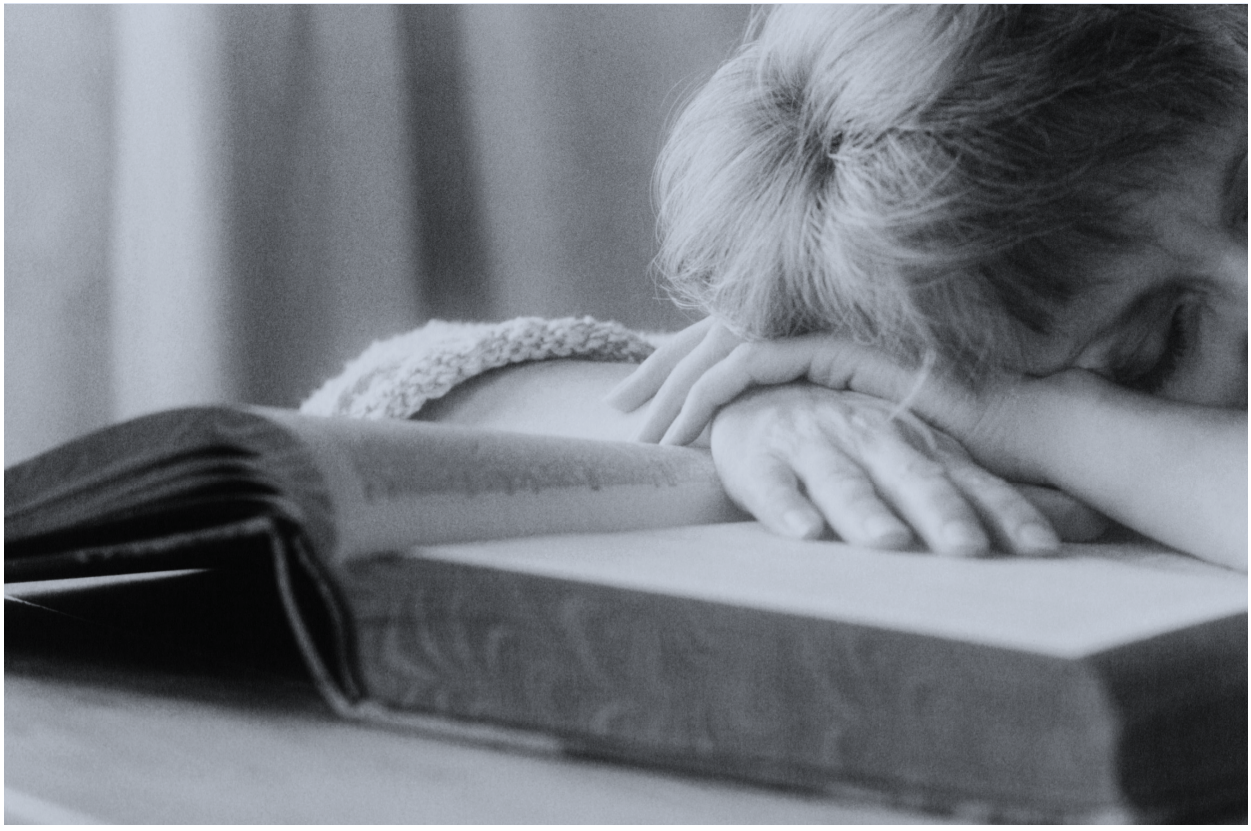
ADOLESCENT SLEEP NEEDS AND PATTERNS

Research Report and Resource Guide



PUBLISHED BY THE NATIONAL SLEEP FOUNDATION

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Preface

The National Institutes of Health (NIH) have identified adolescents and young adults (ages 12 to 25 years) as a population at high risk for problem sleepiness based on "evidence that the prevalence of problem sleepiness is high and increasing with particularly serious consequences." (NIH, 1997) This designation evolved from a Working Group on Problem Sleepiness convened in 1997 by NIH's National Center on Sleep Disorders Research and the Office of Prevention, Education, and Control. The group concluded that steps must be taken to reduce the risks associated with problem sleepiness.

What are these risks? The most troubling consequences of sleepiness are injuries and deaths related to lapses in attention and delayed response times at critical moments, such as while driving. Drowsiness or fatigue has been identified as a principle cause in at least 100,000 police-reported traffic crashes each year, killing more than 1,500 Americans and injuring another 71,000, according to the National Highway Traffic Safety Administration (NHTSA, 1994). ***Young drivers age 25 or under cause more than one-half of fall-asleep crashes****.*

The National Sleep Foundation's (NSF) Sleep And Teens Task Force developed this publication to summarize existing research about sleep-related issues affecting adolescents. We hope that this report will serve as a valuable and practical resource for parents, educators, community leaders, adolescents and others in their efforts to make informed decisions regarding health, safety and sleep-related issues within their communities.

A nonprofit, private organization, NSF is a leader in public education efforts regarding the risks associated with drowsy driving and other issues related to sleepiness and sleep loss. We welcome your comments about this document and your suggestions for expanding public awareness and supporting positive changes to protect the safety and well-being of our nation's youth.

For more information, and an online copy of this report please visit NSF's Web site at www.sleepfoundation.org. The Foundation can also be reached by e-mail at nsf@sleepfoundation.org; phone (202) 347-3471; or fax (202) 347-3472. NSF's address is 1522 K Street, NW, Suite 500, Washington, DC 20005.

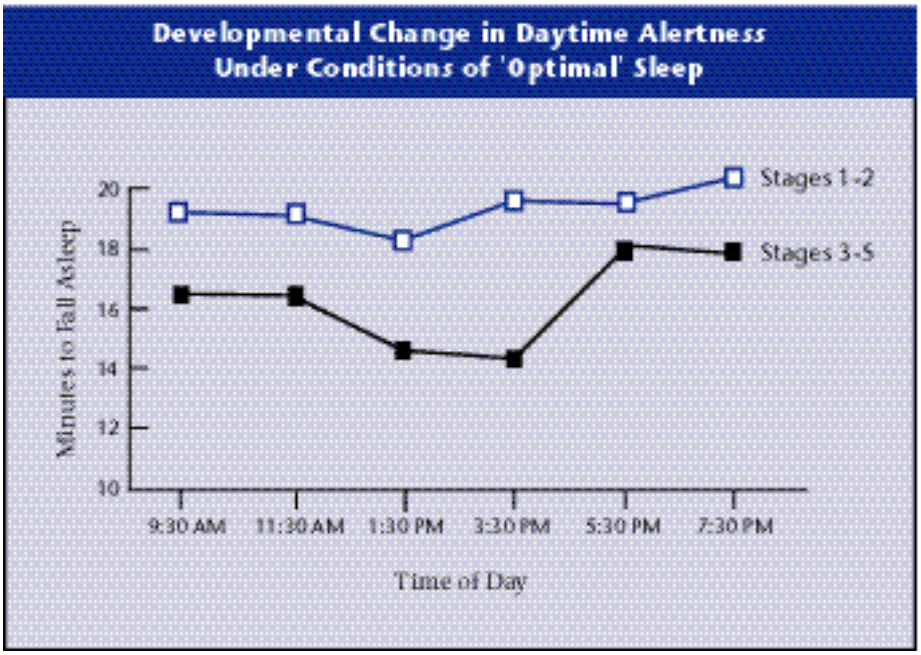
PART ONE

Research Report

Introduction

Sleep is a basic drive of nature. Sufficient sleep helps us think more clearly, complete complex tasks better and more consistently and enjoy everyday life more fully. Although many questions regarding the role of sleep remain unanswered, scientific studies have shown that sleep contributes significantly to several important cognitive, emotional and performance-related functions.

Sleep is, in essence, food for the brain, and *insufficient* sleep can be harmful, even life-threatening. When hungry for sleep, the brain becomes relentless in its quest to satisfy its need and will cause feelings of "sleepiness," decreased levels of alertness or concentration, and, in many cases, unanticipated



Pubertal development is categorized in five stages based upon the occurrence of visible signs of physical maturation, with stage 1 being pre-pubertal, stage 2 early pubertal, and so forth. Stage 5 indicates physical maturity of the secondary sexual characteristics. The first signs of puberty (stage 2) in US children usually begin at about ages 8 to 13 years in girls and 9 to 14 years in boys. Full maturation generally takes about 4 to 5 years to occur after the first signs are seen. A longitudinal study found that when allowed to sleep up to 10 hours a night, adolescents were sleepier during the day when more physically mature (Stages 3, 4, or 5) than when at the early stages of puberty. (Note: In this particular study, the youngest children were 10 years old.)

sleep. Excessive sleepiness is also associated with reduced short-term memory and learning ability, negative mood, inconsistent performance, poor productivity and loss of some forms of behavioral control (NIH, 1997).

Researchers have identified several changes in sleep patterns, sleep/wake systems and circadian timing systems associated with puberty. (Carskadon, 1999) These changes contribute to excessive sleepiness that has a negative impact on daytime functioning in adolescents, including increasing their risk of injury. (Wolfson and Carskadon, 1998) Findings are similar in North America and in industrialized countries on other continents. (Carskadon, 1999)

Scientists hypothesize that these sleep-related problems are due largely to conflicts between physiologically-driven sleep needs and patterns, and behavioral and psychosocial factors that influence sleep habits.

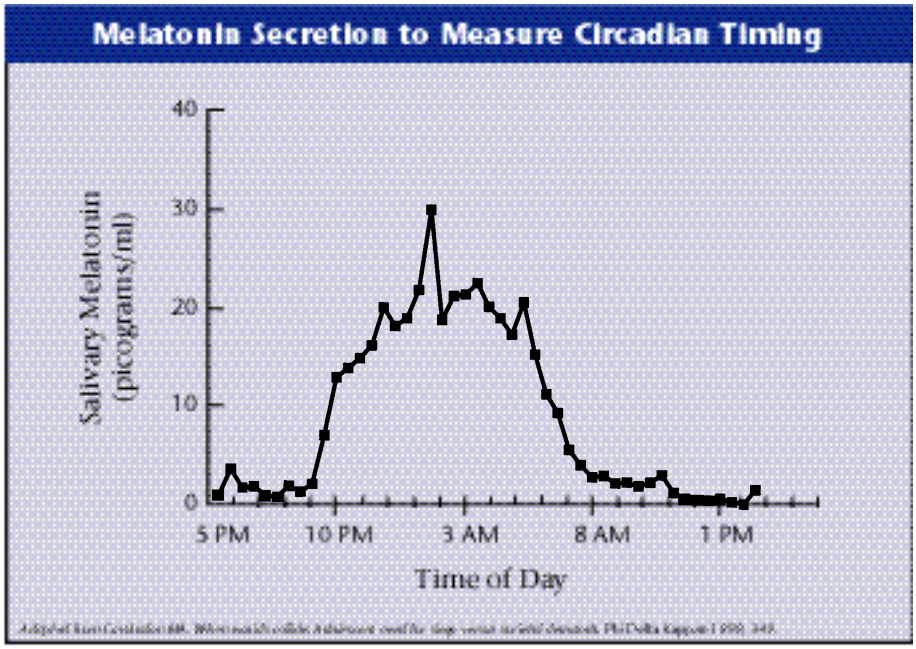
Key changes in sleep patterns and needs that are associated with puberty include:

PHYSIOLOGICAL PATTERNS

- Adolescents require at least as much sleep as they did as pre-adolescents (in general, 8.5 to 9.25 hours each night). (Carskadon et al., 1980)

- Daytime sleepiness increases — for some, to pathological levels — even when an adolescent's schedule provides for optimal amounts of sleep. (Carskadon, Vieri, Acebo, 1993)

- Adolescents' sleep patterns undergo a phase delay, that is, a tendency toward later times, for both sleeping and waking. Studies show that the typical high school student's natural time to fall asleep is 11:00 pm or later. (Wolfson and Carskadon, 1998)



Melatonin secretion is a key indicator of the biological (circadian) timing system, in humans and other animals. This graph illustrates levels of melatonin as secreted in the saliva of adolescents adhering to a strict 10 pm bedtime and 8 am wake time.

BEHAVIORAL AND PSYCHOSOCIAL PATTERNS

- Many U.S. adolescents do not get enough sleep, especially during the week. Survey data show that average total sleep time during the school week decreases from 7 hours, 42 minutes in 13 year olds to 7 hours, 4 minutes in 19 year olds. (Wolfson and Carskadon, 1998) Only 15 percent of adolescents reported sleeping 8.5 or more hours on school nights, and 26 percent of students reported typically sleeping 6.5 hours or less each school night.

- Adolescents have irregular sleep patterns; in particular, their weekend sleep schedules are much different than their weekday schedules, to some extent as a direct consequence of weekday sleep loss. These differences include both the quantity and the timing of sleep. One study of more than 3,000 adolescents showed that the average increase of weekend over weekday sleep across ages 13-19 was one hour and 50 minutes. (Wolfson and Carskadon, 1998) In 18-year-olds, the average discrepancy was more than two hours. In addition, 91 percent of the surveyed high school students reported going to sleep after 11:00 pm on weekends, and 40 percent went to bed after 11:00 pm on school nights.

  Irregular sleep schedules — including significant discrepancies between weekdays and weekends — can contribute to a shift in sleep phase (ie, tendency toward morningness or eveningness), trouble falling asleep or awakening, and fragmented (poor quality) sleep. (Dahl and Carskadon, 1995)

Consequences of Poor Sleep in Adolescents

Data on children, teens and adults confirm that sleep loss and sleep difficulties can have serious detrimental effects. Research specifically on adolescents and young adults is relatively new and limited, but scientists believe that many effects demonstrated in studies and clinical observations of adults are similar in adolescents. Sleep researchers, therefore, believe that insufficient sleep in teens and young adults is linked to:

- Increased risk of unintentional injuries and death. As noted, drowsiness or fatigue has been identified as a principle cause in at least 100,000 traffic crashes each year. In addition, about 1 million, or one-sixth, of traffic crashes in the United States are believed to be attributable to lapses in the driver's attention; sleep loss and fatigue significantly increase the chances of such lapses occurring. A North Carolina state study found that drivers age 25 or younger cause more than one-half (55 percent) of fall-asleep crashes.

The same symptoms of sleepiness that contribute to traffic crashes can also play a role in non-traffic injuries, such as those associated with handling hazardous equipment in the workplace or in the home. Furthermore, adolescents who have not received sufficient sleep and who consume even small amounts of alcohol are at greater risk of injury than those who are not lacking sleep because sleep loss has been shown to heighten the effects of alcohol. (Roehrs et al., 1994)

- Low grades and poor school performance. High school students who describe themselves as having academic problems and who are earning C's or below in school report getting less sleep, having later bedtimes and having more irregular sleep schedules than students reporting higher grades. (Note: A causal relationship has not yet been established.) (Wolfson and Carskadon, 1998)

- Negative moods (e.g., anger, sadness and fear), difficulty controlling emotions and behavior problems. In one study, female high school students who went to sleep on the weekend two or more hours later than their typical weeknight bedtime reported feeling more depressed than those who did not stay up late on the weekends. (Wolfson and Carskadon, 1998)

  Studies also suggest that sleep loss may be associated with a decreased ability to control, inhibit or change emotional responses. (Dahl, 1999) Some signs of sleepiness, such as inability to stay focused on a task, impulsivity, difficulty "sitting still," and problems completing tasks, resemble behaviors common also in attention deficit hyperactivity disorder (ADHD) (Dahl, 1999). In addition, a 1995 study of students in transition from junior high to senior high school found that conduct/aggressive behaviors were highly associated with shorter sleep times and later sleep start time. (Wolfson et al., 1995)

- Increased likelihood of stimulant use (including caffeine and nicotine), alcohol and similar substances. (Carskadon, 1990)

Teens who are heavily involved in school and community activities, their jobs and other responsibilities appear to be at greater risk for the above effects of sleepiness than those who are less involved in activities and who either do not hold jobs or who work fewer hours. (Carskadon, 1990)

What Can Be Done

The consequences of insufficient sleep among adolescents are particularly important to understand because they appear to be closely tied to key elements of human development. Achieving developmental goals during adolescence is essential for lifelong success and for what psychologists call social competency. In addition, the transition from childhood to adulthood is a critical time for "seeding" the values and habits that will shape their lives. Therefore, intervention to improve the sleep patterns of adolescents is important.

Influencing Physiological Sleep Patterns

Sleep researchers have established that basic sleep needs within individuals generally remain the same throughout their lifetime. Furthermore, insufficient sleep accumulates into a sleep debt that can ultimately be relieved only through additional sleep.

Circadian timing systems are also very resistant to change. Behavioral methods, such as controlled light exposure and chronotherapy, can sometimes help shift circadian timing to more socially appropriate sleep and wake times. Because the circadian rhythms in teenagers are typically highly sensitive to erratic schedules, to effectively adjust them requires making gradual, persistent and consistent changes. Adapting to an early school schedule following summer or other vacation periods during which very late schedules are typically kept, for example, can take several days to several weeks.

It is important to recognize that excessive sleepiness during the day and other sleep problems can be an indication of an underlying biological sleep disorder. Accurate diagnosis of disorders such as narcolepsy, sleep apnea and periodic limb movement disorder usually requires examination by a qualified sleep specialist and an overnight stay in a sleep laboratory. In most cases, symptoms of sleep disorders can be eliminated or minimized through the use of appropriate behavior modifications, medication or other therapies.

Creating Sleep-Friendly Schools

School systems can help positively influence adolescent sleep patterns in several ways. Suggestions include:

- Educate teachers, school health providers and other school personnel about adolescent sleep needs and patterns, and about the signs of sleep loss and other sleep or alertness difficulties. Teachers and school staff should also be informed about accommodations that might be needed by some students with chronic sleep disorders.

- Integrate sleep-related education in curricula so that students can learn about the physiology and benefits of sleep and the consequences of sleep deprivation. Relevant academic subjects include, for example, biology, health and psychology. In addition, driver's education courses should cover the prevalence and prevention of crashes related to drowsy driving.

CHANGING SLEEP HABITS

Perhaps the most significant behavioral change that adolescents can make – and that their parents can encourage them to make – is to establish and maintain a consistent sleep/wake schedule. This is a good practice for people at all ages, but may be especially important for adolescents.

Understanding and practicing other behaviors that are considered good sleep habits are also important. These include getting enough sleep, avoiding caffeine and other stimulants late in the day and alcohol at night, gaining exposure to bright light at appropriate times to reinforce the brain's circadian timing system, relaxing before going to sleep and creating an environment conducive to quality sleep.

- Structure the school schedule and related activities to accommodate adolescents' sleep needs and behaviors and circadian rhythm at this developmental stage. One approach is to start daily high school schedules when students are most likely to be alert and able to learn. Several school districts in the nation have adopted later school start times; countless more are considering doing so.

Preliminary findings and focus group studies conducted by the Center for Applied Research and Educational Improvement (CAREI) at the University of Minnesota reveal that after schools shifted from early to later start times, students from both urban and suburban high schools reported that they felt more rested and alert during the first hour of class and, in general, throughout the day. (Wahlstrom and Freeman, 1997)

In addition, students in the suburban Edina high school district whose schools delayed their start times reported increased hours of sleep, less erratic sleep behaviors and less depressive feelings and behaviors, better grades and little restriction in time spent in extracurricular activities. (Wahlstrom and Freeman, 1997) Findings in urban (Minneapolis) schools with later start times varied from the suburban schools somewhat; in particular, student mood appeared unchanged and schedule conflicts with extracurricular activities and employment were more pronounced. (Wahlstrom and Freeman, 1997)

For more information about issues related to high school start times, see pages 13-16

Establishing Public Policies

Governmental and organizational policies significantly influence social change. In addition to federal agencies, national medical and health care specialty organizations, education and parent associations and youth groups can play a key role in developing and implementing recommendations, policies and cooperative initiatives. *(See Minnesota Medical Association Resolutions, page 22.)*

Furthermore, state, district and local efforts may be spearheaded through voluntary, professional and governmental organizations such as school boards and parent-teacher associations, state or district medical societies, motor vehicle administration departments, public health departments and social service agencies.

Below are some examples of policy-related approaches that have been or could be used to better match adolescent sleep patterns and needs with cultural expectations and external demands, thereby increasing teens' overall safety and well-being.

- Legislation to encourage starting high schools no earlier than 9:00 am, and appropriations to help defray the school or school district's costs of changing school schedules. *(See Z's to A's Act, page 19.)*

- Legislation or policies to include age-appropriate sleep information in school curricula, grades K through 12.

- Initiatives to include information about the effects of drowsiness on driving ability in drivers' education courses and licensing tests. *(See Resource Guide.)*

- Graduated licensing regulations to reduce the number of adolescents driving unsupervised at night.

- Child labor laws to restrict the number of hours and the time of day that adolescents are permitted to work.

- Funding to support public education and scientific research on topics such as the interrelationships among sleep loss and injury, learning, and performance, as well as epidemiological data. Relevant federal oversight of funded agencies include the National Center for Sleep Disorders Research and other agencies of the National Institutes of Health, the Food and Drug Administration, the Department of Transportation, the Department of Education, the Centers for Disease Control and Prevention, and military branches.

- Initiatives to educate key adults who have frequent and regular contact with adolescents (eg, caregivers and authoritarians) about sleep, the signs and hazards of sleepiness, and appropriate interventions for children and adolescents showing signs of sleep difficulties or disorders. Constituents include parents, teachers, school administrators, school nurses and counselors, coaches, employers, health providers (family practitioners, adolescent medicine specialists, and those who specialize in mental health or learning disabilities) and voluntary group leaders of youth-oriented organizations. In addition, police and emergency care personnel should be trained to recognize problem sleepiness and distinguish its signs from those associated with drug or alcohol use.

Making New Discoveries

Sleep research has established clear relationships between sleepiness, health, safety and productivity. However, the sleep research field in general is relatively young, and scientists still have much to learn about the role of sleep and the effects of sleep loss in humans. Additional studies on the neurobiology, genetics, epidemiology, and neurobehavioral and functional consequences of sleepiness are needed. (NIH, 1997) More studies specifically on the adolescent population are also needed, including interdisciplinary research to further examine sleep's role in adolescent development, health and behavior.

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PART TWO

Resource Guide

Pointers for Parents

1. Educate yourself about adolescent development, including physical and behavioral changes you can expect (especially those that relate to sleep needs and patterns).

2. Look for signs of sleep deprivation (insufficient sleep) and sleepiness in your children. Keep in mind that the signs are not always obvious, especially in younger (pre-adolescent) children. Signs include:

   - difficulty waking in the morning,
   - irritability late in the day,
   - falling asleep spontaneously during quiet times of the day,
   - sleeping for extra long periods on the weekends.

   Other signs can mimic or exacerbate behaviors commonly associated with attention deficit hyperactivity disorder (ADHD).

3. Enforce and maintain age-appropriate sleep schedules for all children.

4. Talk with your children about their individual sleep/wake schedules and levels of sleepiness. Assess how much time they spend in extracurricular and employment activities and how it affects their sleep patterns. Work with them to adjust their schedules to allow for enough sleep, if necessary.

5. Provide a home environment conducive to healthy sleep. Establish a quiet time in the evening when the lights are dimmed and loud music is not permitted. Do not allow use of the television, computer and telephone close to bedtime.

6. Encourage your children to complete a sleep diary for 7 to 14 consecutive (and typical) days. The diary can provide immediate information on poor sleep habits, and it can be used to measure the effectiveness of efforts to change. Be sure to share the sleep logs or diaries with any sleep experts or other health professional who later assesses your child's sleep or sleepiness. Why not keep your own sleep diary as well? (Sleep diaries are available from the National Sleep Foundation or from your local sleep center.)

7. If your child's sleep schedule during vacation is not synchronous with upcoming school or work demands, help him or her adjust their schedule for a smooth transition. This process can take from several days to several weeks, so plan ahead!

8. If conservative measures to shift your child's circadian rhythms are ineffective, or if your child practices good sleep habits and still has difficulty staying awake at times throughout the day:

   - Consult a sleep expert. Excessive daytime sleepiness can be a sign of narcolepsy, sleep apnea, periodic limb movement disorder and other serious but treatable sleep disorders.

   - Discuss with teachers and school officials ways to accommodate your child's needs, if needed. Excessive daytime sleepiness due to sleep disorders or other medical conditions are covered under the Americans with Disabilities Act and the Disabilities Education Act of 1997 (IDEA 97).

9. Be a good role model: make sleep a high priority for yourself and your family by practicing good sleep habits. Listen to your body: if you are often sleepy during the day, go to sleep earlier, take naps, or sleep longer when possible. Consult a sleep expert if needed. Above all, don't allow any family member to drive when sleep deprived or drowsy.

10. Actively seek positive changes in your community by increasing public awareness about sleep and the harmful effects of sleep deprivation and by supporting sleep-smart policies. Request that sleep education be included in school curricula at all levels and in driver's education courses. Encourage your school district to provide optimal environments for learning, including adopting healthy and appropriate school start times for all students.

Tips for Teens

1. Sleep is food for the brain. Lack of sleep can make you look tired and feel depressed, irritable or angry. Even mild sleepiness can hurt your performance — from taking school exams to playing sports or video games. Learn how much sleep you need to function at your best — most adolescents need between 8.5 and 9.25 hours of sleep each night — and strive to get it every night. You should awaken refreshed, not tired.

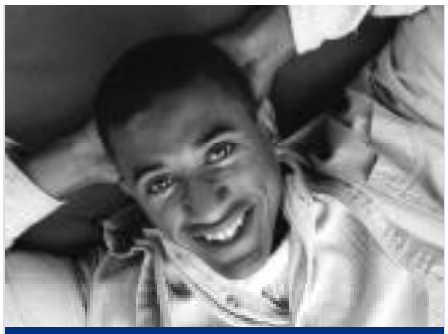
2. Keep consistency in mind: establish a regular bedtime and waketime schedule, and maintain this schedule during weekends and school (or work) vacations. Don't stray from your schedule frequently, and never do so for two or more consecutive nights. If you must go off schedule, avoid delaying your bedtime by more than one hour. Awaken the next day within two hours of your regular schedule, and, if you are sleepy during the day, take an early afternoon nap.

3. Get into bright light as soon as possible in the morning, but avoid it in the evening. The light helps to signal to the brain when it should wake up and when it should prepare to sleep.

4. Understand your circadian rhythms. Then you can try to maximize your schedule throughout the day according to your internal clock. For example, to compensate for your "slump (sleepy) times," participate in stimulating activities or classes that are interactive. Try to avoid lecture classes and potentially unsafe activities, including driving.

5. After lunch (or after noon), stay away from caffeinated coffee and colas as well as nicotine, which are all stimulants. Also avoid alcohol, which disrupts sleep.

6. Relax before going to bed. Avoid heavy reading, studying and computer games within one hour of going to bed. Don't fall asleep with the television on — flickering light and stimulating content can inhibit restful sleep.



Become a sleep-smart trendsetter

- Be a bed head, not a dead head. Understand the dangers of insufficient sleep – and avoid them! Encourage your friends to do the same. Ask others how much sleep they've had lately before you let them drive you somewhere. Remember: friends don't let friends drive drowsy.

- Brag about your bedtime. Tell your friends how good you feel after getting more than 8 hours of sleep!

- Do you study with a buddy? If you're getting together after school, tell your pal you need to catch a nap first, or take a nap break if needed. (Taking a nap in the evening may make it harder for you to sleep at night, however.)

- Steer clear of raves and say no to all-nighters. Staying up late can cause chaos in your sleep patterns and your ability to be alert the next day... and beyond. Remember, the best thing you can do to prepare for a test is to get plenty of sleep. All nighters or late-night study sessions might seem to give you more time to cram for your exam, but they are also likely to drain your brainpower.

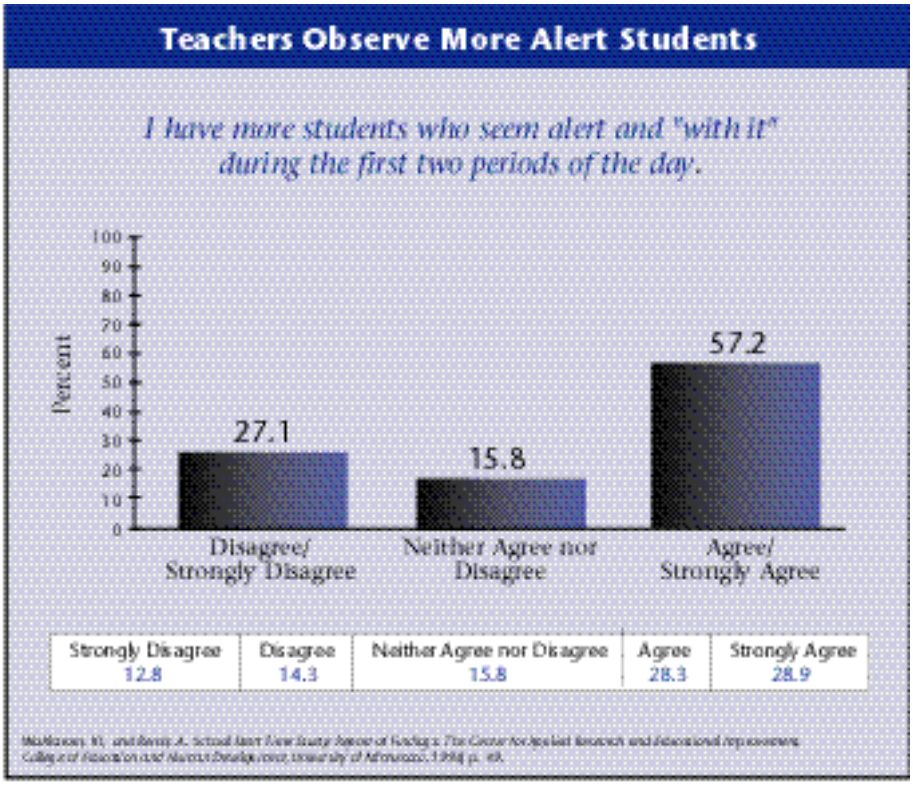
High School Start Times

Summary of Findings

Does changing school schedules make a positive difference on adolescent sleep patterns? Does this approach affect academic achievement, behavior and safety? The Center for Applied Research and Educational Improvement (CAREI) at the University of Minnesota has studied these issues among both suburban and urban schools. (Wahlstrom and Freeman, 1997) Current data reveals that after daily high school schedules are delayed from early morning start times:

- Suburban students report that, in general, they gain an extra hour of sleep each schoolday because they maintain the same bedtime and extend their sleep in the morning.
- Most teachers observe that more students are alert during the first two periods of the school schedule and fewer students fell asleep at their desks. Some students feel they are better able to complete more of their homework during school hours because they are more alert and efficient during the day.
- Overall student attendance increases and tardiness decreases.
- Some students report eating breakfast more frequently.

Students in high schools that have delayed their school start times have reported that they feel more rested and alert during the first hour of school, and, in general, throughout the day. Observations reported by teachers in the Minneapolis high schools in which the start time changed from 7:15 am to 8:40 am concur. Researchers note that of 13 survey questions answered by 335 teachers the summer following the initial change in start times, this survey item generated the most agreement among respondents.



- Teachers in suburban schools report noticeable improvements in student behavior, as evidenced by quieter hallways between classes and less misbehavior in the lunchroom. Similarly, counselors from suburban schools describe the school atmosphere as "calmer," and report that fewer students seek help for stress relief due to academic pressures. Urban teachers, however, observed no general improvement in student behavior.

- Suburban teachers and students did not report any remarkable change or conflict in students' participation in nonacademic activities, including work. However, teachers and students from the urban schools reported that fewer students were involved in extracurricular and social activities, and the later school schedules resulted in conflicts or compromised earnings for students who worked after school.

Individual communities can vary greatly in their priorities and values, and adopting a policy of later start times in high schools might not be optimal for every community or even for every school within a community.

Factors to Consider

Adopting later start times in high schools is a complex process that touches in some way nearly every aspect of the surrounding community. The list below provides insight into common issues and potential options for changing high school schedules.

- Bell schedules of elementary and middle or junior high schools in the district. To accommodate for the shift in the schedule of school buses, food service and other nonacademic services provided as part of the school experience, a change in high school bell times often forces a shift in local schools at other levels. For instance, some districts have found that switching times with the elementary schools is the least cumbersome in terms of school system resources (and is more in line with both groups of students sleep patterns). In other districts, lower level schools as well as high schools have shifted their schedules.

- Transportation services and related issues. Transportation services may be the single most complex, costly and consistently significant factor among school districts, especially if schedule changes result in the need for additional school buses. Issues related to transporting students at all grade levels to and from school might involve public school buses, forms of general public transportation (such as buses or subway systems) and personal transportation provided by parents and high school students.

  Other considerations include availability of drivers and parking spaces for school bus drivers; change in the number of hours that drivers work, which can be influenced by the amount of other traffic while en route; and the effect of the timing of school buses on commuter traffic. The impact of the school bus schedule on availability of transportation for extracurricular activities may also be important.

- Athletic programs and other extracurricular activities. The impact on student athletic programs appears to be of high importance consistently within school districts that have examined the plausibility of changing school bell times. Changing school bell times directly influences the timing of athletic programs and extracurricular activities, and students who participate in athletic programs or extracurricular activities arrive home later as the schedule change generates a "domino effect." A major concern for districts that have outdoor athletic programs is the shortened period of daylight after the school day ends. Also, if school hours differ significantly among schools in the same competitive league, further adjustments or negotiations may be needed to maintain the same program.

  The availability of coaches can become either a problem or a plus with delayed bell times. For example, if coaching staff work for a local elementary or middle school as well as the high school, the interrelationship of the school schedules is significant. On the other hand, a later schedule might facilitate additional involvement by working parents because the time would likely interfere less with their professional schedules. (This theory could apply also to other extracurricular activities.)

- Use of the school for community activities, such as group membership or adult education programs, held during non-school hours.

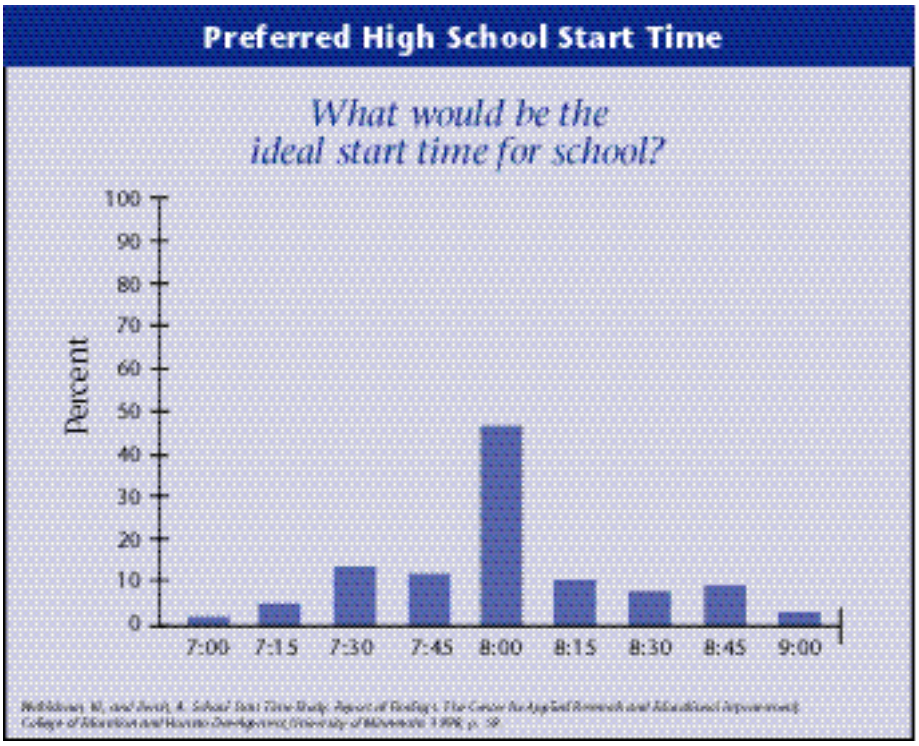
  The impact of bell times on the accessibility of school facilities for community group meetings, adult educational or religious programs and other activities can generate great controversy within the community. Some organizations may object to a request for even minimal schedule changes and, in some cases, revenue potential from leasing facilities or providing other services must be considered. Also, cleaning services may have limited time between the end of the school day and the beginning of evening activities.

- School food service. Factors to be considered include whether later start times would require a change in meal times or the addition of breakfast services. Such service changes may be further complicated by related issues such as the level of service provided by school cafeterias (onsite versus offsite food preparation), auxiliary use of kitchen facilities for other community programs (such as Meals on Wheels or child care programs) and the adaptability of food service workers to time changes. (Wahlstrom and Freeman, 1997)

- Employment of adolescents. Based on interviews with employers of high school students (Wahlstrom and Freeman, 1997), the number of hours available for teens to work would not be significantly affected, although some accommodations for after-school schedules might need to be made by employers. However, child labor laws that restrict the number of hours and time of day that adolescents are permitted to work need to be studied in relation to school hours.

- Safety issues related to daylight and darkness. A significant issue in school schedule discussions is the impact on safety for both students and others in the community. This can be reviewed from several perspectives and with regard to all school levels. First is the amount of daylight throughout the school year during the time that students are commuting to and from school. Many who advo-

cate for older students to begin their school days earlier than younger students (e.g., grade school) base their preference on the belief that older, more self-sufficient children walking to school or waiting for school buses in morning darkness is safer than similar commutes by younger students, for example.



What time should high school students start school to best accommodate their internal sleep clock? Scientists hesitate to recommend a "perfect" start time for optimal learning in high school. They would be likely, however, to parallel the preferences of teachers who had made the shift to later start time: when asked what would be an ideal start time, nearly 73 percent of Minneapolis high school teachers said 8 am or later. (Interestingly, teachers' responses were more evenly divided on other survey questions, such as whether they liked the later start time in general and how they felt the time change affected their personal life and their effectiveness as a teacher.

- Criminal and other risky behaviors. The hours shortly after school appear to be a critical time for assessing safety risks among adolescents. "Latch-key students," or those who return home from school to an empty house, are more prone to risky behaviors during this time than their peers who have supervision at home. (Carnegie Foundation, 1996)

  National studies and analysis of data from the Federal Bureau of Investigation reveal that on school days, 45 percent of juvenile violent crime takes place between 2:00 pm and 8:00 pm, with the sharpest rise occurring between 2:00 pm and 4:00 pm. (Wahlstrom and Freeman, 1997; CSPV, 1998)

  During these times, unsupervised adolescents are more likely to engage in acts of violence, as well as sex and recreational use of alcohol or drugs. Proponents of delayed high school start times suggest that the resultant delayed school closing times could limit the amount of time that adolescents are unsupervised after school.

- Impact on the family. Research on the degree to which changing school start times or making other changes in the schedules and behaviors of adolescents impacts family members is limited and largely anecdotal. The effects vary widely, depending on family composition, socioeconomic status, cultural background and values and other factors.

Issues to consider when assessing the potential impact on the family when changing school start times include the contributions of the adolescent to the care of younger siblings or other household members, preparing meals or handling other household chores, transportation needed and used by the adolescent as well as other household members (e.g., sharing the use of an automobile) and the level of dependence on income generated by the teen.

Household members would theoretically benefit indirectly from the positive effects of improved sleep patterns and behaviors on the adolescent, such as improved moods, behavior and interactions with others.

References

Carnegie Foundation Council on Adolescent Development, 1996.

Center for the Study and Prevention of Violence (CSPV). Youth Violence: A Public Health Concern. Fact Sheet 9. June 1999.

Fairfax County Public Schools. Report of the task force to study high school opening times. 1998.

Wahlstrom, KL and Freeman CM. School Start Time Study: Final Report Summary. The Center for Applied Research and Educational Improvement, College of Education and Human Development, University of Minnesota. 1997.

The Z's to A's Act

A bill introduced in Congress by U.S. Representative Zoe Lofgren (D-CA) to encourage later school start times for secondary students.

106th CONGRESS / 1st Session
H.R. 1267

To provide grants to local educational agencies that agree to begin school for secondary students after 9:00 in the morning.

IN THE HOUSE OF REPRESENTATIVES

March 24, 1999

Ms. LOFGREN introduced the following bill; which was referred to the Committee on Education and the Workforce.

A BILL

To provide grants to local educational agencies that agree to begin school for secondary students after 9:00 in the morning.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE

This Act may be cited as the 'Z's to A's Act'.

SEC. 2. PROGRAM AUTHORIZATION.

(a) IN GENERAL — The Secretary of Education is authorized to provide a grant of not more than $25,000 to each local educational agency that agrees to begin school for secondary students after 9:00 in the morning.

(b) ELIGIBILITY — To be eligible to receive a grant under this section, a local educational agency shall submit an application to the Secretary providing assurances that —

(1) at the time of the application, secondary schools served by the local educational agency begin school before 9:00 in the morning; and

(2) not later than 2 years after the date of submission of the application, secondary schools served by such agency shall begin classes after 9:00 in the morning.

(c) USES OF FUNDS — A local educational agency that receives a grant under this Act may use such grant funds to pay for the administrative and operating costs associated in changing the hours of operation of secondary schools served by such agency.

(d) DEFINITIONS — For purposes of this Act —

(1) the term 'secondary school' has the same meaning given such term in section 14101(25) of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 8801(25)); and

(2) the term 'Secretary' means the Secretary of Education.

Drowsy Driving Report

- It is difficult to attribute crashes to sleepiness because there is no test to determine its presence as there is for intoxication (i.e., a "breathalyzer"). In addition, there are no standardized criteria for determining driver sleepiness and there is little or no police training in identifying drowsiness crash factors. Also, to date, six states (Alabama, Missouri, Arkansas, Delaware, Massachusetts, and Wisconsin) do not have a code for sleepiness on their crash report forms.

- The U.S. National Highway Traffic Safety Administration (NHTSA) estimates that approximately 100,000 police-reported crashes annually (about 1.5% of all crashes) involve drowsiness/fatigue as a principal causal factor. A conservative estimate of related fatalities is 1,500 annually or 4% of all traffic crash fatalities. At least 71,000 people are injured in fall-asleep crashes each year. NHTSA estimates these crashes represent $12.5 billion in monetary losses each year.

- Drowsiness/fatigue may play a role in crashes attributed to other causes. About one million crashes annually — one-sixth of all crashes — are thought to be produced by driver inattention/lapses. Sleep deprivation and fatigue make such lapses of attention more likely to occur.

- In a 1999 NSF poll, 62% of all adults surveyed reported driving a car or other vehicle while feeling drowsy in the prior year. Twenty-seven percent reported that they had, at some time, dozed off while driving. Twenty-three percent of adults stated that they know someone who experienced a fall-asleep crash within the past year.

- People tend to fall asleep more on high-speed, long, boring, rural highways. New York police estimate that 30% of all fatal crashes along the New York Thruway occurred because the driver fell asleep at the wheel.

Who Is Most At Risk?

All drivers who are:

- Sleep-deprived or fatigued
- Driving long distances without rest breaks
- Driving through the night, the early afternoon, or at other times when they are normally asleep
- Taking medication that increases sleepiness or drinking alcohol
- Driving alone
- Driving on long, rural, boring roads
- Frequent travelers, e.g., business travelers

YOUNG PEOPLE

Sleep-related crashes are most common in young people, who tend to stay up late, sleep too little, and drive at night. In a North Carolina state study, 55% of fall-asleep crashes involved people 25 years old or younger. 78% were males. The peak age of occurrence was 20.

SHIFT WORKERS

25 million Americans are rotating shift workers. Studies suggest that 20% to 30% of those with non-traditional work schedules have had a fatigue-related driving mishap within the last year. The drive home from work after the night shift is likely to be a particularly dangerous one.

COMMERCIAL DRIVERS

Truck drivers are especially susceptible to fatigue-related crashes. In addition to the high number of miles driven each year, many truckers may drive during the night when the body is sleepiest. Truckers may also have a high prevalence of a sleep and breathing disorder called sleep apnea. Studies suggest truck driver fatigue may be a contributing factor in at least 30 to 40 percent of all heavy truck accidents.

PEOPLE WITH UNTREATED SLEEP DISORDERS

The presence of an untreated sleep disorder increases the risk of crashes. Disorders such as sleep apnea, narcolepsy, and periodic limb movement disorder, all of which frequently lead to excessive daytime sleepiness, afflict an estimated 30 million Americans. Most people with sleep disorders remain undiagnosed and untreated.

What Are Effective Countermeasures?

Before motorists embark on their trips, they should:

- Get a good night's sleep. While this varies from individual to individual, the average adult requires about 8 hours of sleep a night; adolescents need 8.5 to 9.25 hours each night.
- Plan to drive long trips with a companion. Passengers can help look for early warning signs of fatigue or switch drivers when needed. Passengers should stay awake to talk to the driver.
- Schedule regular stops, every 100 miles or 2 hours.
- Avoid alcohol and medications (over-the-counter and prescribed) that may impair performance. Alcohol interacts with fatigue; increasing its effects — just like drinking on an empty stomach.
- Consult your physician or a local sleep disorders center for diagnosis and treatment if you suffer frequent daytime sleepiness, have difficulty sleeping at night often, and/or snore loudly every night.

Once driving, motorists should look for the following warning signs of fatigue:

- You can't remember the last few miles driven.
- You drift from your lane or hit a rumble strip.
- You experience wandering or disconnected thoughts.
- You yawn repeatedly.
- You have difficulty focusing or keeping your eyes open.
- You tailgate or miss traffic signs.
- You have trouble keeping your head up.
- You keep jerking your vehicle back into the lane.

If you are tired, recognize that you are in danger of falling asleep and cannot predict when a microsleep may occur.

- Don't count on the radio, open window or other "tricks" to keep you awake.
- Respond to symptoms of fatigue by finding a safe place to stop for a break.
- Pull off into a safe area away from traffic and take a brief nap (15 to 45 minutes) if tired.
- Drink coffee or another source of caffeine to promote short-term alertness if needed. (It takes about 30 minutes for caffeine to enter the bloodstream.)

Minnesota Medical Association Resolutions: Models for Change

The Minnesota Medical Association (MMA) has been a catalyst for policy changes regarding school start times and education related to driving and fatigue. MMA has demonstrated the impact that applying sound policies based on scientific evidence can have on local, statewide, and national levels.

School Start Times

In 1993, the Minnesota Psychiatric Society submitted a resolution entitled Sleep Deprivation in Adolescents to the Minnesota Medical Association. MMA subsequently passed the resolution, which provided for an educational campaign "explaining the need for more sleep during adolescence than during childhood, the biological shift to a later sleep pattern in adolescence, and the impact of inadequate sleep on driving safety and school performance. The MMA will urge local school districts to eliminate early starting hours of school for teenagers."

This resolution led to the nation's first school district (Edina, Minnesota) to adopt delayed school start times based on scientific evidence of physiological changes in sleep needs and patterns associated with puberty. This landmark decision opened the doors to additional research about sleep in adolescents and its impact on their cognitive and other functions, and sparked heightened public awareness about this issue across the United States.

Drowsy Driving

On September 28, 1999, the Minnesota Medical Association adopted two sleep-related resolutions highlighting the dangers of drowsy driving. Similar language was submitted to the American Medical Association (AMA) for consideration by its House of Delegates at the 1999 Interim Meeting. AMA consequently adopted Resolution 418 (I-99) with slight modifications.

RESOLUTION 314

RESOLVED, that the Minnesota Medical Association define sleepiness behind the wheel as a major public health issue through the development of a public education campaign, and be it further

RESOLVED, that the Minnesota Medical Association delegation to the American Medical Association (AMA) submit a resolution to the AMA calling on the AMA to define sleepiness behind the wheel as a major public health issue through the development of a national public education campaign.

RESOLUTION 315

RESOLVED, that the Minnesota Medical Association work with interested organizations to promote the incorporation of an educational component on the dangers of driving while sleepy in all drivers education (for all age groups) in the state of Minnesota, and be it further

RESOLVED, that the Minnesota Medical Association delegation to the American Medical Association (AMA) submit a resolution to the AMA calling on the AMA to encourage all state medical associations to promote the incorporation of an educational component on the dangers of driving while sleepy in all drivers education (for all age groups) in each state.

American Medical Association House Of Delegates Resolution 418: Sleepy Driving

INTRODUCED BY: Minnesota Delegation
REFERRED TO: Reference Committee D — Public Health (Willarda Edwards, MD, Chair)

The following incorporates amendments as adopted by the AMA House of Delegates, December 1999. Source: Preliminary reports of the AMA House of Delegates at its 1999 Interim Meeting. AMA cautions that such reports should not be considered final and that only the Official Proceedings of the House of Delegates reflect official policy of the association.

Whereas, Motor vehicle crashes are a leading cause of injury and death in the United States; and

Whereas, The safe operation of a motor vehicle requires alertness as well as quick and accurate perception, judgment, and action; and

Whereas, Analyses performed by the National Highway Traffic Safety Administration (NHTSA) estimate that 1%-3% of U.S. highway crashes and 4% of fatal motor vehicle crashes are caused by driver sleepiness; and

Whereas, Surveys indicate that many individuals have experienced excessive sleepiness while driving, while 60% of sleep-related crashes are attributable to drivers younger than 30; and

Whereas, The reasons for sleepiness in drivers include sleep disorders (e.g., obstructive sleep apnea), sleep deprivation, and cumulative sleep loss; and

Whereas, Physicians have an important role in preventing sleep-related injuries and deaths by assessment and follow-up of excessive sleepiness in their patients and discussion of possible health and safety implications; and

Whereas, Physicians should be alert to the possibility that patients may be impaired by alcoholism and other medical conditions that can affect driving capabilities; and

Whereas, Physicians need to understand the range of sleep disorders, including their diagnosis, treatment, and consequences; and

Whereas, Many drivers, without impact, instinctively open the windows, turn up the radio, and/or drink caffeine to fight sleepiness while driving; and

Whereas, Drivers education courses provide an important opportunity to teach new drivers about the dangers of driving while sleeping; and

Whereas, Educational campaigns to emphasize the fact that sleep is a biological imperative and that sleepiness is neither a minor annoyance nor the sign of a personality defect are recommended to address sleepiness while driving; therefore be it

RESOLVED, That the American Medical Association define sleepiness behind the wheel as a major public health issue and encourage a national public education campaign by appropriate federal agencies and relevant advocacy groups, and be it further

RESOLVED, That the American Medical Association encourage all state medical associations to promote the incorporation of an educational component on the dangers of driving while sleepy in all drivers education classes (for all age groups) in each state.

Other Resources

Readers are encouraged to review the references listed in the *Research Report* and in the *Resource Guide*, as well as the resources below. Please note that the following lists are intended to serve as a starting point for additional information and do not represent an exhaustive list of available resources.

Organizations

AAA Foundation for Traffic Safety
1440 New York Avenue, NW
Suite 201
Washington, DC 20005-6001
www.aafts.org

American Academy of Child & Adolescent Psychiatry
3615 Wisconsin Ave., NW
Washington, DC 20016-3007
www.aacap.org

American Academy of Pediatrics
141 Northwest Point Boulevard
Elk Grove Village, IL 60007-1098
www.aap.org/family/sleep.htm

American Academy of Sleep Medicine
6301 Bandel Road
Suite 101
Rochester, MN 55901
www.aasm.org

American Association of School Administrators
1801 N. Moore Street
Arlington, VA 22209
www.aasa.org

American School Health Association
7263 State Route 43
P.O. Box 708
Kent, OH 44240-0013
www.ashaweb.org/

Board on Children Youth, and Families
National Academy of Sciences
Institute of Medicine
2101 Constitution Avenue, HA 156
Washington, DC 20418
www.national-academies.org/cbsse/bocyf

Center for Applied Research and Educational Improvement
College of Education & Human Development
265-2 Peik Hall
159 Pillsbury Drive SE
University of Minnesota
Minneapolis, MN 55455-0208
http://carei.coled.umn.edu

Department of Adolescent and School Health (DASH)
National Center for Chronic Disease Prevention and Health Promotion
Centers for Disease Control and Prevention
1600 Clifton Road, NE
Atlanta, GA 30333
www.cdc.gov/nccdphp/dash

Insurance Institute for Highway Safety
1005 N. Glebe Road, Suite 800
Arlington, VA 22201
www.iihs.org
www.hwysafety.org

Minnesota Medical Association
Suite 300 Broadway Place East
3433 Broadway Street NE
Minneapolis, MN 55413
www.mnmed.org/

National Association of School Nurses, Inc.
P.O. Box 1300
Scarborough, ME 04070
www.nasn.org

National Center on Sleep Disorders Research
National Heart, Lung, and Blood Institute
National Institutes of Health
9000 Rockville Pike, Building 31
Bethesda, MD 20892
www.nhlbi.nih.gov/about/ncsdr/index.htm

National Center for Injury Prevention and Control
4770 Buford Highway, NE
Atlanta, GA 30341-3724
www.cdc.gov/ncipc

National Education Association
1201 16th Street NW, Suite 521
Washington, DC 20036
www.nea.org

National Highway Traffic Safety Administration
400 Seventh Street SW
Washington, DC 20590
www.nhtsa.dot.gov

National Parent Teacher Association
330 N. Wabash Avenue
Chicago, IL 60611
www.pta.org

National School Boards Foundation, Inc.
1680 Duke Street
Alexandria, VA 22314
www.nsbf.org

National Sleep Foundation
1522 K Street, NW
Suite 500
Washington, DC 20005
www.sleepfoundation.org

Parents Against Tired Truckers
P.O. Box 209
Lisbon Falls, ME 04252-0209
www.patt.org

Society for Adolescent Medicine
1916 NW Copper Oaks Circle
Blue Springs, MO 64015
www.adolescenthealth.org/

Students Against Destructive Decisions
101 Depot Road
Chatham, MA 02688

U.S. Department of Health and Human Services
Division of Children and Youth Policy
200 Independence Avenue, SW
Washington, DC 20201
http://aspe.os.dhhs.gov/hsp/cyphome.htm

Web Resources

See also Website addresses under "Organizations."

Adolescence Directory On-Line
A service of the Center for Adolescent Studies at Indiana University, this site provides information for professionals, parents, and teens about a wide range of adolescent issues.
http://www.education.indiana.edu/cas/adol/adol.html

AMA Adolescent Health On-Line
Sponsored by the American Medical Association, this site includes details about the AMA Guidelines for Adolescent Preventive Services (GAPS); abstracts of selected recent reports and other resources.
http://www.ama-assn.org/adolhlth

Education Resource Organizations Directory
Published by the U.S. Department of Education this directory is intended to help users identify and contact organizations that provide information and assistance on a broad range of education-related topics.
http://www.ed.gov/Programs/EROD/

FamilyEducation Network
Sponsored by a consortium of public sector and private sector relationships — including major educational and professional associations — this online company provides educational and child-development resources and services for families, corporate employers, schools and communities. The National Parent Teacher Association's exclusive Internet partner promoting family involvement, FamilyEducation Network produces familyeducation.com, teachervision.com, myschoolonline.com, and infoplease.com.
www.familyeducation.com

Sleep Home Pages
Funded in part by a grant from the National Institute of Mental Health, this Website offers a comprehensive resource of sleep-related information for consumers, researchers, educators, students and clinicians. www.sleephomepages.org

Sleep from A to Zzz
Developed by an international group of adolescents, this site covers a wide range of sleep-related information for teens and earned a Silver Award in the 1999 ThinkQuest Internet Challenge, Sports & Health Category. http://www.thinkquest.org/library/25553.shtml

Youth Info
A project of the U.S. Department of Health and Human Services, this site includes a "fact sheet" profile of America's youth; full texts or summaries of various reports, publications, and speeches from governmental and non-governmental sources; grant information and other resources. http://youth.hhs.gov

National Sleep Foundation
1522 K Street, NW, Suite 500, Washington, DC 20005
Tel 202.347.3471, Fax 202.347.3472
E-mail nsf@sleepfoundation.org