2007). Another example is that of the metabolic syndrome where hypertension, obesity, high blood sugar and cholesterol levels are known to commonly exist together. Health care providers are considered remiss today if they do not assess patients for all four signs and symptoms in these patients to ensure that treatment plans address the full syndrome (Bulugahapitiya, Siyandalapitiya, Sithole, Fernando, & Idris, 2009).

Education

The results of this study may facilitate a better understanding of sleep deficit and the comorbidities of headache and depression in adolescents. Findings may support development of undergraduate and graduate learning objectives regarding sleep for incorporation into nursing curriculums. The rationale for including these objectives is supported by a definitive lack of coursework regarding sleep deficits and their determinants in nursing schools today(Elliott, 2001; Lee & Landis, 2003) . As sleep

deficits and skewed circadian rhythms are known to impact the health and well-being of adolescents, nursing research on the cluster of sleep deficits, headache, and depression in older adolescents may provide additional knowledge about how this cluster impacts adolescents, an important phenomena for nursing educators and their students to consider. In addition, occurrence of this symptom cluster in various ethnic groups may not be consistent. An increased understanding of the diversity of sleep needs between ethnic groups may enhance patient/family education to promote health and well-being for each group.

Nursing Practice

The average primary care nurse practitioner does not generally assess sleep as a routine part of standard patient assessment (Elliott, 2001; Goolsby, 2006). Sleep education for adolescents could be viewed as an essential component of health promotion, as important as nutrition, wearing seat belts, smoking cessation, and disease prevention. Advanced practice nurses serve a pivotal role in assessing and recognizing the symptom cluster of sleep deficit, headaches, and depression in adolescents and may use this information to formulate a more comprehensive plan of patient care.

Research

The disciplines of psychology, biology, and medicine have provided the majority of studies in sleep science at this point in time. A search of CINAHL (March 2008) revealed only 12 nursing articles related to sleep and adolescents. The National Institute of Health (NIH) and the US Department of Health and Human Services (US DHHS) issued the National Sleep Disorders Research Plan in 2003 (National Institute of Health, 2003), identifying areas of need for sleep research. In 2003, Lee and Landis published a

plan identifying areas in which nursing contributions were needed. One of these areas was recognition of sleep restriction and sleep disturbances in children and adolescents. This area was noted to be a significant societal health issue that has impacted mood disorders, daytime sleepiness, and academic performance. This study focuses on an exploration of whether a relationship exists between sleep deficit, headache, and depression in three different ethnic groups and differs between groups. Findings have the potential to lead to future research directed at predictors and management of these symptoms in older adolescents.

Public Policy

The findings of sleep research have encouraged communities to look at the start times for high schools. Schools in Minneapolis have already instituted changes with later start times and serve as a model for other communities (Wahlstrom, 2002). Longitudinal data of these changes showed statistically significant improvements in graduation rates, rates for continuous enrollment, decreased tardiness, and improved attendance. The proposed study on the relationship of sleep deficit with headache and depression may provide additional evidence to encourage patients and educators to revise time demands placed on older adolescents.

Limitations

The variables of sleep deficit, headache, and depression were measured as they naturally occurred (not in a controlled laboratory situation) in the sampled population, and therefore extraneous characteristics may have impacted results. Possible extraneous characteristics may be differences in school start time; adolescent's reading ability,

adolescent's grades, school achievement, or temperament when completing the instruments. A purposive convenience sample was used rather than a random sample.

Threats to Internal Validity

As participants were self-selected from those who met the study criteria, selection bias may have been a concern. Those who agreed to participate may have had pre-existing differences from those who declined. Randomization was not used in sampling.

Threats to External Validity

As participants were self-selected from two different high schools, there were sociocultural and environmental differences between the adolescents as well as differences in the school environment. Socioeconomic differences may have impacted the populations.

Chapter Summary

Adolescents are known to have common complaints of sleepiness, headaches, and depression. These complaints are associated with negative, long-range health outcomes. This study increased the body of knowledge about a possible symptom cluster of sleep deficit, headaches, and depression in adolescents and the symptom cluster's expression within diverse ethnic groups. The theoretical framework guiding this study was the TOUS, a theory that examines the relationships between symptoms and the psychological, physiological and situational factors that may affect the symptoms. The study was designed to seek responses directly from older adolescents, thereby grounding the symptom cluster of sleep deficit, headache, and depression from their unique perspectives. Theoretical and operational definitions that informed this study were presented. Research questions and associated null hypotheses were also presented.

Assumptions, possible limitations, and the significance of the study to the science of nursing were discussed.

CHAPTER TWO

REVIEW OF THE LITERATURE

This review of the literature first addresses adolescent sleep in regard to delayed sleep phase, sleep deprivation, and sleep deficit from the first studies in the 1950s to current knowledge. The next section concerns adolescent headaches and depression related to sleep deficit. The chapter concludes with a summary of the existing literature found that addresses diverse ethnic populations regarding pediatric sleep deficit.

An extensive review of the literature was conducted. The electronic databases of the Cumulative Index to Nursing and Allied Health Literature (CINAHL), Health and Psychosocial Instruments (HAPI), MEDLINE in PubMed, OVID, PsycInfo, and the Virginia Henderson International Nursing Library were explored for relevant literature. The searches were performed with the subject headings and following key words: *theory of unpleasant symptoms, symptom clusters, sleep and adolescents, sleep and headaches in adolescents, sleep and depression in adolescents, headaches and depression in adolescents* and other combinations of these words, as well as searches for specific authors that were cited in found articles. Sleep articles were selected if they referred to sleep deprivation, sleepiness, sleep deficit, insomnia or delayed sleep onset. Multiethnic, multicultural, urban, or at risk populations of adolescents were searched in regard to sleep research. All database searches were restricted to references written in English.

While emphasis was placed on citations published between 2001 to the present, earlier publications were included if they contributed to the study. *Sleep disorders* were also considered as a possible synonym for *sleep deficit,* but it was later found that the focus of articles on sleep disorders were not related to sleep deprivation or deficit, so

these articles were excluded in this literature review. Several classic writings from Dement and Carskadon were integrated, as these pioneers were highly influential in the development of adolescent sleep research.

Sleep Deficit and Adolescents

Etiology

To appreciate the study of sleep and adolescents, a brief history of sleep studies will be discussed. The first man to devote his career to the modern scientific study of sleep was Nathaniel Kleitman from the University of Chicago. In 1952, Kleitman, along with Gene Aserinsky, observed infants having rapid eye movements during sleep. Further observations were made with college students attached to electroencephalograph (EEGs) in the first sleep lab. From this work, rapid eye movement (REM) sleep and other wave forms of sleep were observed and named. This nomenclature is still in use today (Dement & Vaughan, 1999).

In 1970, William Dement, a resident doctor who had studied with Kleitman, went to Stanford University to continue studying REM activity. He was also interested in what made people sleepy and the purpose of REM sleep. Dement would observe how long it would take sleep-deprived volunteers to fall asleep. This was termed *sleep latency,* and he developed the Multiple Sleep Latency Test (MSLT). His assistant, Mary Carskadon, worked in the summer of 1976 to develop the Stanford Summer Sleep Camp, where sleep latency and sleep debt were first described. The grant for this camp stipulated that the research must be on children, enabling Carskadon and Dement to do a multiyear study of sleep patterns in preteens and to describe how the patterns of sleep change through

adolescence. Carskadon went on to get her PhD, and was the first to describe the circadian rhythms of adolescents (Carskadon, et al., 1980; Dement & Vaughan, 1999).

Until recent times, adolescents' sleep patterns were thought to be influence by social and environmental factors and the adolescents' behavioral control. It is now recognized that adolescent sleep is also influenced by biological processes that are categorized under two regulatory systems: the intrinsic sleep homeostatic mechanisms and the circadian timing system (Fallone, Seifer, Acebo, & Carskadon, 2002). The sleep homeostatic mechanisms are also sometimes referred to as *sleep pressure* (Dement & Vaughan, 1999). The longer an individual is awake, the greater the need for sleep. This need has been found to be approximately one hour of sleep for every two hours awake. The need for sleep is termed *sleep debt* (Crowley, et al., 2007; Dement & Vaughan, 1999). This can be measured while awake by the multiple sleep latency test (MSLT) or through measurement of recovery sleep. When one does not get adequate sleep to meet the sleep debt, the body tries to make up this deficit on subsequent days through recovery sleep. Adolescents typically incur sleep debt during the week and try to catch up on the weekends.

Carskadon found that when adolescents were at the sleep camp and not influenced by parents, school, jobs, or nighttime diversions, they tended to go to bed later and arise later. Also, the need for sleep does not decline across teenage years, averaging around 9.25 hours per night (Fallone, et al., 2002). The second regulatory system, *circadian timing*, has been measured by survey, observations, and melatonin levels, and shows delay in sleep onset or a trend toward more evening wakefulness in adolescents. Children left to their own natural biological rhythm prefer to stay up late and sleep later,

while still needing an average of nine hours of sleep (Carskadon, 1990, 1993, 2005; Carskadon & Acebo, 2002; Carskadon, Acebo, Richardson, Tate, & Seifer, 1997; Crowley, et al., 2007). These descriptions of adolescent sleep form the foundation for present day sleep research.

Early studies that examined delayed sleep phase in adolescents were reported in 1993 and 1997. Carskadon, Vierira, and Acebo (1993) surveyed sixth graders whose ages were 11 and 12 years, to evaluate if adolescent tendency to phase delay may be initiated by a biological process rather than a response to psychosocial factors. Sixth graders were selected, as they reflected children of varying pubertal stages. The final sample consisted of 183 boys and 275 girls. Of the children participating, 85% were Caucasian and living in single-family dwellings with their parents.

A morningness/eveningness survey was used to detect phase tendencies in this age group. Questions were asked about waking times, bedtimes, alertness during daily activities, pubertal changes, and birth order, and a measure of peer group was performed. Results showed that in both boys and girls, weekday bedtimes were significantly related to puberty stage, with later bedtimes reported by students with higher puberty scores (boys $\chi^2 = 8.4$, $df = 2$, $p < 0.02$; girls $\chi^2 = 15.2$, $df = 4$, $p < 0.004$). Weekend bedtimes showed a similar significant relationship in boys ($\chi^2 = 9.7$, $df = 3$, $p < 0.05$), but in girls the relationship was not significant ($\chi^2 = 6.4$, $df = 4$, $p < 0.10$).

Analysis of variance in pubertal status showed a significant effect on morningness/eveningness in girls, $F(2,263) = 3.119$, $p < 0.05$, and similar but not significant findings for boys, $F(1,175) = 3.461$, $p < 0.1.0$. School type and birth order were not significantly related to morningness/eveningness. This study focused on

children at the transitional stage of early adolescence. The results showed that pubertal maturation has a significant influence upon phase preference and that psychosocial factors were less influential. This study only showed significance for girls, but it was noted that the female sample was at a more developed maturational stage than the males. This is one of the early studies showing the biological impact of puberty on sleep phase delay.

Taylor, Jenni, Acebo, and Carskadon (2005) examined sleep tendency (speed of falling asleep) during extended wakefulness in prepubertal and mature adolescents. The study included nine prepubertal (Tanner stage 1) and 11 mature (Tanner stage 5) adolescents. The first 10 nights, the subjects spent at home on a fixed, 10-hour sleep schedule, to prepare all of them at baseline to be well-rested. The next phase of the study was in a sleep laboratory, in which polysomnography was used to follow subjects on a 35-hour constant routine, with sleep latency tests at two-hour intervals. Saliva was collected to measure melatonin as a marker of circadian phase. The study found that dim-light melatonin onset for Tanner 5 group was later (*M* clock time = 21:29 hours; *SD* = 42 minutes) than for prepubertal adolescents (*M* clock time = 20:33 hours; *SD* = 49 min). This was determined by a two-tailed *t*-test ($t = -2.78$; $df = 18$; $P = 0.01$). The sleep latency tests showed longer time to onset of sleep for the Tanner 5 group than the Tanner 1 group after 18.5 hours awake. This correlates with older adolescents that report later sleep onset and sleep wake times. The researchers concluded that sleep phase delay is driven by intrinsic alterations of circadian rhythm and sleep-wake regulation, and that sleep phase delay is a normal developmental process of adolescence.

Wolfson and Carskadon (1998) studied sleep schedules of adolescents and daytime functioning with the purpose of documenting the association between adolescents' sleep/wake habits and daytime sleepiness, high school grades, depressed mood, and other daytime behaviors. The researchers used an eight-paged School Sleep Habits Survey that was distributed to students (ages 13 to 19) in four high schools in Rhode Island. A total of 3,120 students completing the survey. Over 83% of the students reported that they were European American. The survey asked about school and weekend sleep times, school and weekend wake times, school performance, daytime sleepiness, sleep/wake behavior problems, and depressive mood.

The results of the sleep survey were divided into four age groups: 13-14 years, 15 years, 16 years, and 17-19 years. All school-night sleep variables were affected by age, (multivariate F (9.6571) = 22.49, $p < .001$). School night bedtimes increased by an average of 46 minutes, and weekend bedtimes increased by 55 minutes. Average total sleep time decreased by approximately 40 minutes across the four age groups, ($p < .001$). School-night bedtimes ranged from 10:05 PM for the 13 – 14 year old group to 10:51 PM for the 17 – 19 year old group. Weekend sleep delays were similar. Students with higher grades reported longer and more regular sleep, and students with poorer grades reported less sleep, later bedtimes, with irregular sleep/wake habits. These differences were consistent for school nights and weekend nights.

Results also showed that students in the short total sleep group were more often late to class because of oversleeping, felt tired nearly every day, and needed more than one reminder to get up each morning *ps* < .01. This group also reported higher levels of depressive mood *ps* < .001, and had greater sleepiness, *ps* < .001, than those in the long

sleep group. Female and male high school students did not report significant difference in sleep times. Although this study lacked an ethnically and socioeconomically diverse sample, findings demonstrated consistency in tiredness of high school students related to delayed onset of sleep, trends in delayed bedtime associated with increased age, large variations between school night and weekend sleep schedules, and an association between decreased hours of sleep and higher levels of depression. Laberge, Petit, Simard, Vitaro, and Tremblay (2001) examined the developmental changes of sleep patterns as a function of gender and puberty, and assessed the prevalence of sleep habits and sleep disturbances in early adolescence. They studied 588 boys and 558 girls, aged 10 through 13 years. Their mothers were asked to complete annual questionnaires on sleep and pubertal status at ages 10, 11, 12, and 13. A complete set of data were obtained from 746 mothers. An ANOVA procedure was used to make a statistical comparison of gender and age differences with various variables, including results from the Pubertal Developmental Scale.

Results showed the average bedtime on schooldays was delayed further each year ($P < 0.00001$, Tukey HSD), to reach a total difference over three years of approximately 61 minutes. On weekends, the average bedtime was delayed further every year ($P < 0.00001$), for a total difference of approximately 69 minutes over three years. The average wake time on weekends was also delayed every year ($P < 0.00001$), up to 55 minutes. Subjects with higher pubertal status had significant variations between school day and weekend wake times. Subjects with higher pubertal status slept later by 48 minutes on the weekends and slept longer by 31 minutes (after accounting for variation in onset of sleep) than those with lowest pubertal status.

At the Center of Pediatric Sleep Disorders in Rome, Italy, Giannotti, Cortesi, Sebastiani, and Ottaviano (2002) published results of a study with a large sample of 6,631 adolescents, aged 14 to 18 years of age. The aim of the study was to determine the relationship between circadian preferences, regularity of sleep patterns, sleep problems, daytime sleepiness, and daytime behavior. The study used the School Sleep Habits Survey, the same questionnaire used by Wolfson and Carskadon (1998). The average age was 17 years, with 315 males and 427 females in this age group. All girls were postmenarchal, and all boys showed evidence of pubertal changes. Of circadian types, 742 students reported being Evening types and 1,005 students reported being Morning types.

No significant differences were found between morningness/eveningness scores for both gender groups. However, there were significant changes in sleep preference according to chronological age, and in both sexes, increasing age was associated with a tendency toward eveningness. Of note, subjective daytime sleepiness was greater for both males and females in the eveningness group; and, daytime sleepiness became a more frequent complaint as age increased. In regard to emotional problems, the following variables of female sex (β: 0.28, $P < 0.001$), problematic sleep (Sleep-wake Problems Behavior Scale β: 0.25, $P < 0.001$), high level of daytime sleepiness (Sleepiness Scale β: 0.14, $P < 0.001$), less nighttime sleep (β: -0.09, $P < 0.001$), and evening preference (E-type β: 0.06, $P < 0.001$) were significantly associated. Thus, age was shown to be associated with daytime sleepiness and emotional problems were associated with sleep patterns in adolescents.

In 2003 the US Department of Health and Human Services publicized international data from the 1997-1998 survey on Health Behavior in School-aged Children. The survey was conducted in 29 countries in Europe, North America, and the Middle East on children aged 11, 13, and 15 years of age. However, the graphic presentations represented only data from children aged 15. Children answered the question: "In the past six months, how often have you had sleep difficulties" (U.S. Department of Health and Human Services Health Resources and Services Administration, 2003, p. 6). The US was second only to France in the highest percentage of 15-year-olds answering they had sleep difficulties at least once a week. Girls responded positively 31% of the time and boys 26%. The U.S. had the third-highest response percentage of children stating they felt tired four or more times a week. These self-reports reinforce others' findings that American adolescents are experiencing sleep deficits and their antecedents, frequent tiredness or sleepiness.

From 2005 through 2008, examining the relationship between puberty, sleep times, wake times, and reported sleepiness was the focus of 12 studies (Chung & Cheung, 2008; Gibson, et al., 2006; Huk-Wieliczuk & Wdowiak, 2006; Hur, 2007; Jenni & Carskadon, 2004; Johnson & Roth, 2006; Kotagal & Pianosi, 2006; Megdal & Schernhammer, 2007; Robert E. Roberts, et al., 2008; ter Wolbeek, et al., 2006; Yang, et al., 2005). In each of these, older adolescents experienced a developmental change of intrinsic sleep-wake regulation, with a trend toward delayed sleep onset all nights and longer sleep-in times on weekends. These studies were conducted in the US, Korea, Switzerland, Holland, Canada, Poland, and China. Physiologic measurements as well as self-report and parent-report surveys were used. Researchers measured melatonin levels

while controlling for light, correlated activity diaries with polysomnography in a sleep lab, and sleep electroencephalograms. Self-report instruments were sleep diaries, School Sleep Habits Survey, Checklist of Individual Strength questionnaire, Pittsburgh Sleep Quality Index, Horne-Ostberg Morningness-Eveningness Questionnaire, Sleep Quality Index, and the Epworth Sleepiness Scale, derived from the Diagnostic and Statistical Manual of Mental Disorders (DSM, 4th edition) revised criteria for insomnia.

Specific environmental factors related to adolescent sleep have been studied in the past five years. A survey of 2,197 Iowa high school students showed that students taking advanced placement and/or college courses as part of their high school curriculum slept 30 to 60 minutes less per night than students who were not in these advanced curriculums (Jin & Shi, 2008). A study in Brazil (Teixeira, et al., 2007) compared sleep patterns and sleepiness of working and non-working high school students. Working students were moderately sleepier than non-workers during the school week and in classes.

Two studies examined caffeine intake with sleep in adolescents. Orbeta and colleagues (2006) found that adolescents (N = 4,243) with a high caffeine intake were 1.8 times (95% CI 1.5 - 2.1) more likely to be tired in the morning and 1.9 times (95% CI 1.6-2.1) more likely to have difficulty sleeping than students who reported a very low caffeine intake. *High caffeine intake* was defined by the researchers as the ingestion of more than one caffeinated soda or one cup of coffee a day. More than 43% of the students were in the high caffeine group. Calamaro, Mason, and Ratcliffe (2009) determined actual caffeine intake for each student (n = 100) ranging in age from 12 to 18 years, with a median age of 15 years. Those who consumed the most caffeine had a 70%

greater risk of falling asleep at school as well as a 20% risk of increased difficulty falling asleep on school nights.

Sleep Deprivation and Headaches in Adolescents

Research by Sheftell and Bigal (Bigal, et al., 2003; Sheftell & Bigal, 2004) stated that headaches are frequently associated with anxiety and depression. So much so, that the two researchers described the association as likely comorbidities. The term *comorbidity*, according to these researchers, means a "greater than coincidental association to two conditions in the same individual" (Sheftell & Bigal, 2004, para 1). In 1991, Breslau, Davis and Andreski (and in 1993, Breslau and Davis) found that, compared with controls, migraine sufferers are four to five times more likely to have affective disorders including dysthymia, major depression and bipolar disorders. The same group of researchers also found that patients with migraine were three times more likely to develop depression, and patients with depression were also three times more likely to develop migraine than controls.

Studies in which a variety of headache disorders were examined found associations with sleep disorders and sleep deficit in adolescents (Bursztein, Steinberg, & Sadeh, 2006; Gordon, et al., 2004; Mack & Gladstein, 2008; Palermo & Kiska, 2005; Roth-Isigkeit, Thyen, Stoven, Schwarzenberger, & Schmucker, 2005; Zarowski, Mlodzikowska-Albrecht, & Steinborn, 2007). In several studies evidence was documented that sleep deficit was a trigger or antecedent for either tension or migraine type headache (Leviton, Slack, Masek, Bana, & Graham, 1984; Miller, Palermo, Powers, Scher, & Hershey, 2003).

In a prospective comparative study conducted in the Mideast, results of a study by Bursztein and colleagues (2006) suggested that children and young adolescents with reported headaches had distinct sleep patterns and behavior problems. A clinical group of 28 Israeli children from a neurology clinic with persistent headache complaints were compared to a control group of 108 children. The children completed sleep diaries and wore actigraphs at night to record sleep/wake times. Behavior problems were assessed by parental reports. The children in the headache group had a higher level of internalizing behavior problems. Girls suffering from headaches also had poorer sleep quality. The researchers concluded that "behavioral interventions aimed at improving the sleep hygiene of children and adolescents suffering from migraine has been effective in reducing the frequency and duration of their symptoms" (Bursztein, et al., 2006, p. 1015). Children with headache were shown to have increased sleep needs.

Choquet and Menke (1987) studied 327 high school students in regard to psychosomatic symptoms. Girls were reported to have a high correlation for sleep disorders, headaches, and depressive symptoms. Sheftell and Bigal (2004) described the comorbidity of chronic daily headache and depression and sleep. The chronic headache patient felt depressed more frequently than the patient with chronic migraine. These chronic headache sufferers had several sleep problems and indicated they did not feel they slept well nor did they feel rested in the morning.

Sleep Deprivation and Depression in Adolescents

Most of the sleep studies on adolescents were conducted by psychiatrists and included questions or observations about behavioral and emotional characteristics of the sample groups. Several studies (Buckhalt, et al., 2007; S. S.-G. Gau, et al., 2007;

Takahashi, Hohjoh, & Matsuura, 2000; Vignau, et al., 1997) reported an association between depression and sleep deficits among students. Patten, Choi, Gillin, and Pierce (2000) found that depressive symptoms and cigarette smoking had a negative impact on sleeping in 12 to 18 year olds. Finally, Johnson, Roth, and Breslau (2006) explored the association of insomnia with anxiety disorders and depression to determine the direction of risk in a sample of 1,014 adolescents from 13 to 16 years of age. Anxiety disorders preceded insomnia 73% of the time, and a direction of risk for anxiety first followed by insomnia was noted. The opposite was true for depression. Prior insomnia was associated with onset of depression with 69% of cases.

Ethnicity and Sleep Deficit in Adolescents

There is a paucity of literature that examines the relationship of sleep deficit and/or sleep patterns and ethnicity in adolescents. Only one study was found that examined younger adolescents in grades 6, 7, and 8 (Maurice M. Ohayon, et al., 2000) and one looked at sleep patterns and ethnicity in elementary school aged children (Spilsbury, et al., 2004). Seven studies, however, (Durrence & Lichstein, 2006; Hale & Do, 2007; Nunes, et al., 2008; Sanford, et al., 2006; Stamatakis, et al., 2007; Steffen & Bowden, 2006; Thomas, Bardwell, Ancoli-Israel, & Dimsdale, 2006) did focus on addressing the needs of adults for sleep within various ethnic groups. Literature will be reviewed prioritized as to age and relevance to study variables.

Spilsbury et al. (2004) described sleep behaviors of children aged 8 to 11 years in Cleveland, Ohio, selected from previous birth cohorts in three area hospitals. The variables were age, sex, and ethnicity. The study found that minority children were more

likely than nonminority children to have a bedtime of 11 pm or later (OR 4.8; 95% CI 2.9-8.0). Thus, the minority children were getting less sleep than the Caucasian children.

Roberts et al. (1999) used data from a 1994 survey to provide initial estimates of ethnocultural differences in sleep complaints among adolescents. The survey of students in grades 6, 7, and 8 was administered to 5,423) children, and sleep complaints were compared across nine ethnocultural groups. Odds ratios calculated the risk of sleep disturbance in different ethnic groups compared to Anglos. Sleep complaints were limited to insomnia and hypersomnia. The researchers adjusted for effects from age, gender, and socioeconomic status. Results showed Mexican American youths at greatest risk for depression, suicidal ideations and sleep complaints, while Chinese youths were at the lowest risk. Anglo students had the lowest risk for hypersomnia of all groups. The researchers concluded that questions remained regarding minority status and risks for disturbed sleep among adolescents, and that more research was needed about the impact of ethnocultural background on sleep in this age group. To this day, this remains the only published study on ethnocultural differences in sleep complaints among adolescents.

In the studies using data collected from adults, one consistent finding was that Caucasians slept more, and more consistently than African Americans (Dailey, 2005; Hale & Do, 2007; Nunes, et al., 2008; Sanford, et al., 2006; Steffen & Bowden, 2006) or Hispanic Americans (Steffen & Bowden, 2006). This finding was consistent, regardless of other independent variables such as gender, age, marital status, employment status, smoking, weight, or season (Dailey, 2005; Nunes, et al., 2008; Sanford, et al., 2006).

In an evaluation of individuals between the ages of 20 and 98 (n = 703), Sanford et al. (2005) used the Epworth Sleepiness Scale (ESS) with the Beck Depression

Inventory, Fatigue Severity Scale, State-Trait Anxiety Inventory, and the Insomnia Impact Scale to measure sleepiness. For persons with complaints of insomnia and those without, African-Americans had significantly higher ESS scores than Caucasians. For the ESS, a score of 10 or more is the cut-off for determining excessive daytime sleepiness. Results showed that 40.4% of African Americans scored > 10 in comparison to 29% of Caucasians. Other findings point to the impact of socioeconomic level, depression, and sleep deficit in adults.

In the study by Steffen and Bowden (2006) of 168 Hispanic Americans, only sleep disturbance and depressive symptoms were positively correlated with each other ($r = .40$, $p < .0001$). This was determined after examining multiple correlations for other variables, such as perceived racism. Finally, two studies showed that Blacks have greater prevalence of short and long sleep durations, suggesting variation in habitual sleep (Hale & Do, 2007; Nunes, et al., 2008). These two studies focused on actual time asleep but did not assess whether participants received sleep adequate for their needs. Differences in sleep behavior in ethnic groups may lead to increased risk of sleep related co-morbidities.

Summary

This literature review initially focused on the history of investigation about adolescent sleep deficit, from the early literature of Dement and Carskadon identifying a pattern of intrinsic sleep phase delay, to later studies examining additional environmental variables contributing to sleep delay and sleep deficit. Carskadon showed that the need for sleep increases during adolescence to a mean of 9.25 hours per night. Two intrinsic regulatory systems influence adolescent sleep: first, the accrued sleep debt and second,

the delay in circadian rhythm to later hours of sleep onset. The stage of puberty was also shown to influence adolescent circadian rhythms, with more mature adolescents having greater tendency toward sleep deficit. Developmental maturity was more strongly associated with sleepiness and sleep deficit than gender. Depression was also seen to be associated with adolescents' sleep deficit.

In addition, other extrinsic variables were also related to adolescent sleep deficit. High school students in demanding school programs such as advanced placement and/or college courses experienced less sleep. Caffeine intake was also associated with sleep deficit and daytime tiredness, and headaches were commonly associated with sleep deficit as well as depression in adolescents. Rains and Poceta (2005) in their review of literature regarding adults suggests that sleep deficit, headaches, and depression are comorbidities or *symptom clusters* or *constellations* .

Finally, only one study from 2000 examined the relationship of sleep disturbance in middle-school adolescents to multicultural differences. Additional similar studies investigated other age groups. One study examined elementary school age children, while five studies investigated sleep disturbances with regard to cultural or ethnic differences in adults. These studies did find differences between minority groups and Caucasian people. None have looked at this phenomenon in association with depression and headache. Ethnic differences in sleep habits need to be examined for high school adolescents. This study would provide preliminary evidence of the coexistence of these symptoms in adolescents and how they may vary between ethnic groups.

CHAPTER THREE

METHODS

This chapter focuses on the study's design, setting, sample, and protection of human subjects. Data collection procedures and instruments used are discussed, along with the plan for data analysis.

Purpose

The purpose of this study was to investigate the possible symptom cluster or relationship between sleep deficit, headaches, and depression as it occurs in adolescents. A second purpose was to explore the demographic variables of ethnicity that may influence the symptom cluster. Additional variables of gender, hours in a work experience, extracurricular activities, and caffeine intake were described.

Research Design

The study design was non-experimental, retrospective, and multiple correlational. Purposive convenience sampling was used to survey sleep deficit, headache, and depression in a general, multiethnic population of older adolescents in Miami, Florida. The independent variables of sleep deficit and depression were measured by the Epworth Sleepiness Scale and the Beck Depression Inventory-II, respectively. The dependent variable, headache, was measured by the Ped-MIDAS scale. As this study sought to measure adolescents within the community setting, the variables were measured as they naturally occurred within that population.

The study was a multiple correlational design grounded in the theory of unpleasant symptoms (TOUS). The theory provided a conceptual framework from which to explore relationships between variables of sleep deficit, headache, and depression as

they naturally occurred, without any intervention. Also, the correlation or relationship between ethnic difference and sleep deficit, headache, and depression was investigated.

This was a between-subjects design. It was anticipated that any variation would come from differences between participants at a single sampling point in time. A high correlation between the independent variables of sleep deficit and depression, and the dependent variable of headache would have indicated a possible syndrome. This study also explored the relationship of the descriptive variable of ethnic group to the independent and dependent variables, to uncover the possibility of the syndrome occurring within a particular ethnic group.

Setting

Data was collected from two area high schools. The first school was a private Christian school composed primarily of Hispanic and White, non-Hispanic students. The second high school was a public school composed of primarily Hispanic and African-American students. The two schools were needed to get a representative sample of all three ethnic groups. Letters of support from the schools are attached (Appendix B).

Sampling Strategy

A purposive sampling strategy was used to assure that each ethnic group was equally represented.

Determination of Sample Size

A priori power analysis for the needed sample size was determined using G*Power 3.0.1 software (Faul, Erdfelder, Lang, & Buchner, 2007). The sample size was informed by power, effect size and significance level. *Power* was defined as the likelihood of rejecting the null hypothesis and thus avoiding a type II error. According to

Munro (2005), an 80% level was adequate. The conventional probability of accepting a false null hypothesis (β), also known as a Type II error, was 20%. Therefore, a power (1-β) of 0.8 was used in the calculations. *Effect size* is the degree to which the null hypothesis is false or the magnitude of the effect size of an independent variable on the dependent variable. The *significance level* is the probability of rejecting a true null hypothesis or making a type I error. This level, called *alpha*, is usually set at 0.05 (Munro, 2005). Other parameters used to determine an appropriate sample size included a significance level (α), or probability of a Type I error of 0.05 (thus, the probability of rejecting a true null hypothesis was 5%).

For this study, effect size could only be estimated, as previous studies of symptom clusters used chi-square, odds-ratios, or prevalence rates and not correlations. A power of .80 and significance level of .05 were used for the calculation of sample size. For Hypothesis 1, multiple regression was applied to the two predictor variables using a medium effect size of (f^2 = .15). By using G*Power (Faul, et al., 2007), a sample size of 107 participants was calculated. For application of ANOVA for Hypothesis 2, a large effect size of (f = .40) gave a G*Power value of 102 participants. However, to allow for incomplete surveys, a minimum of 150 students was planned.

Eligibility Criteria

Inclusion Criteria. Older adolescents are high school students who range in age from 14 years (9th grade) to 18 years (12th grade) and have generally attained puberty. The ages of puberty differ in boys and girls, various ethnic groups, and among individual families. At the time of puberty, children's' sleep cycles change, and most children begin to develop delayed sleep cycles. Thus, it is important to differentiate between younger

and older adolescents as to sleep patterns (Carskadon, 1990). All adolescents between the ages of 16 and 18 years in grades 11 and 12, who gave assent and whose parents gave written consent were included.

A general population of high school students was used because a high prevalence of headaches, depression, and sleep disorders has been noted in the general adolescent population of the US (Fendrich, et al., 2007). To gain a more accurate picture of the general population, students in the general community were used rather than students already seeing a neurologist or attending a sleep lab. A concern for the sample was to maintain heterogeneity to include diverse or multi-ethnic participants; therefore, two different schools were selected to sample all three ethnic groups: Caucasian, African-American, and Hispanic-American.

Exclusion Criteria. Adolescents who were not able to read and write in English were excluded from the study. Any adolescent who did not have consent from his or her parents, or any individual student who refused to complete the assent form was excluded. Any adolescent who had seen a neurologist for headaches or who had been involved in a sleep study in a sleep lab or hospital setting was also initially excluded.

Protection of Human Subjects

Participation in this study was completely voluntary. Permission for each research location was granted through a letter from the principal of each respective high school. Additional permission was granted from the supervisor of the Christian school and the Research Board of Miami Dade County Schools. Permission to conduct this study was obtained through the Barry University Internal Review Board (IRB).

Signed informed consent was obtained from parents/legal representatives and signed assent from the adolescents, as they had reached the legal age for consent in Florida. Assent for adolescents was based on two written documents. The first was the paper from the American Academy of Pediatrics titled *Informed Consent, Parental Permission, and Assent in Pediatric Practice* (Committee on Bioethics from the Academy of Pediatrics, 1995), which updated a previous statement by the Academy (Brown, 1976). Although the statement focused on assent for clinical treatment rather than research, it has been used as the primary resource for all pediatric assents. In particular, the American Academy of Pediatrics takes the stand that children should be "empowered to the extent of their capacity" (Committee on Bioethics from the Academy of Pediatrics, 1995). Thus, the information provided to children or adolescents must be appropriate to their developmental levels and their individual capacity to fully understand. Information provided to children must be written at the appropriate reading level. With this in mind, assent was considered a shared part of the process of informed consent and obtained along with the consent of parents.

The second document that guided the process of assent for children was the Code of Federal Regulations, Protection of Human Research Subjects, subpart D (2005). This US government document defines assent as "a child's affirmative agreement to participate in research" ("Protection of Human Subjects," 2005). This regulation also states that "failure to object" to participate does not equate with agreement. Therefore, assent for this study was a written and signed agreement to participate, although refusal at any time was honored even if an adolescent declined participation after giving a signed assent.

The risks of participating in this research were minimal. *Minimal risk* was defined as “the probability and magnitude of harm or discomfort anticipated in the research is not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests” ("Protection of Human Subjects," 2005). For the adolescents in this study, a possible risk was psychological consequences of identifying symptoms of depression. If an adolescent became anxious or depressed, provision was made for the classes’ teacher and guidance counselors to be immediately available and have information for additional free referral as needed. In addition, parents/legal representatives and students were given information on medical and mental health resources within the community that were at no cost. Questionnaires were anonymous. Participants could choose not to answer any particular question posed by the researcher and could withdraw from the study at any time without any consequences.

Confidentiality was maintained to the extent permitted by law. Any published results will refer only to aggregate data. There were no participant identifiers or information that could link participants to any published material. The researcher’s dissertation committee does not have access to de-identified data. Hard copies of study data are to be retained in a locked file cabinet in the researcher’s office, with consent forms kept separately from the study data. Electronic data are maintained in a password protected database. Data will be retained for five years and then destroyed.

A letter and consent form with detailed information about the study were sent home to the parents/legal representatives of all 16 to 18-year-old students (11^{th} and 12^{th} graders) who volunteered to participate. The letter explained that participation was

voluntary and that parents/legal representatives could refuse participation of their adolescent. Included on the consent form were the names and telephone numbers of Barry University, the principal investigator, and her dissertation committee chair. Parents/legal representatives were instructed to call any of these numbers if they had any questions regarding the study. If requested, the investigator would thoroughly review the consent form with the parent /legal representative in person. If any parent/legal representative had contacted the researcher, he or she would have been given the opportunity to freely ask questions, to decline participation, or decline to make a decision about participation. If the parent/legal representative gave consent for the adolescent's participation, the parent/legal representative signed the consent form and the child returned the consent form to his or her teacher. A copy was retained by the school, the researcher and a copy returned to the family. If the parent/legal guardian did not return the consent form and if the child did not present a signed form to their teacher, then the adolescent was not allowed to participate in the study. The study was explained by the researcher to the potential participants through school classes or an assembly arranged by the investigator. Time for additional questions and answers was provided for individual students as needed prior to data collection in person, through email or telephone.

Procedures

Recruitment

Request for assistance with this study was made at two local high schools. Once IRB approval and letters of support from the two schools were received, the investigator conducted at least one information session covering the study with the school principals, teachers, and counselors. Additional approval was sought and obtained from the

Christian school's superintendent and the Research Board of Miami Dade Public Schools. Next, letters with consent forms were sent home to parents via the students. Only those students who brought signed consent forms from their parent/guardian and signed an assent form were allowed to participate in the study. Students did not miss essential lessons at school to participate in this study. Students who do not bring completed consent forms or sign assent forms were given an alternative activity provided by the researcher or the teacher. The researcher was available by phone, email, or in person for additional questions prior to data collection. Since students age 18 had reached the legal age of majority, they were asked to sign a consent form rather than an assent form.

Data Collection

At a designated meeting to administer the assent form and questionnaire, the researcher presented short standardized instructions about how to fill in the assent form and questionnaire and answered procedural questions during the process of filling in the forms. Each student signed the assent or consent form as age-appropriate. The original assent forms were retained by the researcher. The parent/legal representative and the school received a copy of the signed assent form. After the students completed the assent form, they completed the questionnaire. All questionnaires were anonymous. The adolescents were informed that they could choose not to answer a particular question and/or stop answering questions at any time. The questionnaire took about 20 minutes to complete. Students did not miss school lessons in order to participate in this study.

Instruments

The questionnaires given to the adolescents were a sociodemographic data form, the Epworth Sleepiness Scale (Olson, Cole, & Ambrogetti, 1998), the PedMIDAS

Headache Tool (Hershey, et al., 2001), and the Beck Depression Inventory (Beck & Beck, 1972). The participants responded to a series of questions or statements that converted into numerical form and were statistically analyzed. The language of the questions or statements was straightforward and had been used in similar age groups of children with similar educational backgrounds. Scales used were nominal and ratio levels. Nominal data was collected to determine demographic information of gender, ethnicity, hours in a work experience or extra-curricular activities, and caffeine intake. The Epworth Sleepiness Scale and the Beck Depression Inventory used ratio level measurement. The PedMIDAS Headache Tool used ratio level measurement to describe disability from headache over the past three months.

Epworth Sleepiness Scale

The two most commonly used tests for daytime sleepiness are the multiple sleep latency test (MLST) and the Epworth Sleepiness Scale (ESS). Although considered valid, the MLST is very cumbersome, time-consuming and expensive to perform. The MLST can only be administered in a sleep laboratory and requires a trained polysomnographer (Johns, 2000). Designed to measure the individual's general level of daytime sleepiness, the ESS was developed by Johns in the Sleep Disorders Unit of Epworth Hospital, Victoria, Australia as a simple, self-administered questionnaire. The scale was originally developed for use with adults with obstructive sleep apnea.

Validity. The ESS has been used with adolescents and validated by Gibson et al. (2006) in a study of over 3,000 Canadian high school students to measure sleepiness. Face validity was based on reviews by educators (Canadian high school teachers and school administrators) and sleep clinicians. Other studies have examined the ESS for use

with adults. The ESS has been shown to be inadequate in specificity and sensitivity in measuring time to fall asleep or insomnia, but works well as a screening test for daytime sleepiness (Johns, 1991; Miletin & Hanly, 2003; Olson, et al., 1998; Sangal, Mitler, & Sangal, 1999).

Reliability. Test-retest reliability was determined by having 30 students complete the questionnaire on two occasions two weeks apart. A correlation coefficient of .88 for the ESS in Canadian students, ages 14 to 18 years, was the same as the score Johns (1991) found with adults (Gibson, et al., 2006).

Gibson also found in his two high school groups significant correlations between an ESS score of $\geq$ 10 and various behaviors. Some of these behaviors were staying up late to study, drinking caffeinated beverages after 6 pm, performance measures of grades dropping, being extremely sleepy at school, having decreased extracurricular activities and missing social or sport events or work.

Chung and Cheung (2000) studied Hong Kong adolescents by using the ESS and other instruments. The sample included 1,629 adolescents ages 12 to 19 years. The test-retest reliability coefficient for the ESS was 0.78, and the Cronbach's alpha was 0.73. Thus, reliability and validity of the ESS has been shown when used with adolescents in Canada and China.

Use of the ESS has not demonstrated differences in the scores between male and female subjects (males = 5.64 $\pm$ 2.56; females = 6.06 $\pm$ 1.84; $t = 0.520$, $p = 0.607$). Elevated ESS scores greater than 16 indicated a high level of daytime sleepiness, and correlated with patients with diagnosed obstructive sleep apnea syndrome, narcolepsy, or idiopathic hypersomnia. Johns (2000) demonstrated that the ESS had a high sensitivity

(93.5%) and high specificity (100%) with a cut-off score >10 in distinguishing excessive daytime sleepiness from normal daytime sleepiness. The internal consistency of the questionnaire showed a Cronbach's alpha of 0.88.

Scoring. Numbers in the ESS are related to eight situations: sitting and reading, watching TV, sitting inactive in a public place, sitting as a passenger in a car for an hour without a break, lying down to rest, sitting and talking to someone, sitting quietly after lunch, and sitting in a car while stopped for a few minutes in traffic. Each situation is scored by the research subject on a scale from 0 to 3. Then the scores for the eight situations are totaled to give a final score that may range from *none* (0) to *extreme* (24). These scores distinguish a range of daytime sleepiness. Scores above 10 are considered to indicate moderate sleepiness. The ESS generates ratio level data in that there is a zero score possible.

Pediatric Migraine-Specific Disability Tool

The PedMIDAS was developed in 2001to assess migraine disability in school-age children and adolescent patients. Headache disability is defined by Hershey et al. (2001) as the impact of recurrent headaches on a patient's quality of life. The original tool, the Migraine Disability Assessment questionnaire (MIDAS) was designed to assess disability in 20 to 50-year-old patients. The PedMIDAS was designed to be developmentally specific to child and adolescent lifestyles. Although the tool specifies that it assesses disability from migraines, the questions do not specify migraines but ask questions about disability from headaches and therefore can be used as a general primary headache questionnaire.

Validity. The PedMIDAS has been tested and validated for ages 4 to 18 with and is modeled after the MIDAS. Validity was assessed by correlating scores with headache frequency, severity, and duration for 441 neurology patients who were diagnosed with migraine. The correlation of the PedMIDAS score with frequency, severity, and duration had Pearson's coefficient values of 0.58, 0.27, and 0.23.

Reliability. During development of the questionnaire, internal consistency and test/retest reliability were evaluated with 441 patients. The mean age of patients who completed the questionnaire was 13.0 $\pm$ 3.3. The female to male ratio was 1.4:1.0. The racial distribution was 92.5% White, 6.3% Black, and 1.1% other. The six questions were found to have a Cronbach's coefficient α value of 0.78. Thus, the six items on the PedMIDAS measure the same characteristic of headache disability. For test-retest evaluation for reliability, 56 patients who completed the original questionnaire were contacted between 10 and 21 days after the initial visit (M = 14.4 $\pm$ 2.1 days).

The Pearson's correlation for the total questions in test-retest was 0.80, which demonstrates there was no statistical difference in the questions. The questions with the strongest correlation were questions 1 (0.76):"How many full school days of school were missed in the last three months due to headaches" and question 4 (0.73) "How many days were you not able to do things at home (i.e., chores, homework, etc.) due to a headache?" The weakest correlation was found with question 2 (0.16): "How many partial days of school were missed in the last 3 months due to headaches (do not include full days counted in the first question)?" These differences in reliability may need to be considered in final scoring if any inconsistencies are found, although the overall tool is sound (Hershey, et al., 2001).

Scoring. Children respond to each item on the tool, indicating the number of days affected by headache within the past three months. The score is simply added together. If the child gives a range of days, use the high end of the range or ask the child to provide a single number, both methods show equal validity. If the answer is blank or is a phrase (i.e. few or couple), then the data cannot be used.

This six question PedMIDAS tool is scored by quartiles. The first quartile with a score of 0 to 10 is considered a disability grade of little to no disability from headache. The second quartile within the range of 11 to 30 is considered a grade of mild disability from headache. The third quartile of 31 to 50 is graded as moderate disability. The fourth quartile is anything greater than 50 and is called the grade of severe disability (Hershey, et al., 2004; Hershey, et al., 2001). The PedMIDAS generates ratio level data in that there is a zero score possible.

The PedMIDAS questionnaire has been used in 10 studies since the tool's inception. In the four most recent studies, each determined validity and reliability based on Hershey's initial work (Akyol, et al., 2007; Fan, et al., 2009; Kernick, Reinhold, & Campbell, 2009; Wang, Fuh, Juang, & Lu, 2009). Thus, the PedMIDAS has shown to be reliable and valid when used with adolescents.

Beck Depression Inventory-II

The final instrument employed in this study was the Beck Depression Inventory-II (BDI-II). The purpose of the BDI-II is to screen for major depression. This is a revision of the older inventory that has been in use for 40 years. This newer version includes the original 21 questions while improving discrimination of the range of depression more in line with DSM-IV criteria. It also eliminates items showing gender bias. Due to its

validity and reliability, this tool has been widely used in clinical and non-clinical settings and is applicable for ages 13 and older. The reading is reported at a sixth grade level, and the inventory takes 5-10 minutes to administer (Arbisi & Farmer, 2004).

Validity. Validity was determined through correlations with Beck's earlier use of his updated tool and through comparison with three other tools that measure anxiety, sociotropy, and solitude with a similar distribution of college students.

Dozois, Dobson, and Ahnberg (1998) used the BDI-II with 1,022 undergraduate college students in Calgary, Canada for the purpose of evaluating the psychometric characteristics of this updated instrument. The students were administered the old BDI instrument and the revised BDI-II instrument. The BDI-II obtained a coefficient alpha of .91, showing, again, high levels of internal consistency. There was no significant gender difference in scores. Since the BDI has been used, tested and well validated, the original tool set a high standard. The convergent validity of the BDI-II to the previous tool was .93 ($p < .01$), with few changes in questions.

Osman, Kopper, Barrios, Gutierrez, and Bagge (2004) examined reliability and validity of the BDI-II with adolescent psychiatric inpatients. To assess content validity seven experts (doctoral-level clinical psychologists with at least five years of experience in clinical assessment or research) rated the individual questions in the inventory as to their relationship to the DSM-IV criteria on a 5-point rating scale (1 = *not at all relevant* to 5 = *extremely relevant*). The experts' mean relevancy ratings ranged from 2.9 to 4.81, ($M = 4.14$, $SD = 0.64$). The relevancy ratings of individual BDI-II questions to DSM-IV criteria ranged from 2.71 to 4.71. The specificity ratings for the tool ranged from a mean of 2.52 to 4.24 ($M = 3.51$, $SD = 0.72$). Furthermore, four out of seven experts considered

item 21 (loss of interest in sex) to be inappropriate for use with adolescents. Of note, the experts did recognize that the BDI-II items can be "faked (good/bad) quite easily" (Osman, et al., 2004, p. 122). Five out of seven experts indicated that they found the tool to contain all the essential symptoms seen in adolescents who are clinically diagnosed with major depressive disorder and that the BDI-II is a highly useful tool in screening for depression severity in adolescents. Within the same study, 13 psychiatric inpatients ranging in age from 13-17 years rated the items on a 1 to 5 scale from *very hard to read* to *easy to read*. The inpatient adolescents scored clarity with a range of 3.48 to 4.76 (M = 4.35, SD = 0.32). The inpatients found most of the items were easy to read and understand except for item 16 (changes in sleep pattern) and item 18 (changes in appetite). These two items required them to choose between seven response options. Osman et al. only noted that these items "might be difficult for youths with severe disturbances in mood to complete" (2004, p. 129). No changes of the instrument were recommended.

Reliability. The initial evaluations of the BDI-II were from Steer and Clark (1997) on college students as well as Beck in 1996. Steer and Clark used a sample of 160 students, who were primarily middle-class American Caucasians (97%). Gender distribution of this sample was 107 (67%) women and 53 (33%) men, with a mean age of 18.76 years. The coefficient alpha was determined to be .89, which indicates a high internal consistency for this updated tool.

Reliability analysis by Osman et al. (2004) was measured (α = .94, CI = 95%, r = .43) and found to be similar for both boys and girls although severity of depressive scores were higher for girls than boys. The internal consistency of the BDI-II was similar to

scores reported by Steer, Kumar, Ranieri, and Beck (1998) for adolescent psychiatric outpatients. In a much larger study with 414 Texas high school aged (14 to 18) adolescents , the BDI-II was completed, along with four other self-report instruments on depressive symptoms (Osman, Barrios, Gutierrez, Williams, & Bailey, 2008). Again, independent samples *t* -test showed no significant differences between boys and girls. The majority of the sample was Caucasian (81.4%), 8.7% were African-American, 4.6% were Hispanic/Latino, and 5.3% were other ethnicities. The internal consistency for scores on the BDI-II was high (coefficient alpha = .92). The BDI-II total score correlated moderately and significantly with scores on self-report measures of hopelessness (r = .63), anxiety (r = .53), and suicide-related behaviors (r = .57), providing support for validity in this age group (Osman, et al., 2008).

In 2008 the BDI-II was used to assess occult depressive symptoms in adolescents who were emergency department patients in Minneapolis, Minnesota (Biros, et al.). This was a cross-sectional study of medically stable adolescent (ages 13-17 years) emergency department patients with non-psychiatric concerns. A total of 967 patients completed the BDI-II, and a demographic questionnaire answering questions about their attitudes, activities, and lifestyle choices. Parents/guardians were asked about family demographics, living situations, and other patient characteristics. According to the BDI-II, 20% (197 patients) had moderate to severe depressive symptoms, while only 10% were recognized by their parents/legal representatives as having depressive symptoms. Adolescents with mental health issues were excluded to determine the occurrence of occult depressive symptoms in mentally healthy adolescents from that study. Of note, the

authors cited studies using the original BDI to support validity, reliability, and application to adolescent age group.

In critiquing several articles, confusion between use of BDI and BDI-II had been noted although each are two distinct and different instruments (Basker, Moses, Russell, Swamidhas, & Russell, 2007; Biros, et al., 2008; Steptoe, Peacey, & Wardle, 2006). One researcher admitted to knowledge of the BDI-II but merely used the older BDI because it was free (Basker, et al., 2007). Fortunately, ample studies have demonstrated reliability and validity of the BDI-II over the 13 years it has been available.

Scoring. Each of the 21 items corresponding to a symptom of depression is summed to give a single score for the BDI-II. There is a four-point scale for each item ranging from 0 to 3. If a subject marks multiple scores for one item, then the highest rating is used. The maximum score is 63. On two items (16 and 18) there are seven options to indicate either an increase or decrease of appetite and sleep. Total score of 0-13 is considered minimal range, 14-19 is mild, 20-28 is moderate, and 29-63 is severe (Beck, Steer, & Brown, 1996). Any item not marked is scored as zero. The BDI-II generates ratio level data in that there is a zero score possible.

Demographic Data

Based on the literature review selected demographic data of gender, ethnicity, afterschool activities, academic school programs, or caffeine intake were collected and analyzed as descriptive data.

Data Analysis Plan

Data Cleaning

All surveys were examined for errors, accuracy, and completeness. While some participants provided surveys in which a question was incomplete, only complete questions were included in the analysis. However, if a participant provided an incomplete response to one question but a complete response to another question, the completed question was included.

A quality check procedure was conducted to minimize data transcription error. Responses to each item of each question were entered into the Statistical Package for the Social Sciences (SPSS) for Windows v.18.0 (SPSS, 2007). Responses to the individual questions were entered into the data matrix and computer scores for the questions were calculated. Additionally, each question was manually summed. The manual sums were subtracted from the computer calculated scores. The result verified accurate data entry.

Outliers were defined as any score falling below or above two standard deviations (*SD*) from the mean (*M*) and were identified by box plots. Outliers were identified to determine if they were part of the population from which the sample was intended.

Descriptions of the Sample

Information obtained on the demographic survey was analyzed by means of descriptive statistics and frequency distributions. The results were used to describe the sample.

Statistical Assumptions

The relationship between the theoretical constructs was analyzed by means of parametric tests; therefore, the data were expected to meet specific characteristics and

were measured as continuous with interval or ratio scales. The data collected by selected instruments were ratio level. Variables were assessed for normal distribution in the population (normality); therefore, data was inspected by histogram through SPSS. Next, the relationship between the dependent variables and the independent variables was to be a linear relationship (linearity). Linearity was examined through scatter plot for a straight-line relationship. Another assumption was the need for equal variances in the scores of the dependent variables and the independent variables (*homoscedacity*), and this was also inspected by scatter plot to demonstrate similar variability for scores. Finally, each value needed to be independent and not related to any other predictor value (multicolinearity and singularity). *Multicolinearity* exists when the independent variables are highly correlated (r = .9 or above). *Singularity* occurs when one independent variable is actually a combination of other independent variables, which is not likely with the uniqueness of each of the independent variables of sleep deficit and depression. One was a symptom of a physical need and the other was a symptom of an emotional mood. Prior to data analyses, SPSS diagnostic methods and manual inspection of histograms and scatter plots were conducted to ensure none of these assumptions had been violated, thereby increasing the likelihood of making a Type 1 and/or Type II error (Pallant, 2007).

Reliability Testing

The previously discussed instruments have demonstrated validity and reliability for the target age group of adolescents 16 to 18 years old. Cronbach's alpha was calculated and reported on each of the three tools (Epworth Sleepiness Scale, Beck Depression Inventory – II, and PedMIDAS) after the data had been collected to ensure

consistency in their use. A reliability coefficient of .70 was considered acceptable for group characteristics (Norwood, 2000).

Hypothesis Testing

Hypothesis One. There will be a significant relationship, uniquely and as a linear composite, between the predictor variables of sleep deficit and depression and the outcome criterion of headache among adolescents between the ages of 16 and 18. The independent variables were *sleep deficit* and *depression*; the dependent variable was *headache*. This hypothesis was analyzed using correlational technique of multiple linear regression to determine the extent that headache was related to the independent variables of sleep deficit and depression. Through multiple linear regression, relationships between all three variables were explicated.

Hypothesis Two. There will be a significant difference in the mean scores for symptom cluster (composite score for sleep deficit, depression, and headache) between the three ethnic groups of adolescents between the ages of 16 and 18 representing African-Americans, Caucasians, and Hispanics. In this hypothesis ethnic groups were the independent variables and the possible symptom cluster or expression of each of the three variables of sleep deficit, depression, and headache was analyzed by analysis of variance (one-way ANOVA).

Summary

This study was a retrospective, non-experimental correlational investigation using a purposive convenience sample to study the possible relationships between sleep deficit, headache and depression as it occurred in community-based adolescents. The study also explored the demographic variables of ethnicity that influence this symptom cluster. The

setting and sample population of high school adolescents were described. The questionnaire consisted of a self-report demographic questionnaire, the Epworth Sleepiness Scale, the PedMIDAS Tool, and the Beck Depression Inventory-II, of which the latter three have been proven valid and reliable for use with adolescents. The questionnaires were distributed to participants after parental permission and adolescent assent was obtained and verified in writing. Participation in the study was confidential; however, questionnaires and data were anonymous. Descriptive statistics, multiple regression, and analysis of variance were used to statistically analyze the questionnaire responses.

CHAPTER FOUR

RESULTS

Introduction

The purpose of this study was twofold. The first was to investigate the possible symptom cluster or relationship between sleep deficit, headaches, and depression as it occurs in adolescents. The second was to explore the demographic variable of ethnicity that may influence the symptom cluster. Additional variables of gender, hours in a work experience, extracurricular activities, and caffeine intake will be described.

Data were collected from a convenience sample. Prior to statistical analysis, all data were subjected to efforts to assure accuracy of entry. No items on the Epworth Sleepiness Scale (ESS) or the Beck Depression Inventory II (BDI-II), or the Pediatric Migraine Disability Scale (PedMIDAS) were required to be reverse coded. The research instruments were tested for reliability through Cronbach's alpha. Total scale scores were calculated for each of the three scales used (ESS, BDI-II, and PedMIDAS). Two hypotheses were posed and tested to provide answers to the research questions. Prior to hypothesis testing, the data underwent rigorous testing as explained in this chapter to determine if it met the criteria considered necessary for parametric statistical methods.

A total of 189 surveys were distributed and returned. One was excluded due to missing data leaving 188 surveys. Of these, 157 (83%) met the inclusion criteria and were complete and appropriate for use. Of the 157 cases, one survey did not complete the descriptive variables and was coded as missing (.6%). Additional individual items of missing data were excluded by cases pairwise in SPSS. This excludes only those cases missing data required for the specific analysis and includes data in any analysis for which

they have the necessary information (Pallant, 2007). On the Epworth Sleepiness Scale one item was missing on measures five (.01%) and seven (.01%), and two items were missing on measure six (1.3%). For the Beck Depression Inventory II, missing items varied from one (.01%) to three (2%) items in varied questions with no particular pattern. Due to the small percentage of missing cases, these were selected in SPSS as excluded by cases pairwise since this was a minor amount of data missing. For the Pediatric Migraine Disability Scale 154 (98%) instruments were received and one of these was missing three of the six items. The PedMIDAS also excluded cases pairwise, as the missing data was then excluded from analysis, but those cases available were then used. All completed portions were then used for both reliability and hypothesis testing.

Description of the Sample

One of the 157 cases did not complete the descriptive section (N = 156), but did complete the symptom scales. Therefore the sample (N = 156) was represented by males (n = 75, 47.8%) and females (n = 81, 51.6%) and consisted of high school students aged 16 years (n = 41, 26.8%), 17 years (n = 65, 41.4%), and 18 years (n = 49, 31.2%). Initial contact with the adolescents was made through their high school classes and parental consent forms were given to children who self reported ages of 16 to 17 years. Individuals reporting that they were 18 years of age were given appropriate consent forms and not required to obtain parental consent as they have reached the age of majority. Plans were made with teachers and students to collect the parental consents, give assent forms, and surveys at the next class meeting time. The descriptive variables "Have you ever seen a neurologist or a doctor who specializes in the care of people with headaches" or, "Have you ever had a sleep study in a sleep lab or hospital setting" were

used to determine those respondents who were excluded from the study. The sample consisted of three major ethnic groups with three quarters of the participants (*n* = 117, 74.5%) identifying themselves as Hispanic. Current data from the Florida Department of Health indicates that 62% of Miami-Dade County is Hispanic (CHARTS, 2010). African-Americans constituted the next highest group (*n* = 16, 10.2%) and White, Non-Hispanic (*n* = 10, 6.4%) and other (*n* = 13, 8.3%) as the remainder. The ethnic background of the sample is presented in Table 1.

Table 1

Ethnic Background (N = 156)

Ethnicity	*n*	%
Hispanic	117	74.5
African-American	16	10.2
White, non-Hispanic	10	6.4
Other	13	8.3

Other descriptive variables in the study were after-school activities, AP (Advanced Placement) or IB (International Baccalaureate) school programs, and use of caffeinated drinks. Nearly half (*n* = 100, 47.1%) participate in after-school activities such as sports or jobs. The sample was almost evenly divided (47% to 52%) in academic programs between students in AP or IB programs and those students not in college

preparatory programs. Of the sample, a majority (n = 111, 70.7%) do not report using caffeinated drinks on a daily basis.

Estimation of Internal Consistency

Cronbach's alphas were calculated to evaluate reliability for each scale and a value of .70 or higher was used to determine internal-consistency among each scale's items (Pallant, 2007). The ESS ($\alpha = .570$) and the PedMIDAS ($\alpha = .438$) were calculated and discussion of these low alphas will take place in Chapter 5. The BDI-II had a Cronbach's alpha of .881.

Exploring the Data for Statistical Assumptions

To assure the data met the assumptions necessary for parametric testing, the continuous variables were explored for normality of distribution and homogeneity of variance. The scores for the ESS, BDI-II, and PedMIDAS were screened for outliers by descriptive statistics of the mean, standard deviation, range of scores, measures of skewness and kurtosis, histograms with the normal curve imposed and by calculation of the Kolmogorov-Smirnov (K-S) value.

Initial descriptive statistics for the eight-item ESS scale ($M = 9.20$, $SD = 3.39$, range of 0 to 18), the 21-item BDI-II ($M = 8.40$, $SD = 6.56$, range of 0 to 36), and the six-item PedMIDAS ($M = 7.46$, $SD = 22.78$, range of 0 to 188) were calculated. The frequency distribution for ESS found all scores to be within 3 *SD* of the mean. The frequency distribution for BDI-II found three scores to be above 3 *SD* of the mean. The frequency distribution for PedMIDAS found five scores to be above 3 *SD* of the mean, see Table 2. Boxplots were used to identify the outlying cases. Boxplots showed some

outliers but the only table with extreme scores was the PedMIDAS. These will be discussed in more detail in Chapter 5, but the decision was to use this data as an important contribution to the picture of this population.

Table 2

Descriptive Statistics of Epworth Sleepiness Scale (ESS), Beck Depression Inventory II (BDI-II), and Pediatric Migraine Disability Scale (PedMIDAS)

	N	Mean	SD	Skewness
ESS	153	9.2026	3.39186	-.052
BDI-II	152	8.4013	6.56729	1.359
PedMIDAS	153	7.4641	22.78100	5.652

Skewness was examined for each of the three scales, see Table 2. The ESS showed a skewness of -.052 which indicates a small shift to the right. The BDI-II showed a skewness of 1.359, which is a stronger shift to the left. The Ped-MIDAS showed a skewness of 5.652, a very strong shift to the left. Kurtosis was examined for each of the three scales, and showed the ESS to be -.10, the BDI-II to be 2.54, and the PedMIDAS to be 35.324. The Kolmogorov-Smirnov statistic was .074, .131, and .372 respectively for each scale. A non-significant result greater than .05 indicates normality (Pallant, 2007). “If a test is non-significant ($p > .05$) it tells us that the distribution of the sample is not significantly different from a normal distribution “ (Field, 2005, p. 93). As each of the values was greater than .05, the data falls within this test for normality. The histograms plotted with the normal curve superimposed for each scale are shown below in Figure 1, 2, and 3. The ESS and BDI-II come close to a normal parametric curve. The

PedMIDAS does not display a normal distribution curve. Criteria for choosing a parametric test was not met for the PedMIDAS. A non-parametric test for multiple regression is not known. A trial test of statistical tests of multiple regression and one-way ANOVA can be applied to skewed distributions with a large sample size (Pallant, 2007; Polit & Beck, 2004) therefore this is what was used.

Hypotheses Testing

Hypothesis I

Hypothesis I stated:

There will not be a significant relationship, uniquely and as a linear composite, between the predictor variables of sleep deficit and depression and the outcome criterion of headache among adolescents between the ages of 16 and 18. Standard multiple regression was used to assess the ability of two control measures (Epworth Sleepiness Scale and Beck Depression Inventory) to predict levels of headache (Pediatric Migraine Disability Scale) in adolescents (Pallant, 2007). In reviewing for correlations, both of the scales (ESS and BDI-II) did not correlate (p = .05) significantly with the PedMIDAS (.258 and .070 respectively), see Table 3. In that statistical sources customarily recommend transformation of skewed data, the PedMIDAS was later transformed by logarithm and multiple regression was run again with the transformed dependent variable (Field, 2005; Munro, 2005; Pallant, 2007). The results of this statistical test continued to show no unique contribution from either of the independent variables (ESS or BDI-II) to predict the dependent variable (PedMIDAS). Correlation between the independent variables of sleep deficit and depression was .135 (below the cutoff of .7) and therefore multicollinearity was not a concern. Under the Model Summary (Table 4), the R Square

value was .017 which when multiplied by 100 indicates that only 1.7% of the variance of the PedMIDAS scores were explained by variance of the ESS and BDI-II scores, in this population. The beta coefficients of the ESS and of the BDI-II were .043 and .118 respectively, with the Beck Depression score being larger than the Epworth Sleep score. This means that the independent variable of depression makes a stronger contribution than sleep deficit to explaining the dependent variable of headache. The significance of the ESS is .814 and the BDI-II is .155. Both are above the level of significance ($p = .05$) therefore neither of the independent variables makes a significant unique contribution to the prediction of the dependent variable.

Table 3

Correlations

		PedMIDAS	ESS	BDI-II
Pearson Correlation	PedMIDAS	1.000	.054	.122
	ESS	.054	1.000	.090
	BDI-II	.122	.090	1.000
Sig (1-tailed)	PedMIDAS		.258	.070
	ESS	.258		.135
	BDI-II	.070	.135	

Table 4

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.129	.017	.033	22.74450

Table 5

ANOVA (Between Groups)

	df	F	Sig
ESS	3	.797	.497
BDI-II	3	.471	.703
PedMIDAS	3	.544	.653

The null hypothesis for hypothesis one was accepted. Standard multiple regression analysis found that both sleep deficit and depression did not account for the variance in adolescent headaches. No prediction of sleep deficit and/or depression can be made for the number of adolescents with headaches in this study.

Hypothesis 2

Hypothesis 2 stated:

There will be no significant differences in the mean scores for symptom cluster (composite score for sleep deficit, depression, and headache) between the three ethnic

groups of adolescents between the ages of 16 and 18 representing African-Americans, Caucasians, and Hispanics.

As the dependent variables in this hypothesis of sleep deficit, depression, and headache do not have a correlation or relationship, multivariate analysis of variance was not used. Each of the dependent variables was considered separately through one-way analysis of variance. A one-way ANOVA was conducted to explore impact of ethnicity on levels of sleep deficit, as measured by the Epworth Sleepiness Scale (ESS) (Table 5). There was no statistically significant difference at the $p < .05$ level in ESS scores for the three ethnic groups: F (3, 148) = .797, p = .497. A one-way ANOVA was conducted to explore the impact of ethnicity on levels of depression, as measured by the Beck Depression Inventory II (BDI-II) (Table 5). There was no statistically significant difference at the $p < .05$ level in the BDI-II scores for the three ethnic groups: F (3, 147) = .471. A one-way ANOVA was conducted to explore the impact of ethnicity on levels of depression, as measured by Pediatric Migraine Disability Scale (PedMIDAS) (Table 5). There was no statistically significant difference at the $p < .05$ level in the PedMIDAS scores for the three ethnic groups: F (3, 148) = .653 After referencing the statistics for ANOVA in all three cases n_1 = 8.55 based on the degrees of freedom (Munro, 2005).

Table 6

ANOVA (Between Groups)

	df	F	Sig
ESS	3	.797	.497
BDI-II	3	.471	.703
PedMIDAS	3	.544	.653

The null hypothesis was accepted. Ethnicity did not explain any of the symptoms of sleep deficit, depression, or headache in this group.

Summary of Results

This research was conducted with 189 adolescents between the ages of 16 and 18 years from two South Florida high schools. Two hypotheses were tested to answer the research questions using multiple regression and three one-way analysis of variance tests. The theoretical model's independent variables of sleep deficit and depression did not predict the dependent variable headaches. The independent variable ethnicity did not show significant differences in sleep deficit, depression or headaches. These findings will be discussed in Chapter 5.

CHAPTER FIVE

SUMMARY AND DISCUSSION OF FINDINGS

Introduction

Adolescents frequently present with complaints of headache and depression and it is well documented that adolescents do not get enough sleep (Crowley, et al., 2007; Gilman, Palermo, Kabbouche, Hershey, & Powers, 2007; Williams, et al., 2009). Racial/ethnic minority adolescents may have increased sleep deficit, headaches, and depression, but scanty data is available on this population. As patients usually present at their health care provider with more than one symptom, research is needed to see if sleep deficit, depression, and headaches constitute a symptom cluster. The purpose of this study was to investigate the possible symptom cluster or relationship between sleep deficit, headaches, and depression as it occurs in adolescents. A second purpose was to explore the demographic variables of ethnicity that may influence the symptom cluster. Additional variables of gender, hours in a work experience, extracurricular activities, and caffeine intake were described.

Implications of the Study

Discussion of Findings

This study is the first to investigate the possible symptom cluster of sleep deficit, depression and headache in adolescents as well as to explore the effect of ethnicity on the symptoms. The findings of the study indicated that a relationship between sleep deficit, depression, and headaches does not occur in high school students ages 16 through 18 years of age. The findings also indicate that ethnicity does not affect sleep deficit, depression, or headache in this age group. The data for sleep deficit and depression were

skewed, with a large number of students not reporting symptoms. Even more pronounced were the findings from individuals in regards to headaches with few students experiencing headaches and a separate small number of students experiencing complaints of daily headaches.

These findings are not congruent with the literature and bring into question several issues related to this study. Questions can be voiced on, selection of the scales used, reliability and validity of the survey or the method by which the survey was administered. Questions can be made concerning differences in the Miami-Dade population as compared to students who have been studied elsewhere. Also questions can be asked as to numbers studied although the sample was statistically more than adequate.

First as to the selection of the scales used. Each scale, ESS, BDI-II, and PedMIDAS had been previously used for adolescent populations. Recent studies in as diverse geographic locations as Rhode Island, Hong Kong, and Canada have used the ESS (Chung & Cheung, 2008; Gibson, et al., 2006; Owens, Belon, & Moss, 2010). In each case the survey has shown to have acceptable internal consistency and test-retest reliability. The only notable difference found is that in many studies a longer instrument was used called the Sleep Habits Survey, which is an 8-page self-report that includes a Sleepiness Scale and Sleep-Wake Behavior Problems Scale, Depressed Mood Scale, and assessment of morningness/eveningness (Owens, et al., 2010). This survey takes 25 minutes to complete. There is no literature to show that this scale is any more reliable than the shorter ESS. A study done in the U.S. in 2006 examined age, gender, ethnicity,

and insomnia on the Epworth Sleepiness scores in adults. Gender and age group had no impact; however, race and insomnia did show different scores (Sanford, et al., 2006).

For depression the Beck Depression Inventory II was selected due to its 35 years of confirmed reliability and validity, use with adolescents 13 years and older, and recent refinements to make the tool congruent with the American Psychiatric Association's Diagnostic and Statistical Manual on Mental Disorders(Beck, et al., 1996). The BDI-II has also been shown to be useful with various ethnicities (Joe, Woolley, Brown, Ghahramanlou-Holloway, & Beck, 2008). In addition, BDI-II has been used in studies on sleep duration (Steptoe, et al., 2006).

The PedMIDAS scale is the most recently developed scale of the three used in this study, and has been in six known published studies since its inception in 2001 (Hershey, et al., 2001; Wang, et al., 2009). The scale is adapted for children and adolescents from an older scale that has been used successfully in adults. This study used scales that are confirmed in numerous studies to be valid and reliable in adolescents.

The next question in regards to the findings was on the use of self-report surveys with high school students. Brenner, Billy, and Grady (2003) found that self-reports of health-risk behaviors are affected by both cognitive and situational factors in adolescents. These factors, however, do not threaten the validity of self-reports of each type of behavior equally. The cognitive perspective focuses on inaccuracies arising from comprehension, recall, and other cognitive operations. The situational perspective focuses on factors related to social desirability and interviewing conditions. It is possible that either of these factors could have affected data collection. All of the students were fluent in English but reading levels could have been inconsistent. Also recall could have

been poor. Also, although confidentiality and anonymity was explained to each group, some individuals may be skeptical since the surveys were administered in their high school classroom and not in a healthcare setting.

There is literature to support that self-report surveys work very well and that data collected from adolescents can be trusted. Wolfson and Carskadon (2003) studied validity of sleep surveys from high school students in New York state. The self-reports were correlated with sleep diaries and their work confirmed validity of the self-report tool in this population. As discussed earlier, each of the tools used had been studied and validated in multiple adolescent populations. Evidence leads to the conclusion that the data can be considered valid and reliable.

As to the uniqueness of the Miami-Dade population this was considered a strength for undertaking this study. Miami is a diverse city with a wide variety of racial and ethnic groups. In addition, among the Hispanic and Black populations diversity exists. To make this mix more unpredictable, enculturation varies greatly among individuals as well as families. Some individuals may be new to the United States and have likely lived in communities that retain many of their original ethnic traditions. Illegal alien status, distrust of bureaucracy, or distrust of someone from another ethnic/racial group could have impacted some of the surveys. Cultural limitations could be explored in the future.

The numbers used (n = 158) were robust for the moderate effect size, the number of variables, and the tools used, however most other studies used larger sample sizes. The recently published study in Rhode Island by Owens et al. (2010) explored adolescent sleep, mood, and behavior with a sample of n = 201. The classic study from Wolfson and Carskadon (1998) used 3,120 high school students to study sleep schedules

and daytime functioning. A Finnish study used 4,187 students (Tynjala, et al., 1999). Gibson et al (2006) studied 3,235 Canadian students and Megdal and Schernhammer (2007) used 585 students in a Los Angles high school just to give a few examples. These were all studies relying solely on self-report.

The Cronbach's alpha's of the ESS and PedMIDAS were low (.570 and .438). This likely occurred because a majority of the adolescents answered that the had no problems with sleep, depression or headache and scored primarily zero on the instruments. Another possible reason is that the Epworth Sleepiness Scale has only eight items and the PedMIDAS has only six items. Pallant (2007) has noted that ten or less items on an instrument can decrease the reliability. Other researchers have noted problems with response bias with adolescents (Griesler, Kandel, Schaffran, Hu, & Davies, 2008; Rosenbaum, 2009). Adolescents may not report their behavior accurately. Adolescents are influenced by concerns about privacy of information, in spite of researchers explanations about confidentiality and adolescents may have a selective memory for various behaviors. After comparison with other studies and reexamination of statistics from the development of the scales, this researcher questions either response bias within the sample or whether the sample truly represents a large number of adolescents without sleep deficit, depression, and/or headache.

Relationships of the Theoretical Variables

Hypothesis 1

Hypothesis 1 proposed that there would be no significant relationship, uniquely and as a linear composite, between the predictor variables of sleep deficit and depression and the outcome criterion of headache among adolescents between the ages of 16 and 18.

The result of the statistical analysis did support this hypothesis. After submitting both sleep deficit and depression into the multiple regression model, neither were related to headache. In addition, there was no correlation found between sleep deficit and depression. Many of the individuals denied either symptom which skewed the statistical tests toward a value of zero. As students who had answered yes to seeing a neurologist were excluded from the original data this researcher tried adding them back into a data set and found this also did not change the results. Perhaps the students with known headaches are the individuals whose sleep habits need to be explored.

This was the first study to examine the relationship between the three variables but other studies have looked at sleep deficit and depression as well as sleep deficit and headache. Owens et al (2010) recently looked at mood and sleep in a high school where the school start time has been pushed back and significant improvement in mood was found with increased sleep. Roberts, Roberts, and Duong (2008) found that chronic insomnia increased risk for somatic health problems, interpersonal problems, psychological problems, and problems in completing daily activities. Another study in Holland (ter Wolbeek, et al., 2006), found increased fatigue correlated positively with severity of depression and anxiety. In this Dutch study the Beck Depression Inventory was used. The relation between fatigue and depression, anxiety, and chronic fatigue syndrome-related symptoms emerged as a cluster. Thus it was anticipated that this study would reveal a relationship between sleep and depression, but it did not.

Bruni, Russo, Ferri, Novelli, Galli, and Guidetti (2007) studied 1,073 adolescents in Rome. The most frequent triggering factor for headaches was poor sleep (32.2%) followed by emotional disorders (27.8%). Another study in Istanbul, sent questionnaires

home to 2,746 parents and found a high prevalence for sleep disorders with children who have migraines (Isik, et al., 2007). A significant study by Boardman, Thomas, Millson, and Croft (2005) investigated the association of headache, with psychological, sleep and lifestyle characteristics, and comorbid conditions in adults. Headache occurrence was associated with anxiety and sleep problems and the strength of the association increased with higher levels of anxiety and sleep problems. A study with young children ages 2 to 12 years showed children with migraine headaches have a high prevalence of sleep disturbances. (Miller, et al., 2003). Thus it was anticipated that some correlation would be found between sleep and headaches. The current study did not support this relationship.

Hypothesis 2

Hypothesis 2 posited that there will be no significant differences in the mean scores for symptom cluster (composite score for sleep deficit, depression, and headache) between the three ethnic groups of adolescents between the ages of 16 and 18 representing African-Americans, Caucasians, and Hispanics. The statistical analysis showed that there was no effect of ethnicity in regard to sleep deficit, depression, or headache in adolescents. No previous studies were found that explored ethnicity to sleep deficit, depression and headache in adolescents as a composite.

This hypothesis was proposed for this study based on documented findings in the literature review that sleep duration deferred between Black and White Americans (Nunes, et al., 2008). Also racial and ethnic differences had been found in cortisol diurnal rhythms in adolescents (DeSantis, et al., 2007). A study of people in California, ages 16 to 94 years concluded that short sleep duration is more common among those

with lower income and education levels, and among minority race/ethnic groups (Stamatakis, et al., 2007). This researcher intended to examine if this was also the case for high school students, particularly in an ethnically and racial diverse population like Miami. However, the current study did not support these findings.

Significance of the Study

The findings from this study suggest that sleep deficit and/or depression are not likely determinants of headache in adolescents. The findings also indicate that ethnicity is not a predictor for sleep deficit, depression, or headache. However, these findings do not suggest that sleep deficit, depression or headaches in adolescents are not important health or wellness indicators. Continued research is needed to know more about adolescent health. The findings of this study leave room for more questions in the areas of nursing education, clinical practice, research, and public policy.

Nursing Education

Without a doubt, sleep is a major determinant of health and needs to become a standard part of the nursing curriculum. Depression and headache particularly in adolescents are known to exist and continue to be explored. Teaching the physiological importance of sleep, assessment of sleep problems, and increasing nurses' knowledge of treatments for sleep, depression, and headache problems and their effect on health and well-being are important. What this study contributes to education is knowledge that in this particular sample a correlation for these three problems could not be describe, but that does not detract from the singular importance of each symptom to health education.

Nursing Practice

The application of the ESS, BDI-II, and PedMIDAS demonstrated the short amount of time it takes to use each tool and that they can be used in nursing practice to assess each of these symptoms. Goolsby (2006) found that nurses do not assess sleep as part of their routine history in spite of its importance to health. The US Preventive Services Task Force (USPSTF) suggests adolescents be screened for depression at every visit (Williams, et al., 2009). Nurses need to become familiar with each of these tools for the adolescent population. Nurses also know from this study that ethnicity as a singular variable is not a predictor of sleep deficit, depression, or headache. Nurses must work to use culturally sensitive care that does not make unfounded assumptions about any ethnic group.

Nursing Research

The disciplines of psychology, biology, and medicine have provided the majority of studies in sleep science up to this time. A search of CINAHL (October, 2010) revealed less than 20 articles related to sleep and adolescents. The National Institute of health (NIH) and the U.S. Department of Health and Human Services issued the National Sleep Disorders Research Plan in 2003 (National Institute of Health, 2003) identifying areas of need for sleep research. Research regarding adolescents was an area identified as needing more research. This research contributes to the body of nursing evidence about sleep and adolescents.

In addition, depression has been recognized through psychological studies, but this is the first known nursing study to examine the relationship between sleep and depression in adolescents. Several studies (Buckhalt, et al., 2007; S. S. Gau, et al., 2007;

Johnson, et al., 2006; Takahashi, et al., 2000) determined there is a causal relationship between depression and sleep, but this study did not confirm those results.

Studies on headaches in adolescents found a strong relationship between depression and headaches (Breslau & Davis, 1993; Sheftell & Bigal, 2004). These and other studies were done with populations of known headache sufferers (Bursztein, et al., 2006; Choquet & Menke, 1987; Rains & Poceta, 2005). The studies did not examine a community population of high school students. Our community population did not confirm the previous findings.

Finally, no studies are known that examine sleep deficit and ethnicity in high school students. Studies on children and adults do indicate some relationships between minority groups and complaints of insomnia and hypersomnia (Dailey, 2005; R. E. Roberts, Roberts, & Chen, 2000; Sanford, et al., 2006; Spilsbury, et al., 2004). Two studies showed a relationship between depression and sleep deficit in African Americans (Hale & Do, 2007; Sanford, et al., 2006; Steffen & Bowden, 2006). This research did not confirm these findings and continues to leave a question as to the need for more research that may confirm or exclude these symptoms in health school students. Many of the studies on sleep and depression involving minors have been done by surveying the parents (M. M. Ohayon, Carskadon, Guilleminault, & Vitiello, 2004; Wolfson & Carskadon, 1998). A qualitative study examining sleep disturbances through the voice of both the high school student and the parents may also contribute more information.

Health Policy

In performing this study, principles, teachers, and students have all eagerly asked for the data to be shared with them. They are interested to know if this data would

support changes to start times for high schools in Miami. Schools in Minneapolis have already instituted changes with later start times and serve as a model for other communities (Wahlstrom, 2002). Schools in Rhode Island have now followed this model (Owens, et al., 2010) and found benefit in later start times for their high schools. Longitudinal data of the changes in both states showed statistically significant improvements in graduation rates, rates for continuous enrollment, decreased tardiness, and improved attendance. The results of this study did not support a need for changes in school start times in Miami.

Strengths and Limitations of the Study

Strengths

This study examined adolescent sleep deficit as it occurs in South Florida adolescents in local high schools. Of interest is that the study examined primarily Hispanic teens. Most studies previously published sampled white, non-Hispanic teens. This study also included African-American adolescents. The findings regarding sleep deficit varied from other studies done in Minnesota, Los Angles, Rhode Island, as well as outside of the United States(Eaton, et al., 2010; Gibson, et al., 2006; Liu, et al., 2000; Megdal & Schernhammer, 2007; Owens, et al., 2010). Finding new results can be valuable in that it brings into question whether Hispanic adolescents may vary from other populations. If South Florida Hispanic adolescents do not suffer from sleep deficit, understanding how these adolescents meet their sleep requirements may help other adolescent high school students in the future.

The framework of the Theory of Unpleasant Symptoms and the concept of symptom clusters are still relatively new. This research demonstrated the application of a

nursing model for examining symptom clusters which are often referred to under the medical model as syndromes. Repeated use of the TOUS as exemplars may encourage other nurse researchers to see the value of clinical research, particularly in family practice.

As a researcher focusing on high school students, much was learned about sampling minors in a high school population. Researchers may be discouraged from engaging in research on adolescents because gaining access to this population can be very difficult. This study, serving as a model to demonstrate the steps involved in adolescent research may encourage more nursing research on this age group. Once the bureaucratic hurdles were overcome, the sampling went quickly and a larger than anticipated sample was collected. This was helpful when statistical tests did not yield anticipated results, as sample size was not a limitation.

Limitations

Findings did not support the premise that sleep deficit would show a relationship with depression or headaches. In addition, ethnic groups in particular, Hispanics were not shown to predict sleep deficit, depression or headaches. This section will explore possible reasons that may have contributed to these findings, while the findings must be acknowledged as their own independent results.

First, limitations may lie in the design of the investigation and therefore may involve internal validity. The study design was to use a convenience sample that was not randomized from a population of high school students. Because these groups came from similar age groups and were all high school students, a bias that was not uncovered may have occurred in the population. Without randomization, causation is limited. Although

demographic data was collected, other influences on this population were not known at the time of the study and may have influenced the findings. The majority of the populations answered negatively to questions about the three symptoms. This could mean that the symptoms do not appear predominantly in this sample or that cultural or social factors influenced the teens' answers. The internal validity calls into question whether the lack of sleep deficit was the reason for the lack of depression and headaches in the group or the ethnic background influenced the questions. Either way, there was no correlation between symptoms within the samples. Selection bias may have occurred because individuals were not assigned randomly and there was no control group. Perhaps those with detectable symptoms choose not to participate. Polit states, "Selection bias is one of the most problematic and frequently encountered threats to the internal validity of studies not using an experimental design " (2004, p. 214). Beyond this problem no other threats to internal validity, such as maturation, testing, or mortality, were identified as this study used one time sampling for all data collection.

The next area to consider is external validity. As the findings were the opposite of what the researcher expected to find, it is difficult to cite expectancy as having an effect on the population. In addition the group was only sampled at one point in time. Therefore interaction, experimenter or novelty effects are difficult to indentify. Students were given the same information to take home to parents for consent, and assent forms were given to students immediately before administration of the research instrument. At that point students did not have an opportunity to discuss the study with their peers. In addition, samples came from different schools in different areas of the town and were unlikely to know each other. One school was a small private Christian school and the

other was a large public high school (the largest public school in Florida). More likely characteristics of the population were inherent and findings reflect the adolescents' true health.

In regards to statistical procedures, some problems were be identified. The number of cases used met requirements for the power analysis. The study was designed to test hypothesis one with multiple regression. The characteristics for multiple regression were met: two or more continuous independent variables and one continuous dependent variable, however the statistics did not meet requirements for parametric testing (Pallant, 2007). Transformation of the dependent variable of headache in hypothesis 1 had no impact on results. One-way between groups ANOVA was used for hypothesis 2 thereby meeting the assumption for one categorical independent variable (three or more levels) and one continuous dependent variable, however again parametric sample was not achieved. (Pallant, 2007).

Recommendations for Future Studies

This researcher believes that the study of sleep needs of adolescents in various ethnic populations will continue to be a rich area for continued inquiry. Based on comparisons of the literature to findings in this study use of the longer sleep habits survey, which includes the Epworth Sleepiness Scale, may enrich future studies in nursing and provide a broader picture of sleep habits and sleepiness. Other characteristics of sleep deficit in adolescents need future exploration. For instance no difference was seen for participants who take college preparatory programs (AP or IB classes) versus those in regular classes although students often complain of staying up late to complete assignments in the college prep courses. Perhaps sleep logs or sleep

diaries which are often used in other studies, would show if differences exist in sleep times.

Additional questions arose from the descriptive data. Although there was no significant difference in sleep, depression, or headaches between those who engaged in after school activities, perhaps sleep diary studies may show differences. In addition, logs from parents on their children's sleep patterns may reflect varying results from the adolescents self perceptions. More study is needed as to physical changes of puberty on sleep schedules, especially menstrual patterns in girls. Of note, the descriptive data did show more headaches in the girls than the boys and this may be associated with menstruation. Another difference that may be more significant than ethnicity may be socioeconomic levels of families. An interesting finding in the descriptive data was that increased use of caffeine was associated with increased sleep deficit. A scale that assessed more information on sleep and more increments and habits of caffeine use may reveal how adolescents compensate for sleep deficit. Finally a qualitative study to find out how adolescents attempt to compensate for sleep deficit may provide richer information. The number of unanswered questions about sleep and adolescents continues to grow.

Conclusion

This non-experimental, retrospective survey study tested the relationships among variables grounded in the theory of unpleasant symptoms (sleep deficit, depression, and headache) in adolescents. The study also examined the affect of ethnicity on the three variables of sleep deficit, depression, and headache in this age group. Additional variables of gender, hours in a work experience, extracurricular activities, school

curriculum, and caffeine intake were described. The convenience sample consisted of 157 adolescents in local Miami-Dade high schools who were ages 16 years to 18 years. Two hypothesis were tested using first multiple regression analysis and then analysis of variance. The findings of this study were discussed, limitations of the study highlighted, and suggestions for future researched presented. This research contributes to nursing knowledge about sleep deficit, depression, and headaches in a diverse population of adolescents in South Florida.

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APPENDIX A

BARRY IRB DOCUMENTS

BARRY UNIVERSITY

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INSTITUTIONAL REVIEW BOARD

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Research with Human Subjects
Protocol Review

Date:	May 10, 2010
Protocol Number:	100320
Title:	A multi-ethnic view on the Symptoms of Sleep Deficit, Depression and Headache in Adolescents
Name:	Ms. Pamela Wessling
Address:	11300 NE 2nd Ave. Wiegand 103 Miami Shores, FL 33161
Sponsor:	Dr. Andra Hanlon
School:	Division of Nursing

Dear Ms. Wessling:

On behalf of the Barry University Institutional Review Board (IRB), I have verified that the specific changes requested by the IRB have been made. Therefore, I have granted final approval for this study as exempt from further review. Enclosed is the Consent Cover letter with the IRB stamp. Please use this letter when collecting your data.

As principal investigator of this protocol, it is your responsibility to make sure that this study is conducted as approved by the IRB. Any modifications to the protocol or consent form, initiated by you or by the sponsor, will require prior approval, which you may request by completing a protocol modification form.

It is a condition of this approval that you report promptly to the IRB any serious, unanticipated adverse events experienced by participants in the course of this research, whether or not they are directly related to the study protocol. These adverse events include, but may not be limited to, any experience that is fatal or immediately life-threatening, is permanently disabling, requires (or prolongs) inpatient hospitalization, or is a congenital anomaly cancer or overdose.

The approval granted expires on March 22, 2011. Should you wish to maintain this protocol in an active status beyond that date, you will need to provide the IRB with and IRB Application for Continuing Review (Progress Report) summarizing study results to date.

If you have questions about these procedures, or need any additional assistance from the IRB, please call the IRB point of contact, Mrs. Barbara Cook at (305)899-3020 or send an e-mail to dparkhurst@mail.barry.edu . Finally, please review your professional liability insurance to make sure your coverage includes the activities in this study.

Sincerely,

Doreen C. Parkhurst

Doreen C. Parkhurst, M.D., FACEP
Chair Institutional Review Board
Associate Dean, SGMS &
Program Director, PA Program
Barry University
Box SGMS
11300 NE 2nd Avenue
Miami Shores, FL 33161

Enc: Cover Letter

cc: Dr. Andra Hanlon

Note: The investigator will be solely responsible and strictly accountable for any deviation from or failure to follow the research protocol as approved and will hold Barry University harmless from all claims against it arising from said deviation or failure.

APPENDIX C

CONSENT, COVER LETTER, AND ASSENT FORMS

Dear Parent/Guardian:

My name is Pam Wessling, and I am a doctoral student from the Division of Nursing at Barry University. I am conducting a study on the relationship between sleep deficit, depression, and headache in adolescents 16 to 18 years of age. I am asking for your assistance to learn more about these symptoms, so that healthcare providers may be better able to care for teenagers. If you give permission for your child to participate in this research project he/she will be asked to answer a questionnaire which will take approximately 20 minutes or less.

Attached to this letter is a consent form. The attached consent form gives your permission as a parent/guardian for your child to participate in this research project on May 17, 2010. **If you would like your child to participate, please sign and date the form, returning it in the envelope provided. PLEASE HAVE YOUR CHILD RETURN THE ENVELOPE TO SCHOOL AND GIVE TO THEIR TEACHER.** If you do not wish your child to participate there is nothing you need to do or return. All participation is voluntary and even if you give your consent your child is not required to participate. If your child does not participate an alternate exercise will be provided by me during the time that other children are completing the questionnaire. Children will not miss school lessons for this study. Please be aware that:

- Participation is voluntary: you and your child can end participation at any point.
- Risks to participating children are minimal, and only require completion of an anonymous questionnaire.
- Information collected is presented in any reports, presentations, or publication as grouped data and will be anonymous.

I want to thank you for taking the time to read and think about this letter.

If you have any questions about this letter or the research project in general, please feel free to call me at (305) 899-3812 or email at pwessling@mail.barry.edu. I am happy to answer any of your questions.

Yours truly,

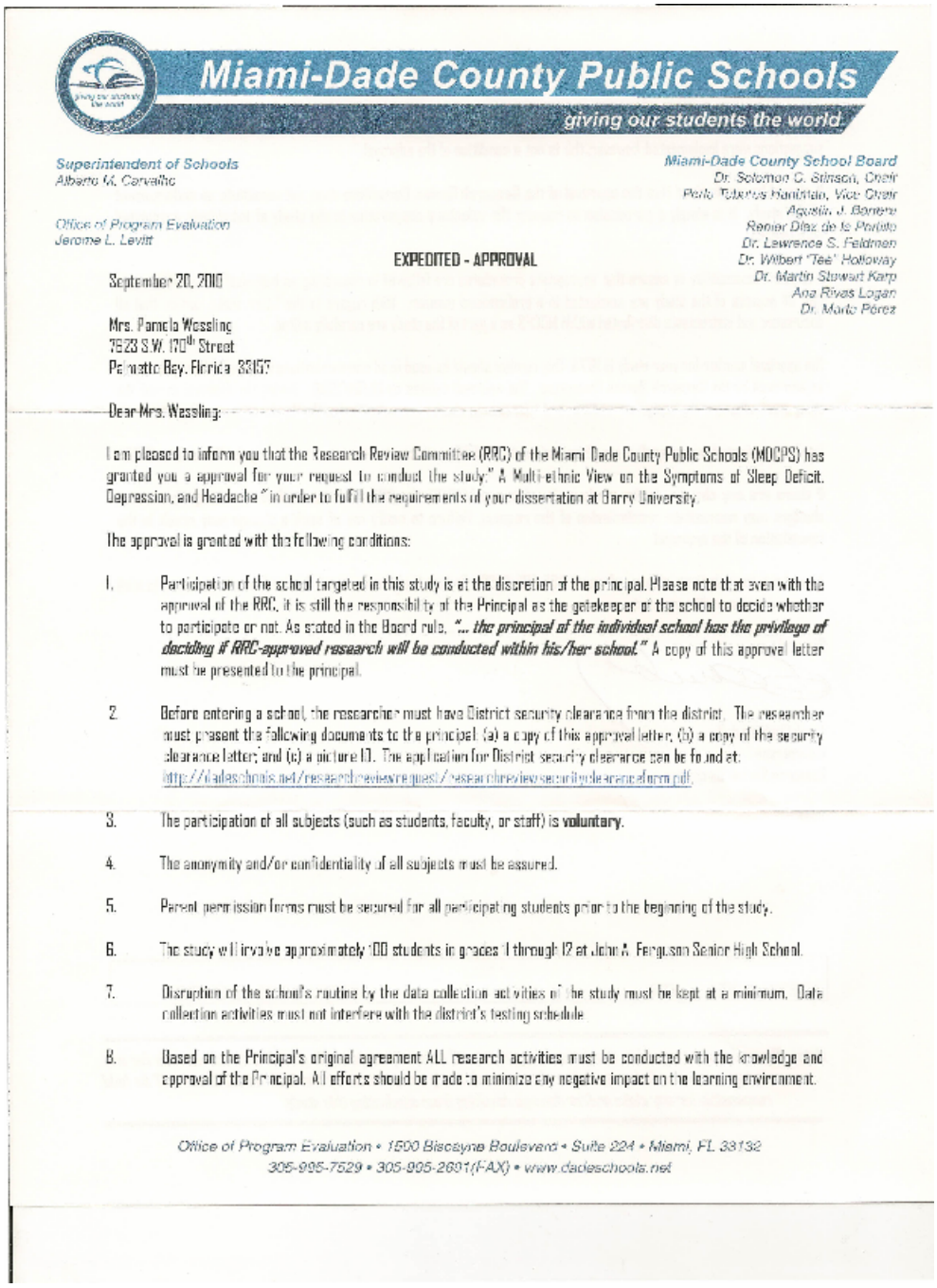
Pamela Wessling

Pam Wessling, MSN, Family Nurse Practitioner

Doctoral Student, Barry University

APPENDIX B

LETTERS OF SUPPORT FROM SCHOOLS



Miami-Dade County Public Schools

giving our students the world

EXPEDITED - APPROVAL

September 20, 2010

Mrs. Pamela Wessling
7923 S.W. 170th Street
Palmetto Bay, Florida 33157

Dear Mrs. Wessling:

I am pleased to inform you that the Research Review Committee (RRC) of the Miami Dade County Public Schools (MDCPS) has granted you approval for your request to conduct the study," A Multi-ethnic View on the Symptoms of Sleep Deficit, Depression, and Headache " in order to fulfill the requirements of your dissertation at Barry University.

The approval is granted with the following conditions:

1. Participation of the school targeted in this study is at the discretion of the principal. Please note that even with the approval of the RRC, it is still the responsibility of the Principal as the gatekeeper of the school to decide whether to participate or not. As stated in the Board rule, ***"... the principal of the individual school has the privilege of deciding if RRC-approved research will be conducted within his/her school."*** A copy of this approval letter must be presented to the principal.

2. Before entering a school, the researcher must have District security clearance from the district. The researcher must present the following documents to the principal: (a) a copy of this approval letter, (b) a copy of the security clearance letter; and (c) a picture ID. The application for District security clearance can be found at: http://dadeschools.net/researchreviewrequest/researchreviewsecurityclearanceform.pdf.

3. The participation of all subjects (such as students, faculty, or staff) is **voluntary**.

4. The anonymity and/or confidentiality of all subjects must be assured.

5. Parent permission forms must be secured for all participating students prior to the beginning of the study.

6. The study will involve approximately 100 students in grades 11 through 12 at John A. Ferguson Senior High School.

7. Disruption of the school's routine by the data collection activities of the study must be kept at a minimum. Data collection activities must not interfere with the district's testing schedule.

8. Based on the Principal's original agreement ALL research activities must be conducted with the knowledge and approval of the Principal. All efforts should be made to minimize any negative impact on the learning environment.

Beyond the conditions for approval, the Research Review Committee thinks that the study would be improved, if these suggestions were implemented; however, this is **not a condition** of the approval.

It should be emphasized that the approval of the Research Review Committee does not constitute an endorsement of the study. It is simply a permission to request the voluntary cooperation in the study of individuals associated with MDCPS.

It is your responsibility to ensure that appropriate procedures are followed in requesting an individual's cooperation, and that all aspects of the study are conducted in a professional manner. With regard to the latter, make certain that all documents and instruments distributed within MDCPS as a part of the study are carefully edited.

The approval number for your study is **1674**. This number should be used in all communications to clearly identify the study as approved by the Research Review Committee. The approval expires on **12/31/2010**. During the approval period, the study must adhere to the exact procedures and instruments which were submitted to the Research Review Committee.

Finally, as indicated in your application, please submit to the RRC an abstract of the research findings by **December, 2010.**

If there are any changes in the study as it relates to MDCPS, the RRC must be notified in writing. Substantial changes may necessitate resubmission of the request. Failure to notify me of such a change may result in the cancellation of the approval.

If you have any questions, please call me at 305-995-7529. On behalf of the Research Review Committee, I want to wish you every success with your study.

Sincerely,

James L. Rabbi, Ed. D.
Chairperson
Research Review Committee

TR: df

APPROVAL NUMBER: 1674	APPROVAL EXPIRES: 12/31/2010

Note: The researcher named in this letter of approval will be solely responsible and strictly accountable for any deviation from or failure to follow the research study as approved by the RRC. M-DCPS will NOT be held responsible for any claim and/or damage resulting from conducting this study.

LETTERS OF SUPPORT FROM SCHOOLS

To Whom It May Concern:

I am writing this letter in support of the dissertation research of Pamela Wessling and acknowledges that she will be conducting a survey with our high school students in fall 2010. Her questionnaire on the relationship of sleep deficit, headache, and depression in adolescents within a diverse population will survey our students to gain insight into their health needs. I understand that a research questionnaire containing 43 items will be used to elicit confidential information from the students whose parents have given consent and student assent/consent to participate. Pamela Wessling has assured me that she will evaluate the information collected and later provide the school with aggregate data about her findings.

I understand that the data collection will occur during regularly scheduled class times. Pamela Wessling will distribute and collect all surveys. Teachers will be present to maintain the desired levels of student attention. In keeping with the school's policy, parents will be notified of the session and given an opportunity to opt out of the parent's consent form created by Mrs. Wessling. Those children whose parents prefer that they not complete the questionnaire will be given an alternative assignment during the data collection session.

My signature below indicates my support of the study and my consent for children at (school) to participate.

Joe Adams — Principal

9/3/10 — Date

John A. Ferguson Senior — School

305-408-2700 — Phone

APPENDIX B

LETTERS OF SUPPORT FROM SCHOOLS

To Whom It May Concern:

I am writing this letter in support of the dissertation research of Pamela Wessling and acknowledges that she will be conducting a survey with our high school students in spring 2010. Her questionnaire on the relationship of sleep deficit, headache, and depression in adolescents within a diverse population will survey our students to gain insight into their health needs. I understand that a research questionnaire containing 43 items will be used to elicit confidential information from the students whose parents have given consent and student assent/consent to participate. Pamela Wessling has assured me that she will evaluate the information collected and later provide the school with aggregate data about her findings.

I understand that the data collection will occur during regularly scheduled class times. Pamela Wessling will distribute and collect all surveys. Teachers will be present to maintain the desired levels of student attention. In keeping with the school's policy, parents will be notified of the session and given an opportunity to opt out of the parent's consent form created by Mrs. Wessling. Those children whose parents prefer that they not complete the questionnaire will be given an alternative assignment during the data collection session.

My signature below indicates my support of the study and my consent for children at (school) to participate.

Principal — 4-21-2010 Date

Westminster Christian School — 305-233-2030 Phone

School

APPENDIX C

CONSENT, COVER LETTER, AND ASSENT FORMS

Dear Parent/Guardian:

My name is Pam Wessling, and I am a doctoral student from the Division of Nursing at Barry University. I am conducting a study on the relationship between sleep deficit, depression, and headache in adolescents 16 to 18 years of age. I am asking for your assistance to learn more about these symptoms, so that healthcare providers may be better able to care for teenagers. If you give permission for your child to participate in this research project he/she will be asked to answer a questionnaire which will take approximately 20 minutes or less.

Attached to this letter is a consent form. The attached consent form gives your permission as a parent/guardian for your child to participate in this research project on May 17, 2010. **If you would like your child to participate, please sign and date the form, returning it in the envelope provided. PLEASE HAVE YOUR CHILD RETURN THE ENVELOPE TO SCHOOL AND GIVE TO THEIR TEACHER.** If you do not wish your child to participate there is nothing you need to do or return. All participation is voluntary and even if you give your consent your child is not required to participate. If your child does not participate an alternate exercise will be provided by me during the time that other children are completing the questionnaire. Children will not miss school lessons for this study. Please be aware that:

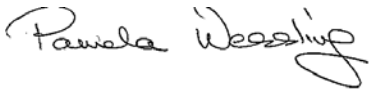
- Participation is voluntary: you and your child can end participation at any point.
- Risks to participating children are minimal, and only require completion of an anonymous questionnaire.

- Information collected is presented in any reports, presentations, or publication as grouped data and will be anonymous.

I want to thank you for taking the time to read and think about this letter.

If you have any questions about this letter or the research project in general, please feel free to call me at (305) 899-3812 or email at pwessling@mail.barry.edu. I am happy to answer any of your questions.

Yours truly,



Pam Wessling, MSN, Family Nurse Practitioner

Doctoral Student, Barry University

Barry University
Parental Informed Consent Form

Your child's participation in a research project is requested. The title of the study is A Multi-Ethnic View on the Symptoms of Sleep Deficit, Depression and Headache in Adolescents. The research is being conducted by Pamela Wessling, a doctoral student in the Division of Nursing of Barry University, and is seeking information that will be useful in the field of adolescent health. The aim of the research is explore the possible associations between sleep deficit, headaches, and depression in adolescents and how this may occur in varying ethnic populations. The research is in need of adolescents between the ages of 16 and 18. Only those children who return a signed and dated consent form will be selected. We anticipate the number of participants to be 155.

If you decide to allow your adolescent to participate in this research, he/she will be asked to complete a 43 item questionnaire on lack of sleep, depression and headaches which will take the adolescent about 20 minutes to complete. A written anonymous questionnaire will be distributed to the participating students during one of your adolescent's classes. Adolescents who do not wish to participate will be given an alternative activity developed by Mrs. Wessling. Adolescent students will not miss an assignments or school lessons while participating in this study.

The consent to be a research participant is strictly voluntary and should you decline to allow your child to participate or should your child choose to drop out at any time during the study, there will be no adverse effects on you or your child.

The risks of involvement in this study are minimal and the risks in the study are not greater than those encountered in daily life. However, since some of the questions do

address depression and suicide, all students will be provided with an information sheet on how to contact mental health support services available to them such as their school counselor and crisis intervention hotlines. Although there are no direct benefits to your adolescent, his/her participation in this study may help our understanding of sleep deficit, headaches, and depression in this age group.

As a research participant, the information that your child provides will be anonymous. Any published results of the research will refer to group averages only and no names will be used in the study. Data will be kept in a locked file in the researcher's office. Your signed consent will be kept separate from the data. All data will be destroyed after 5 years.

If you have any questions or concerns regarding the study or your child's participation in the study, you may contact me, Pamela Wessling, or my advisor, Dr. Andra Hanlon at (305)899-3812 or the Institutional Review Board point of contact, Barbara Cook, at (305)899-3020. If you are satisfied with the information provided and are willing to allow participation in this research, please sign this form.

Voluntary Consent

I acknowledge that I have been informed of the nature and purposes of this experiment by Pamela Wessling and that I have read and understand the information presented above, and that I have received a copy of this form for my record.

I give my voluntary consent to allow my child to participate in this experiment.

_____	_____
Name of Adolescent	Date
_____	_____
Signature of Parent	Date
Pamela Wessling _____	_____
Signature of Researcher	Date

Addendum to Consent/Ascent

If you have any feelings of sadness, depression or thoughts about suicide here are some numbers you can call for help:

- Your school counselors
  Mr. Wm. Kirtland
  High School College and Career Counselor
  305-233-3010 ext. 1242
  wkirtland@wcsmiami.org

- Florida Suicide Hotlines
  - 1-800-SUICIDE
    1-800-784-2433
  - 1-800-273-TALK
    1-800-273-8255

    Toll-Free Nationwide USA
    24 hours/7 days a week

- Switchboard of Miami
  211 Children's Trust Helpline
  Call 211
  TTY: (305) 644-9449
  http://www.switchboardmiami.org/

- The Counseling Ministry of South Florida, Inc.

  305-531-0723

  http://www.counselingsflorida.org/index.htm

Barry University

ASSENT FORM (AGES 16-17)

Your participation in a research project is requested. The title of the study is A Multi-Ethnic View on the Symptoms of Sleep Deficit, Depression and Headache in Adolescents. The research is being conducted by Pamela Wessling, a doctoral student in the Division of Nursing of Barry University, and who is seeking information that will be useful in the care of teens. The aim of the research is explore lack of sleep, headaches, and depression in teenagers ages 16 to 18. You will be asked to fill out an anonymous questionnaire which will take approximately 20 minutes to complete.

The consent to participate in this research is strictly voluntary and if you choose not to do it or want to drop out at any time during the study, there will be no unfavorable effects on you. Study participants will not miss any school class time. Those who are not participating will be given an alternate activity to complete.

The risks of involvement in this study are minimal and are not greater than those encountered in daily life. However, since some of the questions do address depression and suicide, all students will be provided with an information sheet on how to contact mental health support services available to you such as your school counselor and crisis intervention hotlines. Although there are no direct benefits to you, your participation in this study may help our understanding of sleep deficit, headaches, and depression in this age group.

Any information you provide will be anonymous. If results of the research are published, it will refer to group averages only and no names will be used in the study.

Data will be kept in a locked file in the researcher's office. Your signed assent will be kept separate from the data. All data will be destroyed after 5 years.

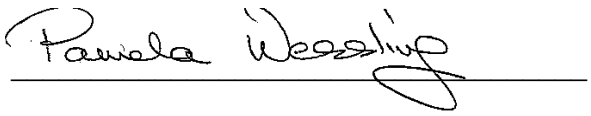
If you have any questions or concerns regarding the study, you may call me, Pamela Wessling at 305-899-3812, or my advisor, Dr. Andra Hanlon at 305-899-3811 or the Institutional Review Board point of contact, Barbara Cook at 305-899- 3020. If you are satisfied with the information provided and are willing to be a part of this research, please consent by signing this assent form.

Voluntary Consent

I acknowledge that I have been informed of the nature and purposes of this experiment by Pamela Wessling. I have read and understand the information presented above. I have received a copy of this form.

____ I am willing to be a part of the research study.

____ I am not willing to be a part of the research study.



_____ _____

Signature of Researcher *Date*

_____ _____

Signature of Adolescent *Date*

Barry University

INFORMED CONSENT FORM (AGE 18)

Your participation in a research project is requested. The title of the study is A Multi-Ethnic View on the Symptoms of Sleep Deficit, Depression and Headache in Adolescents. The research is being conducted by Pamela Wessling, a doctoral student in the Division of Nursing of Barry University, who is seeking information that will be useful in the care of teens. The aim of the research is explore lack of sleep, headaches, and depression in teenagers ages 16 to 18. You will be asked to fill out an anonymous written 43 item questionnaire during one of your classes which will take approximately 20 minutes to complete.

The consent to participate in this research is strictly voluntary and if you choose not to do it or want to drop out at any time during the study, there will be no unfavorable effects on you. Study participants will not miss any school class time. Those who are not participating will be given an alternate activity to complete.

The risks of involvement in this study are minimal and are not greater than those encountered in daily life. However, since some of the questions do address depression and suicide, all students will be provided with an information sheet on how to contact mental health support services available to you such as your school counselor and crisis intervention hotlines. Although there are no direct benefits to you, your participation in this study may help our understanding of sleep deficit, headaches, and depression in this age group.

Any information you provide will be anonymous. If results of the research are published, it will refer to group averages only and no names will be used in the study. Data will be kept in a locked file in the researcher's office. Your signed consent will be kept separate from the data. All data will be destroyed after 5 years.

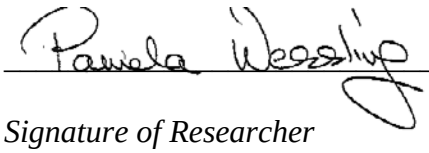
If you have any questions or concerns regarding the study, you may call me, Pamela Wessling at 305-899-3812, or my advisor, Dr. Andra Hanlon at 305-899-3811 or the Institutional Review Board point of contact, Barbara Cook at 305-899- 3020. If you are satisfied with the information provided and are willing to be a part of this research, please consent by signing this form.

Voluntary Consent

I acknowledge that I have been informed of the nature and purposes of this experiment by Pamela Wessling. I have read and understand the information presented above**.** I have received a copy of this form.

____ I am willing to be a part of the research study.

____ I am not willing to be a part of the research study.



_____ _____

Signature of Researcher *Date*

_____ _____

Signature of Adolescent *Date*

Addendum to Consent/Ascent

If you have any feelings of sadness, depression or thoughts about suicide here are some numbers you can call for help:

- Your school counselors
  Mr. Wm. Kirtland
  High School College and Career Counselor
  305-233-3010 ext. 1242
  wkirtland@wcsmiami.org

- Florida Suicide Hotlines
  - 1-800-SUICIDE
    1-800-784-2433
  - 1-800-273-TALK
    1-800-273-8255

    Toll-Free Nationwide USA
    24 hours/7 days a week

- Switchboard of Miami
  211 Children's Trust Helpline
  Call 211
  TTY: (305) 644-9449
  http://www.switchboardmiami.org/

- The Counseling Ministry of South Florida, Inc.

  305-531-0723

  http://www.counselingsflorida.org/index.htm

APPENDIX D

RESEARCH INSTRUMENTS

Confidential

Sleep Deficit and Associated Symptoms Survey

I am trying to gain a better understanding of teenagers' experiences of sleep deficit and other symptoms. Please help me by taking the time to answer this questionnaire. The results will be used to help healthcare workers understand sleep deficit better and provide information that may lead to improvements in the care of teenagers. Your answers are very important.

This questionnaire will take about 20 minutes to complete. There are 43 questions. All the information you provide will be kept confidential.

March 17, 2010

Pamela Wessling
Barry University

Section A – Demographic Information

Check the **single best** answer for each question.

1. Age:
   - □ 16 years
   - □ 17 years
   - □ 18 years

2. Have you ever seen a neurologist or a doctor who specializes in the care of people with headaches?
   - □ Yes
   - □ No

3. Have you ever had a sleep study in a sleep lab or hospital setting?
   - □ Yes
   - □ No

4. Gender:
   - □ Male
   - □ Female

5. Ethnicity:
   - □ Hispanic
   - □ African –American
   - □ White, non-Hispanic
   - □ Other

6. Do you have afterschool activities or a job?
   - □ Yes
   - □ No

7. Are you in any of the following academic school programs: Advanced Placement [AP], International Baccalaureate [IB], College classes at a local university or college?
   - □ Yes
   - □ No

8. Do you drink coffee, soda, or energy drinks every day?
   - □ Yes
   - □ No

Go on to Section B.

Section B – Sleep Information

How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired?
This refers to your usual way of life in recent times. Even if you have not done some of these things recently, try to work out how they would have affected you.
Check the box that most applies to your level of sleepiness:

Activity	would *never* doze	*slight* chance of dozing	*moderate* chance of dozing	*high* chance of dozing
1. Sitting and reading				
2. Watching TV				
3. Sitting inactive in a public place (classroom, movie theater, etc)				
4. As a passenger in a car for 1 hour without a break				
5. Lying down in the afternoon when circumstances permit				
6. Sitting and talking to someone				
7. Sitting quietly after lunch				
8. In a car, while stopped for a few minutes in traffic				

Go on to Section C - Additional Symptoms

Section C(a) – Additional Symptoms

Pick the **one statement** in each group that best describes the way you have been feeling during the **past two weeks, including today**. Circle the number beside the statement you have picked. If several statements in the group seem to apply equally well, circle the highest number for that group. Be sure that you do not choose more than one statement for any group.

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

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

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

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

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

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

7.

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

8.

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

9.

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

10.

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

11.

0. I am no more restless or wound up than usual.
1. I feel more restless or wound up than usual.
2. I am so restless or agitated that it's hard to stay still.
3. I am so restless or agitated that I have to keep moving or doing something.

12.

0. I have not lost interest in other people or activities.
1. I am less interested in other people or things than before.
2. I have lost most of my interest in other people or things.
3. It's hard to get interested in anything.

13.

0. I make decisions about as well as ever.
1. I find it more difficult to make decisions than usual.
2. I have much greater difficulty in making decisions than I used to.
3. I have trouble making any decisions.

14.

0. I do not feel I am worthless.
1. I don't consider myself as worthwhile and useful as I used to.
2. I feel more worthless as compared to other people.
3. I feel utterly worthless.

15.

0. I have as much energy as ever.
1. I have less energy than I used to have.
2. I don't have enough energy to do very much.
3. I don't have enough energy to do anything.

16.

0. I have not experienced any change in my sleeping pattern.
1a. I sleep somewhat more than usual.
1b. I sleep somewhat less than usual.
2a. I sleep a lot more than usual.
2b. I sleep a lot less than usual.
3a. I sleep most of the day.
3b. I wake up 1-2 hours early and can't get back to sleep.

17.

0. I am no more irritable than usual.
1. I am more irritable than usual.
2. I am much more irritable than usual.
3. I am irritable all the time.

18.

0. I have not experience any change in my appetite.
1a.My appetite is somewhat less than usual.
1b.My appetite is somewhat greater than usual.
2a.My appetite is much less than before.
2b.My appetite is much greater than usual.
3a. I have no appetite at all.
3b. I crave food all the time.

19.

0. I can concentrate as well as ever.
1. I can't concentrate as well as usual.
2. It's hard to keep my mind on anything for very long.
3. I find I can't concentrate on anything.

20.

0. I am no more tired or fatigued than usual.
1. I get more tired or fatigued more easily than usual.
2. I am too tired or fatigued to do a lot of the things I used to do.
3. I am too tired or fatigued to do most of the things I used to do.

21.

0. I have not noticed any recent change in my interest in sex.
1. I am less interested in sex than I used to be.
2. I am much less interested in sex now.
3. I have lost interest in sex completely.

Go on to Section C (b) – Additional Symptoms

Section C (b) – Additional Symptoms

The following questions try to assess how much headaches are affecting day-to-day activity. Your answers should be based on the **last three months**. Enter a **number** in the box to the right of each question. There are no "right" or "wrong" answers so please put down your best guess.

Questions	Answers
1. How many full school days of school were missed in the last 3 months due to headaches?	
2. How many partial days of school were missed in the last 3 months due to headaches (do not include full days counted in the previous question)?	
3. How many days in the last 3 months did you function at less than half your ability in school because of a headache (do not include days counted in the previous two questions)?	
4. How many days were you not able to do things at home (i.e. chores, homework, etc.) due to a headache?	
5. How many days did you not participate in other activities due to headaches (i.e. play, go out, sports, etc.)?	
6. How many days did you participate in these activities, but functioned at less than half your ability (do not include days counted in question 5.)?	

Thank you very much for your assistance with this study.

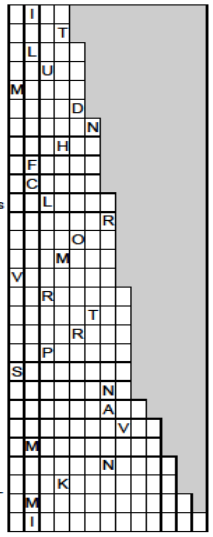
APPENDIX E

ALTERNATIVE ASSIGNMENT

2000s TELEVISION!

CLUE SEARCH PUZZLES.COM

Sex in the __ starred Sarah Jessica Parker and Kim Cattrall
__ features plane crash survivors on a mysterious island
Jennifer Garner starred as a high-tech spy in __
Each episode of 24 features one hour in the life of agent Jack __
CSI: Las Vegas, New York, and __
Malcom in the Middle starred Frankie Muniz as the __ child of five
__ Legal was a spinoff of The Practice that started in 2004
Neil Patrick Harris came back to TV on How I Met Your __
The __ with Steve Carell is based on the UK show of the same name
Medical sit-com with J.D. and other medical interns
Lauren Graham and Alexis Bledel play mother and daughter on __ Girls
That 70s Show once starred Topher Grace and Ashton __
Law and Order and its related shows are based in __ __
Everybody Hates Chris parodies Every Loves __
Buffy the __ Slayer had a cult-like following
Jason Bateman played the normal family member in __ Development
Stargate SG-1 ended in 2007 and led to spinoffs __ and Universe
Simpsons' creator Matt Groening also created __
HBO mobster series that ran for 86 episodes between 1999-2007
__: Borneo, Panama, Palau, Fiji, China, Guatemala, The Amazon…
Martin Sheen played the president on The __ __
Vince surrounds himself with friends "Drama," "E," Turtle and Ari on __
Desperate __ stars Teri Hatcher and Felicity Huffman and others
This show focuses on Superman's teenage years
Who wants to be a __? with Regis Philbin from 1999-2002
Teen shows like Drake and Josh and Zoey 101 have worked well for __
Simon, Randy, Paula, and a whole bunch of contestants
This animated series created by Mike Judge started in 1997



T	H	I	R	D	E	T	S	E	R	R	A	E	K	P
R	A	Y	M	O	N	D	K	R	E	O	L	I	S	T
J	V	A	M	P	I	R	E	N	F	L	N	B	L	I
S	M	W	L	T	O	U	T	F	I	G	W	O	E	N
U	H	L	S	Y	A	O	I	V	O	A	E	S	R	I
R	H	O	W	B	U	C	L	F	S	T	S	T	I	C
V	L	E	U	R	E	L	T	O	M	L	T	O	A	K
I	N	V	A	S	A	H	P	G	I	A	W	N	N	E
V	Y	G	A	M	E	R	I	C	A	N	I	D	O	L
O	E	T	S	H	A	W	M	O	M	T	N	A	I	O
R	C	I	I	N	N	D	I	O	I	I	G	L	L	D
G	S	L	O	C	T	T	R	V	T	S	H	I	L	E
O	L	S	G	I	L	M	O	R	E	H	N	A	I	O
K	A	M	A	R	U	T	U	F	G	S	E	S	M	N
S	C	R	U	B	S	K	U	T	C	H	E	R	I	D

Enter unused letters from puzzle, in order:

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _

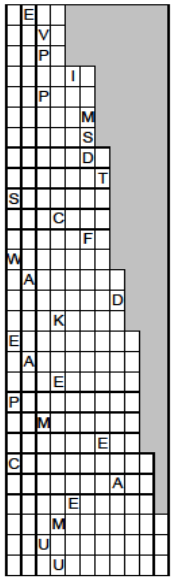
Copy boxed letters to form your hidden message:

Solve Hundreds of Clue Search Puzzles
Covering All Kinds of Topics for FREE!
No Membership or Email Required!
Visit us at www.ClueSearchPuzzles.com

TELEVISION! Part 1

CLUE SEARCH PUZZLES.com

"__ air" is when a blank or frozen image is being broadcast
A broadcast that is not previously recorded
__ delay allows live shows to be reserved for a time slot
Cable channels reserved for low-budget programming: __ access
When the show has been seen before, maybe recently
Short for "situational comedy"
Part of a newscast that features scores and game results
A single show in a series of the same title
__ replay allows review of a live event, especially sports
"This has been a public __ announcement of this station..."
A unique program that relates to a seasonal or current event
TV show featuring characters popularized in another TV show
Part of a newscast that tells you if you'll need an umbrella
Programming with contestants in a studio trying to win prizes
Everything that is not broadcast live is pre-__
Programming featuring a host and guests discussing current events
"This has been a test of the __ Broadcast System..."
Common name for talk shows that run after the 11:00pm news
When a scheduled show is replaced by another show
TV programming that runs between 8pm and 11pm
When a radio station and a TV station broadcast the same audio
Daytime dramas originally oriented toward housewives
The FCC is the Federal Communications __
The prerecorded audience response used on some sitcoms
The cable programs most in demand are offered on __-__-__
The part of the broadcast that pays for the rest
Common term for a sedentary, frequent TV viewer
Nonfiction TV show telling the story of an actual event or person



K	G	S	I	N	S	T	A	N	T	R	S	T	L	T
L	A	I	C	E	P	S	W	E	A	T	H	E	R	A
U	D	M	O	P	I	E	B	D	R	G	T	Y	E	E
K	W	U	U	I	N	O	Q	O	I	E	R	N	W	P
C	T	L	C	S	O	R	P	N	C	A	O	O	O	E
A	E	C	H	O	F	S	E	I	T	I	H	Y	H	R
R	M	A	P	D	F	T	V	N	S	S	C	D	S	P
T	I	S	O	E	A	R	E	S	K	N	I	E	E	R
H	T	T	T	L	E	M	I	L	E	H	L	A	M	E
G	E	P	A	S	U	M	A	G	T	L	B	D	A	E
U	M	E	T	C	M	T	R	T	I	A	U	M	G	M
A	I	U	O	O	W	E	I	V	R	E	P	Y	A	P
L	R	D	C	W	M	R	E	C	O	R	D	E	D	T
B	P	L	E	E	A	R	E	P	O	P	A	O	S	E
S	I	T	C	O	M	M	E	R	C	I	A	L	S	D

Enter unused letters from puzzle, in order:

_□_□□_□_□

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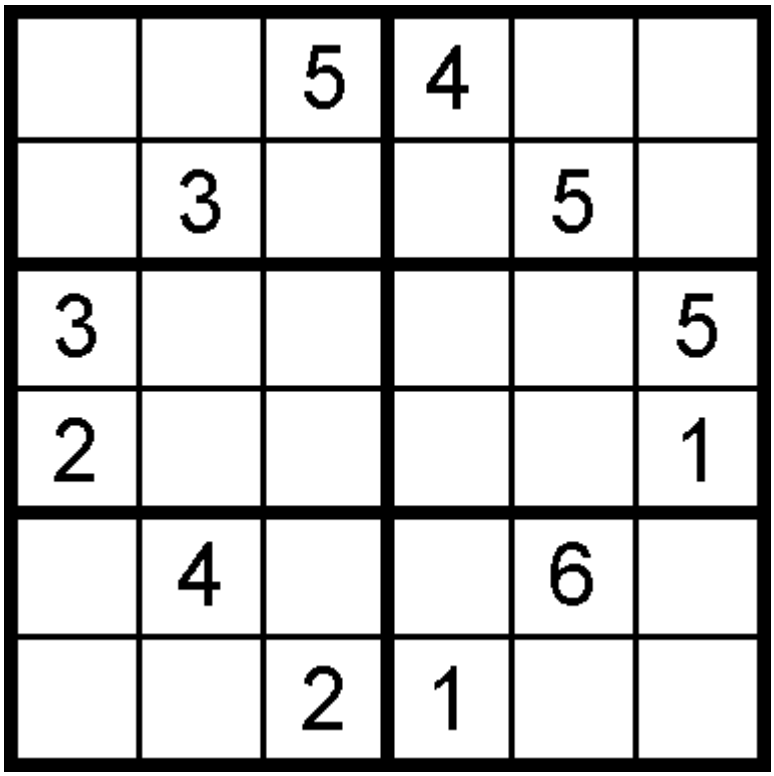
SODUKO PUZZLE

Place a digit from 1 to 6 in each empty cell so every row, every column, and every 2x3 box contains all the digits 1 to 6.



KE001-Solution

6	2	5	4	1	3
4	3	1	2	5	6
3	1	4	6	2	5
2	5	6	3	4	1
1	4	3	5	6	2
5	6	2	1	3	4

VITAE

Pamela J. Wessling, MSN, ARNP, NP-C

7623 SW 170th Street

Miami, FL 33157

Ph (w) 305-899-3812 (h) (305) 233-3010

e-mail pwessling@mail.barry.edu

EDUCATION	DEGREE	DATE
Barry University, Miami, FL	PhD in Nursing	Anticipated Graduation 12/10
University of Miami Coral Gables, FL	MSN in Nursing	1999
University of Miami Coral Gables, FL	BSN in Nursing	1975

PROFESSIONAL EXPERIENCE

Assistant Professor of Nursing	Barry University	2005 – Present
Family Nurse Practitioner	Minute Clinics	2007 - 2009
Family Nurse Practitioner	Office of Dr. S. Bennett	2005 – 2007
Nurse Educator	Miami Children's Hospital	1998 – 2004
Clinical Nurse Specialist	Diabetes Research Institute University of Miami	1995 – 1998
Staff Nurse (NICU)	Miami Children's Hospital	1995
Education Instructor	South Miami Hospital	1981 – 1995

Staff Nurse (SICU)	South Miami Hospital	1980-1981
Infection Control Nurse	Florida Hospital	1979 - 1980
Critical Care Nurse	Florida Hospital, Orlando, Florida	1976 - 1979
Medical Surgical Nurse	Jackson Memorial Hospital, Miami, Florida	1975 – 1979

HONORS AND AWARDS

2009	Chair's Distinguished Award, Division of Nursing
1999	Academic Excellence Award, University of Miami
1991	James Healey Memorial Award American Heart Association of Greater Miami
1985	Sigma Theta Tau, International Nursing Honor Society

PUBLICATIONS

Wessling, P. (2002). Preventing Medical Errors, American Psychological Association, online.

PRESENTATIONS

2006 – Florida Atlantic University, Poster presentation**:** Using Problem-Based Learning to Facilitate Role Transformation in Nurse Practitioner Education

2005 - James L. Knight Center, Miami, FL Topic: Cardiac Disease in Women with Diabetes

2004- National League for Nursing Conference, Poster presentation: Nursing Support Program

1987- University of Miami, School of Nursing Topic: Respiratory Disease