The Sleep Needs of Adolescents

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The amount of sleep affects the way adolescents perform, feel, think, learn, and remember. Significant physiological and social changes have profound effects on adolescents' sleeping patterns. Lack of sleep increases the possibility of increased daytime sleepiness, which may result in a tragic automobile or work accident. Other consequences of sleep deprivation include poor school performance, heightened risk of drug and alcohol use, increased irritability, and aggressive behavior, all of which can interfere with relationships with classmates, parents, and teachers. The purpose of this paper is to explore the literature concerning what is known about why adolescents need more sleep and why adolescents do not obtain enough sleep. Nursing interventions targeting adolescents, parents, teachers, schools, and employers are included. If adolescents understand and learn to improve their sleep patterns while they are young, they may have improved sleep habits in adulthood. Teaching adolescents about the importance of sleep is an important task for school nurses.

Introduction

The amount of sleep is known to affect the way adolescents perform, feel, think, and learn during the day. The influence of sleep on an adolescent's behavior is a frequently ignored aspect of child development (Wolfson, 1996). There is a general lack of knowledge of developmental trends in sleep during adolescence, gender differences in adolescent sleep patterns, and quality and quantity of sleep required for optimum physical and mental health (Yarcheski & Mahon, 1994). Most people think adolescents need less sleep than elementary school children. The fact is, adolescents need more sleep. Significant changes during adolescence affect sleep and waking patterns. These changes arise from a variety of sources, such as academic and social pressures, an increase in extracurricular activities, changes in parent–child relationships, part-time employment, and alcohol and drug use. Sleep needs of adolescents are also affected by the biological onset of puberty, with the resulting physical and hormonal changes. A lack of sleep during adolescence increases the possibility of increased daytime sleepiness, which may result in serious accidents (Carskadon, 1989-1990; 1990).

While working with adolescents as a substitute school nurse, students would frequently come to me with the following request: "Can I lie down and rest for 10 minutes? I'm so tired, I can't stay awake." Such complaints of excessive sleepiness led the author to ask several questions. How much sleep do adolescents need? Why do they not get enough sleep? What can nurses working with adolescents do to increase adolescents' sleep need awareness and increase their sleep time?

Significance of the Problem

Sleep is very important for maximum adolescent achievement; therefore, lack of sleep has significant consequences. Frequently, adolescents do not get enough sleep because of their busy lives. Adolescents perform best with 7–9 hours of sleep. A study by Mahon (1995) notes that when the amount of sleep decreases, adolescents report feeling less healthy. Adolescents and their parents need to be aware of the importance of obtaining adequate sleep and the potential consequences of sleep deprivation.

Some of the potential consequences of insufficient sleep include increased daytime sleepiness, which may result in falling asleep in class, while working, or when driving. Sleepy adolescents may encounter more academic and learning difficulties. Wolfson and Carskadon (1998) report more hours of sleep, earlier bedtimes, and later week-day rise times are associated with better grades. Carskadon (1989-1990) notes the most active, highest achieving, and hardest working adolescents may be at greatest risk of falling asleep when driving, while working with dangerous equipment, or working in a hazardous environment. Although motor vehicle accidents are the greatest cause of occupational injuries in the 15- to 19-year-old age group, there are other hazardous conditions that adolescents encounter (Brezler, 1999). Examples of dangerous or hazardous jobs that adolescents hold include janitorial or clean-up jobs which may expose them to toxic chemicals in cleaning products, blood on discarded needles, and slippery floors. In addition, adolescent food service workers are exposed to hot cooking equipment and sharp objects. Retail sales clerks are at risk from violent crimes and heavy lifting (NIOSH, 1997).

Another important and dangerous consequence of not getting enough sleep is the combined effect of alcohol and sleep deprivation. Although adolescent drinking is ille-

gal, some adolescents do consume alcohol. A non-sleep-deprived adolescent may not suffer harm from one or two beers in the afternoon or evening. However, an adolescent who is sleep deprived may not be able to tolerate this combination without feeling excessively sleepy (Carskadon, 1989-1990). More importantly, this combination can be a safety hazard for the adolescent when driving or working.

Other consequences of sleep deprivation in adolescents include poor school performance, greater risk of drug abuse to counteract sleepiness with caffeine or other strong stimulants, and increased irritability, which can interfere with relationships with adults and classmates (Carskadon, 1990). Insufficient sleep is associated with aggressive behavior and the possibility of increased school violence (Wolfson, 1996). Aggressive behaviors can interfere with peer, teacher, and parent relationships. If sleep time is increased, adolescence may be less stressful for parents and teachers, as well as the adolescent. The purpose of this article is to describe what is known about why adolescents need more sleep and why they do not obtain enough sleep.

Literature Review

For this review, there are two concepts that need to be defined: adolescence and sleep. Adolescence is the period of physical and psychological developmental changes that take place between childhood and adulthood. Adolescence is divided into three age groups: early adolescence, which is ages 12 to 14; middle adolescence, which is ages 15 to 17 years; and late adolescence, which includes ages 18 to 21 (Mahon, 1995; Yarcheski & Mahon, 1994). Sleep is defined as a "period of physiological loss of consciousness with reduced cerebral function and almost absent voluntary physical activity" (Thomas, 1977, p. S-56). Anch, Browman, Mitler, and Walsh (1988) define sleep as a "recurring state of existence characterized by the following occurrences: (a) reductions in awareness of and interaction with the environment; (b) lowered motility and muscular activity; and (c) partial or complete abeyance of voluntary behavior and consciousness" (p. 2).

Mahon (1995) summarizes four theories of why humans need to sleep. The restorative theory implies that sleep promotes physiologic responses that rejuvenate the

mind and body. The energy conservation theory suggests that sleep conserves energy through a period of enforced rest and immobility. Another theory, known as adaptive theory, implies that sleep is a behavior that enhances survival. It also implies that sleep is an instinct occurring in response to stimuli, promoting survival of the species. The last theory is the memory consolidation theory, in which the function of sleep is to promote storage of previously learned information.

Sleep literature describes two additional concepts — sleep quantity and sleep quality. Sleep quantity is the amount of sleep obtained in a 24-hour period. Sleep quality includes three elements: sleep disturbances, sleep effectiveness, and sleep supplementation. Sleep disturbances include increased amount of time it takes to fall asleep (sleep latency), waking up in the middle of sleeping, excessive movement during sleep, and lack of soundness of sleep. If someone has problems falling asleep at night, wakes up many times at night, moves their legs and arms enough to awake, or sleeps "too shallowly," any one or all of the above sleep problems are considered sleep disturbances. Sleep effectiveness is the subjective quality of sleep. It is assessed upon wakening and is usually reported as how well an individual slept. Sleep supplementation is daytime sleeping or napping (Carskadon, 1989-1990; Mahon, 1995; Yarcheski & Mahon, 1994). Sleep supplementation is prevalent in adolescents (Mahon, 1995). The many social demands of adolescents decrease the total quantity of hours available to sleep. The quality of sleep changes in adolescence, and sleep disturbances are common in all adolescent age ranges.

Sleep is divided into two stages called NREM (non-rapid eye movement) and REM (rapid eye movement). NREM is divided into four stages, stages one to four — from light to deep sleep. In NREM stage one sleep, the individual transitions from wakefulness to sleep in about five minutes. The person is drowsy, relaxed, somewhat aware of the surroundings, has quickly passing thoughts, and can easily be awakened (Murray & Zentner, 1997). Eye movements are slow, rolling, and swaying in this stage (Wolfson, 1996). Stage two NREM sleep is the beginning of a deeper sleep and fills 40–50% of total sleep time. The individual is more relaxed than in stage one, but can be awakened easily (Murray & Zentner, 1997). According to Wolfson (1996), stage two is the most frequently occurring sleep stage and is characterized by the absence of eye movements. NREM stage three sleep is a period of progressively deeper sleep and starts 30 to 45 minutes after sleep onset. Muscles are more relaxed, metabolic activity is lower, and the individual is difficult to awaken. Stage four NREM sleep is a very deep sleep and occurs approximately 40 minutes after stage one. This stage rests and restores the body and is as important as REM sleep. The individual is very relaxed and seldom moves, is difficult to arouse, and if awakened responds slowly (Murray & Zentner, 1997).

REM sleep is called *active* or *paradoxic* sleep. REM occurs before the deeper sleep stages of two, three, and four and is characterized by rapid eye movements, intense brain activity, irregular respiration and heart rate, and dreaming. REM sleep occurs in 70- to 90-minute cycles that increase in length through the night. REM sleep rests and restores the brain and is important for learning and psychological functioning. During REM sleep, the brain reviews the day's events, categorizes and integrates information into memory, and solves problems (Murray & Zentner, 1997). When adolescents shorten sleep time, there is insufficient time spent in all stages of sleep, and they are deprived of the rest and restorative benefits of sleep.

Wolfson (1996) explains the changes in sleep/wake patterns of adolescents. By early adolescence, electrophysiological sleep parameters are approximately the same as those of young adults. In addition, the ratio between stage four and stage three NREM sleep decreases, and the ratio between stage one and stage two NREM sleep increases. This means adolescents spend less sleep time in the deep sleep of stage four, and there is an increase of time in stage one. Adolescents spend more time in the lighter stages of sleep than they do in the restorative stages of deep sleep. There is a slight decrease in the amount of REM sleep, and adolescents have a reduced REM latency.

Why Do Adolescents Need More Sleep?

Adolescents experience profound changes in physical growth, hormonal changes, social development, and intellectual development, resulting in an increased need for sleep. In addition, alterations in sleep and waking patterns occur during puberty. The quality and quantity of sleep are influenced by many factors, such as physiological changes, changes in academic demands, earlier school starting times, peer pressure, increased access to drugs and alcohol, part-time employment, changes in parent–child relationships, and extracurricular activities (Carskadon, 1990; Wolfson, 1996).

Wolfson (1996) reports that adolescents obtain less sleep than elementary school children. Elementary children sleep approximately 10 hours, and adolescents sleep less than 7 hours. Studies show that adolescents enjoy staying up late (Wolfson, 1996). Although adolescents stay up late, they want to sleep longer and complain of being tired in the morning (Strauch & Meier, 1988). Another survey found 45% of tenth to twelfth graders go to bed after midnight on school nights, and 90% later than midnight on weekends (Wolfson, 1996). Other studies report weekend sleep averages 60 minutes more than on school nights in 10-year-olds; this time increases to 90 minutes in 13-year-olds and increases to approximately three hours by age 18 (Carskadon, 1990; Strauch & Meier, 1988; Wolfson, 1996). This may be interpreted as adolescents not getting enough sleep on school nights, and then needing to make up for essential sleep on the weekend. This need to obtain more sleep on the weekend is considered a "sleep debt" (Wolfson, 1996). Lack of sleep in adolescents also correlates to factors such as the onset of puberty, circadian rhythm changes, parental influences, curfew changes, school schedules, increased academic demands, employment, and extracurricular activities.

Why Adolescents Do Not Obtain Enough Sleep?

Puberty. Carskadon (1990) explains that daytime sleepiness peaks at middle adolescence and remains at a higher level through the remaining years of adolescence. Middle and late adolescents become sleepy in the daytime, even when sleeping as much as early adolescents. She concludes that middle and late adolescents may require more sleep to be alert than early adolescents.

Circadian rhythms. Biological rhythms are in repetitive and rhythmic patterns, and are found in plants, animals, and humans. The rhythms are found in the external and internal environment and can be exogenous or endogenous. Exogenous rhythms depend on the rhythms of the external environment, such as seasonal variations, moon phases, and the day and night cycle. These events help synchronize internal rhythms with

the external environment. Endogenous rhythms, such as the sleep–awake and sleep–dream cycles, arise from within the individual. Circadian rhythms are a form of endogenous rhythm that reoccurs in a cyclic pattern ranging from 20 to 28 hours. Body temperature, blood pressure, pulse, respirations, urine production, and hormones (growth hormone is highest during nighttime sleeping), blood sugar, hemoglobin, and amino acid levels demonstrate a rhythmic pattern. Similar variations or rhythms can be demonstrated in levels of alertness, fatigue, tenseness, and irritability (Murray & Zentner, 1997).

Hauri (1991) further defines circadian rhythms and describes how circadian rhythms influence adolescent sleep. The rhythms of the human body are on a 24-hour clock that regulates sleeping and waking patterns. From about 6 months to 14 years, the circadian rhythms are approximately 24 hours in length. Most pre-adolescents and early adolescents are able to fall asleep and wake up at about the same time each day. During middle and late adolescence, circadian rhythms slow from the normal 24-hour day to a 26- to 30-hour "day." This may explain why some adolescents do not want to go to sleep when it is 11 p.m., for their body clock says it is 8 p.m. This is also true of waking up, resulting in difficulty getting up in the morning. When people are in their late 20s or early 30s, the circadian rhythms return to the 24-hour cycle (Hauri, 1991). When adolescents stay up later at night, this delays the onset of sleep. This change of sleep onset is due to psychosocial factors and biological changes occurring during puberty (Wolfson & Carskadon, 1998). When adolescents go to sleep later and sleep a great deal on the weekends, this further disrupts their circadian rhythms, delaying and lengthening their sleep time.

Parental influences. Another factor that influences the sleep schedules of adolescents is the way parents control their children's bedtime. The average bedtime for 10-year-olds is 9 to 9:30 p.m. For 13-year-olds, the average bedtime is 10 to 10:30 p.m. For 17-year-olds, the usual bedtime is 11 to midnight, and for college freshman, the average bedtime is 1 to 2 a.m. (Carskadon, 1990). Carskadon (1990) surveyed children and parents on the topic of parent-controlled bedtimes. For over half of the surveyed 10-year-olds, parents decided the bedtimes on school nights. Only 19% of 13-year-olds' parents decided bedtimes on school nights. This reveals a change in parental influence as the child reaches adolescence. Do parents feel a 13-year-old is able to determine his or her own sleep needs; do parents mistakenly feel their children need less sleep during adolescence; or have they lost control of this aspect of their adolescent's life?

Curfews. Carskadon (1990) examined the issue of bedtime curfews. This study evaluated middle adolescent students attending boarding school with and without determined curfews. The findings revealed students given a bedtime curfew reported going to bed about an hour earlier than students who did not have a curfew. All the students in this study slept the same amount of time. The students with bedtime curfews woke up about an hour earlier than those without a curfew and reported fewer symptoms of excessive sleepiness. The author concluded that external influences, such as bedtime curfews, have a significant influence on adoles-

cent sleep patterns. Parents need to understand that adolescent sleep would improve if they set specific bedtime curfews.

School schedules and increased academic demands. The time that school begins in the morning is influential on setting sleep patterns and the amount of sleep adolescents receive. In many school districts, junior high and high school students start school at an earlier time than elementary school students. This requires the older students to get up earlier to take a district school bus. The combination of late night activities, homework, employment, and early morning school attendance limits the hours available for sleep. Adolescents who are "evening types," those that stay up later and wake up later in the morning, have more difficulty adjusting to earlier school starting times. A study done by Carskadon, Wolfson, Tzischinsky, and Acebo (1995) on early school schedules concluded that students transitioning from ninth grade to tenth grade and the 65-minute earlier starting time on school days for tenth graders, resulted in excessive daytime sleepiness. The study reported that adolescent subjects fell asleep rapidly, which may indicate daytime sleepiness severe enough to interfere with school performance and other activities, such as driving.

Another study on school starting times reported that earlier risers compared to later risers in the study complained more about daytime fatigue and sleepiness, and attention and concentration difficulties in school (Epstein, Chillag, & Lavie, 1998). The students' complaints were independent of the reported hours of sleep. The authors concluded that early school starting time reduces total sleep time and has a negative effect on daytime behavior.

Junior high and high school students have more homework, complex projects, and more difficult subjects than they did in elementary school. For highly motivated and gifted high school students, the desire to excel and the excessive competition to be accepted into a prestigious college result in staying up late to complete homework and study for tests. Students who want to attend college and work part-time experience more sleep deprivation, since they may sacrifice sleep time to complete their assigned homework or study for examinations.

Part-time employment and extracurricular activities. Part-time jobs have a significant, deleterious influence on the sleep patterns of adolescents. The combined hours of school, homework, and part-time employment may increase the high school student's hours to more than 50 hours per week. According to Carskadon (1989-1990), sleep patterns of students working 20 hours or more per week differ from those who do not work, or work fewer hours. Working students stay up later and sleep less on school nights. The students who worked extended hours reported more daytime sleepiness, falling asleep in class, frequent tardiness due to oversleeping, and greater use of caffeine, alcohol, and tobacco. In addition, high school students who took part in extracurricular activities and worked 20 hours or more per week reported a chronic pattern of extremely shortened sleep times. These students had symptoms of daytime sleepiness and increased use of stimulants and alcohol. This study also found that students who worked long hours reported being sleepy while driving. Ten percent of high school males who worked 20 hours or more a week in addition to 20 hours per week in extracurricular activities admitted to having fallen asleep "at the wheel."

Implications for School Nurses

There are many and complex reasons why adolescents need more sleep, and why they do not obtain sufficient sleep. Nurses working with adolescents can be effective counselors to investigate reasons why they do not sleep. They are in an influential position to design successful school educational programs revolving around adolescent sleep needs. When adolescents come into the school nurse's office tired and wanting to sleep, explore possible reasons for this tiredness and suggest solutions for change before letting them take a short nap. An important role for the school nurse is to promote health through targeting groups of sleepy students who would benefit from nurse-facilitated group discussions and brainstorming about how to lessen their demands and increase sleep time. It is imperative to target working students, and those with many extracurricular activities, for sleep interventions.

School nurses may assess sleep quantity and quality by initiating an informal sleep questionnaire or diary that includes how long the adolescent slept each night and how he or she felt the following day. This is completed by the student for 5 to 10 days and returned to the nurse. With this information, the nurse is able to determine the necessity for individual counseling or for a school-wide educational program.

School nurses are in an excellent position to educate adolescents on the importance of obtaining adequate sleep. Parts of a successful school educational program addressing adolescent sleep needs include clarification of what sleep is, how much sleep adolescents need (strive for 8 hours), why adolescents need to sleep, and how the physical and social changes they are experiencing may interfere with getting adequate sleep. The program lessons include information on the importance of good life-long sleep habits, developing a nightly bedtime routine, and getting to bed at the same time each night, including weekends. Class lessons include information on relaxation techniques before going to sleep, such as listening to mellow music, taking a warm bath, and drinking warm milk, which contains l-tryptophan, a chemical that increases brain serotonin and induces sleep (Murray & Zentner, 1997). Additional information includes things adolescents should avoid before going to bed, such as caffeine or foods that contain caffeine, stimulant drugs, smoking, exercising, or watching violent television programs. Other lessons should emphasize the relationship between getting enough sleep and feeling well, and the potentially serious consequences of not getting enough sleep, such as falling asleep while driving. Adolescents need to understand that excessive moodiness, depression, irritability, fatigue, tiredness, aggressiveness and violence could be due to a sleep deficit. Measurable goals of a successful sleep education program include increased knowledge of how lack of sleep affects all aspects of an adolescent's life and expanded understanding and awareness of how to obtain more sleep. Attitude and behavior change are also essential outcomes of any educational program.

In addition to working with students, an important role for the school nurse is advising, educating, and supporting parents about adolescent sleep requirements and suggesting ways to empower them to direct their adolescents' bedtimes and curfews so they obtain more sleep. School nurses need to inform business owners and work supervisors of the potential sleep deficits of their adolescent employees and recommend changing job activities that place adolescents at risk for injuries. School nurses need to be knowledgeable about the U.S. Department of Labor laws covering prohibited jobs and

hour limitations pertaining to adolescents. This information is found on the Internet at www.dol.gov/dol/opa/public/summer/guide/flsa.htm

In conclusion, school nurses are well positioned to advocate for later school starting times for junior and senior high students. This can be facilitated by informing school boards and administrators, members of the state legislature, parents, teachers, and other nurses about the reasons that adolescents need to sleep longer, why they do not obtain adequate sleep, and the potentially catastrophic results if adolescents do not get sufficient sleep.

Conclusions and Need for Further Research

The literature revealed answers to the following questions: how much sleep adolescents require, why adolescents need more sleep, and why they do not obtain enough sleep. Adolescents go through physical, emotional, and social changes that affect the amount of sleep they receive. With the information in this article, school nurses can design and coordinate creative educational programs addressing ways to improve adolescent sleep. The impact of adolescents not sleeping long enough has the potential to affect all of us.

Finally, nurses need to do sleep research with adolescents to identify threats to the safety of adolescents who experience sleep problems and identify how schools, parents, and employers can help adolescents obtain sufficient sleep. Nurses should observe patterns of office visits related to sleepiness, or injuries relating to sleep deprivation. An important role for school nurses is to educate the public and adolescents about adolescent sleep requirements. This might be done by writing articles in school newspapers, local newspaper editorials, or television news reports — even in popular magazines — or by starting a web page on the Internet to inform others of the serious sleep deficit most adolescents experience and what can be done to help them obtain more sleep. The importance of sleep for optimal health is undeniable. If adolescents learn to acknowledge their sleep needs and improve their sleep habits, they may be happier, healthier, safer, and more productive during their adolescent years.●

REFERENCES

Anch, A.M., Browman, C.P., Mitler, M.M., & Walsh, J.K. (1988). *Sleep: A scientific perspective.* Englewood Cliffs, NJ: Prentice-Hall.

Brezler, G.D. (1999). Injuries in adolescent workers, health promotion and primary prevention. *AAOHN, 47*(2), 57-64.

Carskadon, M.A. (1989-1990). Adolescent sleepiness: increased risk in a high-risk population. *Alcohol, Drugs and Driving, 5*(4)/*6*(1), 317-328.

Carskadon, M.A. (1990). Patterns of sleepiness in adolescents. *Pediatrician, 17*(1), 5-12.

Carskadon, M.A., Wolfson, A.R., Tzischinsky, O., & Acebo, C. (1995). Early school schedules modify adolescent sleepiness. *Sleep Research, 24,* 92.

Epstein, R., Chillag, N., & Lavie, P. (1998). Starting times of school: effects on daytime functioning of fifth-grade children in Israel. *Sleep, 21*(3), 250-256.

Hauri, P. (1991). *No more sleepless nights.* New York: John Wiley & Sons.

Mahon, N.E. (1995). The contributions of sleep to perceived health status during adolescence. *Public Health Nursing, 12*(2), 127-133.

Murray, R.B. & Zentner, J.P. (1997). *Health assessment and promotion strategies through the life span* (6th ed.) Stamford, CT: Appleton & Lange.

National Institute for Occupational Safety and Health (NIOSH). (1997). Are You a Working Teen? What You Should Know About Safety and Health on the Job (DHHS Publication No. 97-132). Washington, DC: U.S. Government Printing Office.

Strauch, I. & Meier, B. (1988). Sleep need in adolescents: a longitudinal approach. *Sleep, 11*(4), 378-386.

Thomas, C.L. (Ed.). (1977). *Taber's cyclopedic medical dictionary* (13th ed.). Philadelphia: F.A. Davis.

Wolfson, A.R. (1996). Sleeping patterns of children and adolescents: developmental trends, disruptions, and adaptations. *Child and Adolescent Psychiatric Clinics of North America, 5*(3), 549-568.

Wolfson, A.R. & Carskadon, M.A. (1998). Sleep schedules and daytime functioning in adolescents. *Child Development, 69*(4), 875-887.

Yarcheski, A. & Mahon, N.E. (1994). A study of sleep during adolescence. *Journal of Pediatric Nursing: Nursing Care of Children and Families, 9*(6), 357-367.

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