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National Highway
Traffic Safety
Administration

The NHTSA & NCSDR Program to Combat Drowsy Driving

A Report to Congress on the Collaboration Between the National Highway Traffic Safety Administration (NHTSA) and the National Center on Sleep Disorders Research (NCSDR)

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The NHTSA & NCSDR Program to Combat Drowsy Driving

Report to the House and Senate Appropriations Committees Describing Collaboration Between National Highway Traffic Safety Administration and National Center on Sleep Disorders Research National Heart, Lung and Blood Institute National Institutes of Health

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NHTSA & NCSDR Program to Combat Drowsy Driving

Report to the House and Senate Appropriations Committees
Describing Collaboration Between
National Highway Traffic Safety Administration
and
National Center on Sleep Disorders Research
National Heart, Lung and Blood Institute
National Institutes of Health

In 1996, the National Highway Traffic Safety Administration (NHTSA) embarked on a congressionally mandated effort to develop educational countermeasures to the effects of fatigue, sleep disorders, and inattention on highway safety. In collaboration with National Center on Sleep Disorders Research (NCSDR), the program established three main components: a workplace education program for shift workers to reduce the incidence of drowsy driving, a school-based program for high-schools to increase students' awareness of the dangers of drowsy driving, and an in-vehicle data-collection effort to obtain driver and vehicle performance measures of real-life inattention events.

The Committee on Appropriations of the U.S. Senate, in Senate Report 104-325 on the Department of Transportation and Related Agencies Appropriations Bill, 1997, directed NHTSA to report to the House and Senate Appropriations Committees describing the collaborative efforts and funding activities between NHTSA and the NCSDR. In addition to providing the requested information, this report provides an overview of and status report on the agencies' development, implementation, and evaluation activities.

Legislative History

The following paragraphs provide the text of the Appropriations Committee Conference Reports from fiscal years 1996 and 1997, which guided the development of NHTSA's fatigue education program.

FY 1996 Report Language

*"**Driver fatigue and inattention.** — NHTSA data indicate that in recent years there have been about 56,000 crashes annually in which driver drowsiness/fatigue was cited by police. An annual average of roughly 40,000 nonfatal injuries and 1,550 fatalities result from these crashes. It is widely recognized that these statistics under report the extent of these types of crashes. These statistics also do not deal with crashes caused by driver inattention, which is believed to be a larger problem. The Committee maintains that NHTSA has not devoted sufficient resources to understanding and dealing with the role of driver fatigue, sleep disorders, and inattention in highway safety.*

Consequently, the Committee's allowance includes $1,000,000 to analyze the role of these problem areas in highway crashes; to develop and test appropriate educational countermeasures; and to develop a strategy and lay the foundation for a public information campaign using a variety of media and approaches. These activities will be conducted in close cooperation with the National Center on Sleep Disorders Research. In planning this initiative, NHTSA should include an assessment of public knowledge and behavior before and after the implementation of the public information campaign. The Committee intends to recommend additional funds for completion of the campaign and its evaluation in the future. The funds recommended above are in addition to any support for studies conducted under the ITS program."

FY 1997 Report Language

*"**Driver fatigue.** — The conference agreement includes $1,000,000 to analyze the role of driver fatigue, sleep disorders, and inattention. NHTSA should collaborate directly with the National Center on Sleep Disorders Research to conduct and assess public information activities in these three areas and submit a report to the House and Senate Appropriations Committees by May 1, 1997 that describes these collaborative efforts."*

Program Overview

In order to comply with the mandates issued in the FY 1996 and FY 1997 appropriations bills, NHTSA established a coordinated program of research and development comprising the seven component projects listed in Table 1. Although the appropriations language did not specify a schedule, staff endeavored to speed the development process so that it would produce actual program materials within two years. To accelerate the initiation of actual program development work, NHTSA established all projects through cooperative agreements, interagency agreements, and task orders under existing indefinite-quantity contracts.

Table 1.
Project Objectives and Statistics

Project	Objectives	Amount Start Date Duration	Participants
Analyze role of fatigue, sleep disorders, & inattention (FSDI) in highway crashes	• Describe characteristics of FSDI crashes • Identify subgroups most at risk	$130,000 8/14/96 30 mo	National Center on Sleep Disorders Research
Investigate instances of fatigue-related events in motor-vehicle operation	• Observe drivers during fatigue-related inattention incidents • Establish characteristics of inattention	$100,000 9/23/96 24 mo	NHTSA Vehicle Research and Test Center
Develop and test educational countermeasures for fatigue-related highway crashes	• Specify target populations • Determine message themes (content) • Establish motivational approaches • Establish dissemination strategies	$175,000 6/26/96 30 mo	Harvard Univ. School of Public Health
Develop strategy and lay foundation for education and information campaign	• Determine campaign objectives & target audience • Determine content, strategy, & media mix • Prepare and test draft materials • Refine materials	$325,000 9/20/96 30 mo	Global Exchange, Inc.
Promulgate the educational program to implementation sites	• Identify communities, organizations and associations that serve appropriate target group constituencies • Create interest in program implementation • Award competitive grants to support implementation activities • Provide program materials to implementors	$271,000 9/26/97 24 mo	Global Exchange (materials production & program administration)
		$200,000 fall 98 6-12 mo	To be Arranged (grants to implementors)
Evaluate information and education campaign to combat fatigue-related highway crashes	• Determine appropriate outcome measures & evaluation design • Choose evaluation sites • Collect pre- & post-campaign data • Evaluate campaign • Recommend revisions	$516,000 9/1/97 30 mo	Systems Assessment and Research, Inc.
Conduct supplementary implementation activities for youth audiences	• Adapt campaign themes for use in ongoing educational programs for target audiences • Produce and disseminate supplementary materials through appropriate channels to reach target audience	$234,000 (9/15/97) 12 mo	National Center on Sleep Disorders Research

NHTSA established several principles to guide the design of the program:

- *Qualitative Focus.* The focus of the program should be on qualitative aspects of the problem (Who is involved? How can they be reached?). Staff concluded that refining quantitative estimates of the proportion of traffic crashes due to fatigue would not contribute substantially to the development of a public-education program and would consume resources that could otherwise be devoted to program development.

- *Social Marketing Approach.* The program should follow the social-marketing model to ensure a successful educational program by establishing a thorough understanding of the target populations' level of knowledge, concerns about the issue, and desires for change.

- *Integrated Evaluation.* The evaluation efforts should be integrated with the campaign development to ensure that the educational objectives can be evaluated and to embed the required data collection and process monitoring into the operation of the program.

- *Implementation Support.* The program should make funds available to implementors to provide incentives for participants to adopt program recommendations and to support data-collection and process-monitoring activities that would not normally be associated with program adoption.

These guidelines provided the structure for a program-development process that focused resources on issues that had the support of the extended sleep-research community, concerned a significant and identifiable population, and would be amenable to educational countermeasures.

Detailed Project Descriptions

The following sections describe in greater detail each of the component projects listed in Table 1. While NHTSA staff determined the general approach and the nature of each project, the ultimate shape of the program became the product of a development team comprising key personnel from each

individual project and staff from NHTSA and NCSDR. As in all complex program development efforts, various components of this program overlap in both time and content. For example, the development of the program evaluation must necessarily coincide with the development of the program objectives and materials. By working collaboratively and collegially, the development team has seamlessly integrated the development of each program component at each stage of development.

Analyze Role of Fatigue, Sleep Disorders, & Inattention (FSDI) in Highway Crashes

NHTSA established an interagency agreement with the NCSDR, an agency of the NIH that is organizationally located within the National Heart, Lung, and Blood Institute (NHLBI), using FY 1996 funds to convene a panel of experts to guide the development of the educational program. A roster of the panel members is provided as Attachment 1.

The panel of experts reviewed the literature on fatigue-related crashes and produced a 36-page report covering the biology of human sleep and sleepiness, characteristics of drowsy-driving crashes, risk factors for drowsy-driving crashes, population groups at highest risk, countermeasures, and recommendations for an educational campaign.

In addition to the guidance provided by the panel's report, the NCSDR selected a steering committee from among the members of the panel to provide oversight of the program development effort and to participate with the development team in making critical decisions affecting program direction.

The expert panel report was published as a joint DOT/NIH report (DOT HS 808 707) in April, 1998 and distributed by both NHTSA and the NCSDR. The report is also available electronically on each agency's web site. The copy at *www.nhtsa.dot.gov/people/perform/human/Drowsy.html* can be read directly from the browser. The copy at *www.nhlbi.nih.gov /nhlbi/sleep/prof drsy_drv.htm* preserves the appearance of the original and must be downloaded and viewed using the Adobe Acrobat Reader.

The subsequent paragraphs are extracted from the executive summary of the panel's report .

Biology of Human Sleep and Sleepiness

Sleep is a neurobiologic need with predictable patterns of sleepiness and wakefulness. Sleepiness results from the sleep component of the circadian cycle of sleep and wakefulness, restriction of sleep, and/or interruption or fragmentation of sleep. The loss of one night's sleep can lead to extreme short-

term sleepiness, while habitually restricting sleep by 1 or 2 hours a night can lead to chronic sleepiness. Sleeping is the *only* way to reduce sleepiness. Sleepiness causes auto crashes because it impairs performance and can ultimately lead to the inability to resist falling asleep at the wheel. Critical aspects of driving impairment associated with sleepiness are reaction time, vigilance, attention, and information processing.

Characteristics of Drowsy-Driving Crashes

Subjective and objective tools are available to approximate or detect sleepiness. However, unlike the situation with alcohol-related crashes, no blood, breath, or other measurable test is currently available to quantify levels of sleepiness at the crash site. Although current understanding largely comes from inferential evidence, a typical crash related to sleepiness has the following characteristics:

- The problem occurs during late night/early morning or late afternoon.
- The crash is likely to be serious
- The crash involves a single vehicle leaving the roadway.
- The crash occurs on a high-speed road.
- The driver does not attempt to avoid the crash.
- The driver is alone in the vehicle.

Risk Factors for Drowsy-Driving Crashes

Although evidence is limited or inferential, chronic predisposing factors and acute situational factors recognized as increasing the risk of drowsy driving and related crashes include:

- Sleep loss.
- Driving patterns, including driving between midnight and 6 a.m.; driving a substantial number of miles each year and/or a substantial number of hours each day; driving in the late afternoon hours (especially for older persons); and driving for longer times without taking a break.
- Use of sedating medications, especially prescribed anxiolytic hypnotics, tricyclic antidepressants, and some antihistamines.

- Untreated or unrecognized sleep disorders, especially sleep apnea syndrome (SAS) and narcolepsy.

- Consumption of alcohol, which interacts with and adds to drowsiness.

These factors have cumulative effects; a combination of them substantially increases crash risk.

Population Groups at Highest Risk

Although no driver is immune, three broad population groups are at highest risk, based on evidence from crash reports and on self-reports of sleep behavior and driving performance. These groups are:

- Younger people (ages 16 to 29), especially males.

- Shift workers whose sleep is disrupted by working at night or working long or irregular hours.

- People with untreated sleep apnea syndrome (SAS) and narcolepsy.

Countermeasures

To prevent drowsy driving and its consequences, Americans need information on approaches that may reduce their risks.

- The public needs to be informed of the benefits of specific behaviors that help avoid becoming drowsy while driving. Helpful behaviors include (1) planning to get sufficient sleep, (2) not drinking even small amounts of alcohol when sleepy, and (3) limiting driving between midnight and 6 a.m. As soon as a driver becomes sleepy, the key behavioral step is to stop driving—for example, letting a passenger drive or stopping to sleep before continuing a trip. Two remedial actions can make a short-term difference in driving alertness: taking a short nap (about 15 to 20 minutes) and consuming caffeine equivalent to two cups of coffee. The effectiveness of any other steps to improve alertness when sleepy, such as opening a window or listening to the radio, has not been demonstrated.

- A more informed medical community could help reduce drowsy driving by talking to patients about the need for adequate sleep, an important behavior for good health as well as drowsy-driving prevention. The detection and management of illnesses that can cause sleepiness, such as

SAS and narcolepsy, are other health care-related countermeasures.

- Information could be provided to the public and policymakers about the purpose and meaning of shoulder rumble strips, which alarm or awaken sleepy drivers whose vehicles are going off the road. These rumble strips placed on high-speed, controlled-access, rural roads reduce drive-off-the-road crashes by 30 to 50 percent. However, rumble strips are not a long-term solution for sleepy drivers: any wake-up alert is an indication of impairment—a signal to stop driving and get adequate sleep before driving again.

- Employers, unions, and shift work employees need to be informed about effective measures they can take to reduce sleepiness resulting from shift work schedules. Counter-measures include following effective strategies for scheduling shift changes and, when shift work precludes normal nighttime sleep, planning a time and an environment to obtain sufficient restorative sleep.

Panel Recommendations for an Educational Campaign

To assist the educational campaign in developing its educational initiatives, the panel recommended the following three priority areas:

1. Educate young males (ages 16 to 24) about drowsy driving and how to reduce lifestyle-related risks.

2. Promote shoulder rumble strips as an effective counter-measure for drowsy driving; in this context, raise public and policymaker awareness about drowsy-driving risks and how to reduce them.

3. Educate shift workers about the risks of drowsy driving and how to reduce such risks.

The panel also identified complementary messages for educational campaigns and called for the active involvement of other organizations to promote sufficient sleep—as a public health benefit as well as a means to reduce the risk of fall-asleep crashes.

Investigate Instances of Fatigue-related Events in Motor-vehicle Operation

This project was designed to fill two needs: to obtain graphic representations of drowsy drivers in real-world situations and to document instances of driver inattention separate from drowsiness. To these ends, NHTSA's Vehicle Research and Test Center (VRTC) has conducted a program of research that involved installation of an unobtrusive, portable data acquisition system called Micro-DAS into the private vehicles of 10 paid volunteer test participants. The test participants spanned a range of college students, shift workers, and military personnel on leave, i.e., populations thought to be at high risk for drowsy driving. In addition to using their privately owned vehicles, the test participants were observed while making trips of their own choosing rather than routes provided by the researchers. The data collection periods varied from 2 weeks for a shift worker to a long weekend for a military person on a long-distance trip while on weekend leave. Micro-DAS instrumentation included video of the road scene, video of the driver's face to capture eye glance and eye closure data, as well as numerous engineering measures such as steering wheel inputs, travel speeds, braking events, and lane position.

The study produced over 100 hours of real-time driver and vehicle data. Because all data was digitally recorded, targeted events can be identified and analyzed using automated procedures.

Analysis of this data is currently being completed by VRTC. Periods of drowsy driving are being identified by means of a NHTSA-sponsored drowsy driver detection system algorithm and verified by observed eye closure data. The algorithm uses engineering measures of steering inputs and lane-keeping to predict drowsy driving periods. These are then verified by measures of eye closure during those same periods. Since visual inattention can give rise to similar disruptions in steering behavior and lane-keeping, driver eyes-off-road glances will be analyzed to determine the extent to which the algorithm might be able to detect distracted or inattentive driving, apart from drowsy driving periods. This work will contribute valuable real-world data to an assessment of drowsy driving and inattentive driving.

Preliminary analyses have identified several dramatic examples of both sleepiness-related and non-sleepiness-related inattention. A full report of this study is expected in early 1999. Videos from this study will be incorporated into the educational program to provide dramatic illustration of events

related to drowsy driving and inattention. These videos and associated vehicle data will also be made available to investigators who wish to establish similarities among and differences between events resulting in driver inattention.

Develop and Test Educational Countermeasures for Fatigue-related Highway Crashes

NHTSA established a cooperative agreement with the Harvard School of Public Health to create the research foundation for the public education program. Accordingly, Harvard's project staff attended the meetings of the NCSDR expert panel and used the recommendations of the panel to plan and execute a series of focus groups to explore the educational needs and motivational approaches of the two potential target populations recommended by the expert panel: young males and shift workers.

Project staff conducted a total of eight focus group discussions in two cities (San Diego, CA, and Memphis, TN) with members of two potential target groups (young males and shift workers).

- *Young male* group members showed a variety of levels of education and types of employment, but were nearly unified in their attitudes about sleep and drowsy driving. The young males reported sleeping between 5 and 7 hours per night and were aware that drowsiness was a hazard when driving. However, they seemed to accept these risks as part of their chosen lifestyle, and appeared to be unwilling to change either their sleep routines or their driving behavior.

- *Shift workers* reported getting less sleep than the young males (4-6 hours per 24 hour period), with sleep being fragmented into two or more occasions. Shift workers were acutely aware of the risks of driving when sleepy, many of them having had personal experiences with falling asleep when driving home and not remembering substantial parts of the trip. In contrast to the young males, shift workers seemed eager to learn how to improve their sleep and appeared to be motivated to change their routines if they could be more rested as a result. However, many expressed frustration with factors "beyond their control" that interfered with their getting adequate and restful sleep.

Based on the apparent intractability of the young male group and the high level of interest in change shown by the shift workers, the development team recommended to the steering committee that the program should target shift workers. Some members of the steering committee, acknowledging the

difficulty of achieving results with young males, nevertheless expressed concern that young males constituted the bulk of the problem and were given highest priority by the expert panel. The steering committee and the development team agreed to defer target group selection until more information could be obtained regarding program implementation in the work place and acceptance by shift work employees and supervisors.

Accordingly, a second round of focus groups, conducted in Framingham, MA, and Atlanta, GA, gathered information from shift workers and shift-work supervisors. The participants in these groups confirmed the findings of the earlier groups and revealed a number of areas in which shift workers feel "forgotten" by management:

- *Food Service.* Cafeterias are closed, leaving vending machines as the only source of snack foods. Furthermore, night workers reported that these machines are usually restocked during the day and depleted of choice items by the time their shifts begin.

- *Meetings.* Meetings and training sessions are usually scheduled during the day shift, so night shift workers must arrive early or stay past their normal working hours to attend these meetings.

- *Lighting.* Some employers reduce lighting levels during night shifts, making it more difficult for workers to stay alert. Employees of hospitals and power companies were the most vocal about this issue.

Discussions with shift-work supervisors indicated that supervisors have the same concerns as the staff they supervise. Many supervisors make ad-hoc adjustments to company policy to accommodate the needs of their staff, but all agreed that changing official policies would be difficult, if not impossible.

To get some idea of how upper management would respond to suggestions for changing the work environment and company policies to accommodate the needs of shift workers, project staff conducted one-on-one telephone interviews with over a dozen executives. Most executives represented companies or organizations that had expressed interest in traffic safety in general and drowsy driving of shift workers in particular. They had numerous suggestions for ways in which employers could be involved in providing some assistance to shift workers.

Based on these studies, project staff recommended to the steering committee that the educational program should specifically target shift workers, recognizing that some portion of the shift-work population would be young males.

The program should provide information on how shift workers could improve both the amount and the quality of their sleep, including recommendations for changing sleep schedules, use of sleep aids such as room-darkening shades or white-noise machines, exercise and nutrition programs, and changes to the work environment. The program should appeal to the shift worker's natural desire to feel more rested. Information should be provided through a variety of media and channels, including safety training sessions, posters in the workplace, flyers and brochures (perhaps included with pay stubs), and a short video for employees to take home to watch with their families. Employers should be encouraged to participate by providing information regarding the general effects of drowsiness on productivity and more specifically, the lost productivity resulting from injuries caused by traffic crashes.

The steering committee approved the focus on shift workers.

Develop Strategy and Lay Foundation for Education and Information Campaign

NHTSA issued a task order to Global Exchange, Inc., to cover the development and production of camera-ready materials for all program elements, including educational materials and administrative and implementation guidelines.

The focus of this project is to develop materials for both shift workers and their employers. Materials will contain information on methods to improve the quality of sleep the shift worker currently gets, thereby lowering the probability of the worker being involved in a crash due to sleepiness. These materials will also provide information on how to change work and home environments, as well as life-style choices, to improve the quality of sleep.

Materials will include brochures, posters, paycheck stuffers, an educational video, and scripts for safety meetings. Specific messages may cover issues such as quality of life, productivity, consequences of drowsy driving, and general sleep education. Since the major communications channel with shift workers is anticipated to be through employers, the program will not develop materials for mass media distribution, such as radio or TV public service announcements.

The materials will be subjected to focus-group testing and revision prior to duplication and distribution.

Promulgate the Educational Program to Implementation Sites

NHTSA issued a second task order to Global Exchange, Inc., to conduct the implementation phase of the program. This task order set aside $200,000 for awarding mini-grants to employers or community agencies to implement the drowsy-driver educational program for shift workers. The grants will range in magnitude from $5,000 to $15,000, depending on the extent to which the applicants intend to adopt the recommended program elements and the degree to which they participate in collecting evaluation data. The number of grants awarded will depend on the amounts awarded.

Global Exchange staff, in conjunction with program evaluation staff from Systems Assessment and Research, Inc. (see next section), have developed guidelines for applicants and prepared a simplified application form. Project staff will publicize the availability of these grants and the application procedures using mailings and published notices:

- *Mailings.* Announcements will be mailed to organizations on selected mailing lists maintained by NHTSA, NCSDR and other interested organizations as suggested by the steering committee;

- *Published Notices.* Notices describing the program and the availability of funds will be published in newsletters of interested organizations.

Applications will be reviewed by the members of the development team and the steering committee according to the criteria specified in the application notices. The current schedule anticipates that awards will be determined by December, 1998, for program implementation to begin in February, 1999.

NHTSA Administrator Dr. Ric Martinez will announce the awards early in 1999, in a joint press conference with Dr. Claude Lenfant, director of the NCSDR's parent organization, the National Heart, Lung, and Blood Institute. This press event will also highlight the collaborative activities of the two agencies as well as other NHTSA and DOT efforts to combat fatigue and inattention in highway crashes.

Project staff will duplicate and distribute program materials to awardees, monitor program implementation, and provide technical assistance as needed.

Evaluate Information and Education Campaign

NHTSA obtained the services of Systems Analysis and Research, Inc. (SAR) through an interagency agreement with the General Services Administration Federal Systems Integration and Management Center. This agreement covers evaluation design; pretesting of instruments; collecting process, pre- and post-program data; and preparing an evaluation report including recommendations for revisions of the program materials and procedures.

Evaluation project staff are active members of the development team, ensuring that the program objectives are realistic and can be evaluated. During the course of the early development process, SAR staff have established realistic objectives that can be evaluated and developed a number of candidate measures for capturing appropriate data to assess program functions and effects. Evaluation staff have recruited a number of organizations employing shift workers to serve as test sites for pilot testing the evaluation instruments and procedures.

Evaluation project staff have also worked closely with the team responsible for awarding and overseeing the implementation grants, to ensure that the grant announcement includes the appropriate information regarding the implementors' involvement in the evaluation process and that the application process properly indicates the level of participation of the grantees in the collection of data in support of the program evaluation.

Evaluation staff will monitor the implementation process and collect data from workers both before and after program implementation. Staff will also provide technical assistance to employers that wish to collect additional data related to program functioning.

After analyzing the data, evaluation staff will make recommendations to the materials development contractor to improve the effectiveness of the educational and administrative materials.

Conduct Supplementary Implementation Activities for Youth Audiences

While the main thrust of NHTSA's drowsy driving program is for shift workers (many of whom are young males), the project development team also sought ways to influence a more general audience of young drivers. Using FY 1997 appropriations, NHTSA executed an interagency agreement with the NCSDR to conduct two activities directed towards this end.

Develop and Distribute Educational Materials Specifically for Young Audiences

To reach young drivers, NCSDR called on an existing partnership with Scholastic Magazine, Inc., an information source that reaches students in virtually all high schools in the United States. Under the direction of the NCSDR, NHTSA, and the steering committee, Scholastic Magazine developed a series of educational materials for distribution to high school audiences (both students and teachers) through its existing channels.

- Program content included information about sleep, teenagers' need for more sleep, the contribution of fatigue to crashes, and steps for getting teens to get more or better sleep. Materials provided scenarios to stimulate classroom discussion and discussion guides for teachers to assist in presentation of the materials.

- Published materials included a 4-page insert in *Choices* and *Health Choices* for grades 7-12, and an accompanying teachers guide (Attachment 2); a 1-page quiz in *Scope* for grades 7-9, as well as in five other publications within Scholastic's Teen Magazine Network (Attachment 3); and a 1-page informational article in *Coach and Athletic Director* for athletics instructors (Attachment 4).

- Materials were distributed in May, 1998, coinciding with the time when students are about to embark on summer vacations. The timing was chosen to influence preparation for vacation-related automobile trips on which they may be driving.

Conduct a Strategy Development Workshop

A second activity under the interagency agreement was a strategy development workshop that was held on June 5, 1998 on educating youth about the importance of sleep and the dangers of sleep deprivation, especially drowsy driving. The workshop brought together experts from the areas of adolescent sleep, driver education, high-school education, middle-school education, and curriculum development. NCSDR published the workshop proceedings, "Educating Youth about Sleep and Drowsy Driving," which will also be available on their web site. Ideas generated at the workshop will be used in planning future education activities directed toward youth. Attachment 5 provides the workshop agenda and list of participants.

Conclusions

Despite extensive analytical efforts, determining the extent to which fatigue is involved in traffic crashes has remained elusive. The techniques currently used can only reveal crashes in which the drivers appear to have actually fallen asleep. At best, this approach can provide only a "bare minimum" number of fatigue-related crashes. Until a driver's level of fatigue can be determined by a reliable physical measurement, analogous to using blood alcohol concentration to determine alcohol impairment, establishing accurate estimates of fatigue involvement in crashes is virtually impossible.

Even so, some population groups are at much greater risk for drowsy-driving crashes than others. As reported by the NCSDR expert panel, young males (especially those who drive on long trips involving late-night hours) and shift workers are especially vulnerable among non-commercial drivers. The programs described in this report show how NHTSA and the NCSDR have focused educational efforts on shift workers and youthful drivers.

Fatigue is becoming an issue of growing importance as our society evolves into one that offers an increasing number of services on a 24-hours, 7 day/week basis. Currently 15 million people are working non-daytime shifts. While factory workers still constitute the largest number of shift workers (over 4 million), the largest percentage gains have been in service occupations and technical services, such as 24 hour catalog ordering and computer support. Other social forces, such as welfare-to-work programs, may also swell the number of shift workers.

The materials for providing education to shift workers are nearing completion and will be ready for distribution in February, 1999. Grants for implementation and evaluation of the programs are expected to be awarded by late fall, permitting programs to begin by March, 1999. The evaluation report and recommendations for program revisions are expected by then end of December, 1999.

In addition to the programs described in this report, NHTSA has plans to initiate a program to address long-distance driving by young males in FY 2000. Also in FY 2000, NHTSA will undertake a program, in coordination with FHWA, to educate

the public regarding the function of rumble strips and proper responses to their warnings. Meanwhile, NHTSA continues its work to develop in-car devices to detect drowsy or inattentive driving and systems to provide warnings to drivers to take appropriate actions.

ATTACHMENT 1

NCSDR/NHTSA Expert Panel on Driver Fatigue and Sleepiness Membership Roster

NCSDR/NHTSA Expert Panel
on Driver Fatigue and Sleepiness
Membership Roster

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ATTACHMENT 2

NCSDR/Scholastic Magazine Educational Materials for Youth Audiences

Insert from
Choices,
Health Choices
and
Teacher's Guide
May, 1998

TOP 5 REASONS TO GET ENOUGH SLEEP

- Drowsy drivers can crash their cars. Crashes disfigure, disable, and kill drivers, passengers, or pedestrians.
- Drowsy teens react more slowly and perform worse in sports than well-rested teens.
- Drowsy teens do poorly in school and have problems socially.
- Drowsy teens have trouble making good decisions.
- Drowsy teens don't look their best.

DEAR STUDENT:

You have school and homework. Sports and clubs. Friends and family. And an after-school job. **Who has time for sleep? Who needs sleep anyway?**

Believe it or not, you do. As a teen, you actually need more sleep than younger kids: about nine hours every night. Like most teens, you probably sleep only about six. You wake up tired, and you stay that way. Do you think that's okay — that you'll be fine, just like everyone else? No way! Here's why: **When you don't get the sleep you need, you start to get drowsy in class, at work, at parties, and behind the wheel of your car.** That's where lack of sleep can really hurt you and others.

The solution is simple—**crash in bed, not on the road.** Go to bed earlier. Take a nap if you're sleepy. Sleep late when you can.

Remember, when you're short on sleep, stay out of the driver's seat.

Sincerely,

C. Lenfant

Claude Lenfant, M.D.
Director
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PEOPLE SCIENCE 1948-1998 HEALTH
National Heart, Lung, and Blood Institute

FEELING SLEEPY? HERE'S WHY!

- Many teens need at least 9 hours of sleep per night. More than younger kids, and more than adults. But most teens get less than 6.5 hours of sleep. If "most teens" is you, you're probably sleepy most of the time.
- When kids hit puberty, their internal clocks change: that's why teens just naturally want to go to bed late and sleep late in the morning!
- Teenagers have more responsibilities than younger kids. And, between school, homework, jobs, sports and a social life, it is difficult for them to get enough sleep.

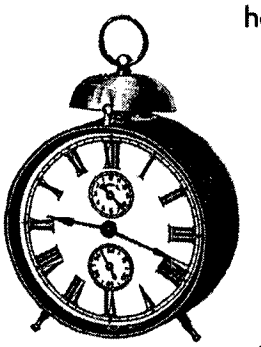
WHAT WOULD YOU DO?

HOW WOULD YOU HANDLE THESE SITUATIONS?

(For ideas, check out the **YOU SHOULD KNOW** section.)

Brianne is a 17-year-old junior who lives in the suburbs. She's a good student, a member of the high school basketball team, and is very socially active. She stayed up late studying for mid-terms, got to school at 7:30 a.m., finished basketball practice at 4:00 p.m., then drove a friend home from practice. Now it's 6:00 p.m., and she's heading home on the freeway. After a 20-minute drive, she suddenly realizes she missed the exit to her house and doesn't remember driving the last few miles.

What could have happened to Brianne while she was on "auto-pilot"? How could she have avoided this dangerous situation?



Pete is 18, and thinking about graduation. He works after school at the mall to make money for college. His older brother is at the state university, about two hours from home; and Pete's planning a weekend road trip starting tonight. After a short night of sleep he goes to school, works for about 4 hours at his job, and grabs a bite to eat. Then, he and his girlfriend, Shelley, jump in the car and head toward the university. It's already 8:00 p.m. Shelley falls asleep and after about 30 minutes, Pete realizes that he's exhausted, too. A few minutes later, he's startled into alertness as he hits the rumble strips along the shoulder of the highway.

How could Pete have avoided this dangerous situation? What should he do now?

Adam is 17, and has just received his license. His parents have given him a strict 11:00 p.m. curfew. It's now 1:30 a.m., and after a long day, he's about to leave a party at a friend's house. Feeling alert, he jumps behind the wheel of the family car with his best friend Chris in the passenger seat. A few minutes later, Chris yells, "Hit the brakes!" just as Adam, with his eyes closed, is about to drift through a red light.

How could Adam have avoided this dangerous situation? What should he do now to get home safely?

YOU SHOULD KNOW...

...the only way to prevent drowsy driving is to get enough sleep on a regular basis.

...it's possible to build up a big "sleep debt" by sleeping too few hours for too many days on end. You can't "pay off" the sleep debt in just one night—or day. It can take days to get back to normal.

...most sleepiness-related crashes happen between 2 a.m. and 6 a.m. (during normal sleeping hours).

...there is only one sure-fire way to wake yourself up when you're sleepy: take a 15-20 minute nap before driving.

...getting a good night's sleep before a long drive can save your life.

...traveling with a friend who's awake can help keep you awake. But, a sleeping friend is no help at all.

...rolling down a window to get some air, stretching your legs, or even cranking up the radio are almost useless when you're trying to stay awake.

...one beer, when someone is sleep-deprived, will hit as hard as two or three beers when one is well rested.

...drinking caffeine (a caffeinated soft drink, coffee, or tea) before hitting the road may help for a short time, but it can also be a problem. Caffeine can make you lose sleep, which leads to more sleepiness!

opinion poll

Some high schools across the country have decided to start classes about one hour later to allow teenage students to get extra sleep. Do you think this will make a difference? In many families, parents get less sleep than their kids. How could you help convince your family members of the importance of getting more sleep?

Teenagers are under a lot of pressure—preparing for college, playing sports, working after-school jobs, and trying to have a social life.

How can kids lighten their load without losing out on important parts of their lives?

WAKE UP CALL!

RATE YOUR SLEEP HABITS

1. Most nights, I sleep
(a) under 6 hours.
(b) 6 to 8 hours.
(c) 9 or more hours.

2. I blow off sleep to
(Circle any that apply)
(a) study.
(b) party.
(c) work.
(d) watch TV.
(e) talk with friends.
(f) I don't blow off sleep.
(g) other

3. I drive when I'm sleepy because
(a) I know I can keep myself awake.
(b) I don't want to ask for a lift—it's embarrassing.
(c) I love my car.
(d) I don't think about sleepiness until I'm actually falling asleep.
(e) I don't drive when I'm sleepy.

4. When I get sleepy while driving, I
(a) count on highway rumble strips or passengers to wake me up.
(b) stop and call for a lift.
(c) stop for caffeinated soft drinks or coffee.
(d) stop and take a nap.
(e) open a window to get some air.
(f) turn the music up.
(g) just keep driving.

Score points for your answers as follows:
1. (a) 0; (b) 1; (c) 2
2. (a) to (e) 0; (f) 1; (g) 0
3. (a) to (d) 0; (e) 3
4. (a), (e), (f), (g) 0; (c) 2; (b), (d) 3

What your score means:
9 points—Wide Awake
6-8 points—Waking Up
4-5 points—Asleep at the Wheel
Less than 3 points—Hear the Alarm

ATTACHMENT 3

NCSDR/Scholastic Magazine Educational Materials for Youth Audiences

Insert from *Scope* May 11, 1998

ZZZZZ...

HOW MUCH IS ENOUGH?

You need it to grow, to learn, to look good, and to stay alive behind the wheel. Take this quiz and learn why your body wants you to get more sleep.

TRUE OR FALSE

1. The average teenager needs about 8 hours of sleep every night.
2. You can make up for lost sleep by drinking caffeinated soft drinks or coffee.
3. Lack of sleep can affect performance in school, on the job, in sports, and can even make a difference in how you look.
4. Teenagers just naturally want to go to bed late and get up late.
5. Sleeping late on the weekends will make up for lost sleep during the week.
6. Driving while drowsy (struggling to stay awake) is a significant factor in traffic crashes.
7. Even a small amount of alcohol when someone is sleepy can make sleepiness worse.

ANSWERS:

1. False. According to recent research, many teenagers actually need 9 or more hours of sleep per night — more than their younger siblings, and more than adults.
2. False. Caffeinated soft drinks, or coffee, will not help you make up for lost sleep but they may help you stay awake for a short time.
3. True. Sleep-deprived people have difficulty concentrating or paying attention. Sleepy teens also don't look their best.
4. True. Scientists have discovered that teenagers' biological clocks push them toward later bedtimes and later rising times.
5. False. You may not be able to pay off a "sleep debt" in one or two nights. It can take several days to get back to normal.
6. True. According to the National Highway Traffic Safety Administration, about 26% of highway crashes involve drivers under the age of 25. Most teens may be experiencing significant "problem sleepiness."
7. True. One beer, when sleep-deprived, will hit as hard as two or three beers when one is well rested.

WHAT CAN YOU DO?

- **Keep a log for one week to calculate how much sleep you're getting.**
- **Make a time chart to organize your time and to fit in more sleep.**
- **Never drive if you're feeling sleepy; avoid riding with a sleepy driver.**
- **If you're sleepy, and know you will be driving, take a nap beforehand.**
- **If you feel drowsy behind the wheel, stop the car. If you can, stop driving. Take a nap, or call for a lift. If you have no other choice, drink a caffeinated beverage.**

SCHOLASTIC

ATTACHMENT 4

NCSDR/Scholastic Magazine Educational Materials for Youth Audiences

Insert from *Coach and Athletic Director* May/June, 1998

Advertisement

ON YOUR MARK...GET SET...

SLEEP

Many teenagers need at least 9 hours of sleep per night, most of them only get 6!

WAKE UP CALL!

According to recent research:

- Most adults need roughly 8 hours sleep per night, many teenagers need more — at least 9 hours per night.
- Teenagers' natural biological clocks control their sleep/wake systems and push them toward later bedtimes and later rising times. But, their busy schedules prevent them from doing what comes naturally.

WHY IT MATTERS

- Teens who get fewer than 9 hours of sleep per night may be sleep deprived.
- Teens who are sleep deprived are at high risk for car crashes and poor performance in sports, class, and at work.
- Drowsy teens can be a danger to themselves and others — especially on the road. Drowsy driving is a significant factor in traffic fatalities.

In fact, According to the National Highway Traffic Safety Administration, about 26% of highway crashes involve drivers under the age of 25. Most teens may be experiencing significant problems with sleepiness. Only one solution is effective in the long run: more sleep!

HOW CAN YOU HELP?

- Help the kids on your team understand that sleep is as important as eating and breathing. Without sufficient sleep, no one can give a peak performance.
- Explain that drowsy athletes can let down their teammates, and that drowsy drivers are as dangerous as drunk drivers.
- Help teens manage their time. Schedule sporting events and practices with teens' sleep needs in mind. Work with them to brainstorm techniques for building sleep into their busy schedules. Encourage them to find alternatives to driving when they're feeling tired.

ATTACHMENT 5

NCSDR Strategy Development Workshop on Educating Youth About Sleep and Drowsy Driving

Agenda & List of Participants

June 5, 1998

National Center on Sleep Disorders Research

Strategy Development Workshop on Educating Youth About Sleep and Drowsy Driving

Omni Shoreham Hotel
Washington, DC
June 5, 1998

Agenda

8:00 - 8:20	Welcome and Introductions Purpose of Workshop	Dr. Millman/Dr. McCartt Ms. Rogus
8:20 - 8:50	Sleep in Adolescence	Dr. Carskadon
8:50 - 9:30	Drowsy Driving and Teens	Dr. Pack/Dr. Strohl
9:30 - 9:45	Break	

NOTE: Participants will be assigned to four small groups for the remainder of the morning to focus on the following specific program areas:

- Driver Education Programs
- High School Curricula/Programs
- Middle School Curricula/Programs
- Community-Based Programs

9:45 - 10:45	**Part 1: Current Opportunities for/Obstacles to Incorporating Sleep Education Into Program Area	Small Groups
10:45 - 11:45	***Part 2: What Can Be Done to Integrate Sleep Education Into Program Area?	Small Groups
11:45 - 1:00	Lunch	
1:00 - 4:15	Top Ideas for Successful Integration of Sleep Education Into:	Small Group Presentations/Large Group Discussion

1:00 - 1:45	Driver Education Programs
1:45 - 2:30	High School Curricula/Programs
2:30 - 2:45	BREAK
2:45 - 3:30	Middle School Curricula/Programs
3:30 - 4:15	Community-Based Programs

4:15 - 4:30	Summary
4:30	Adjournment

***Part 1:** The small groups will consider the following questions for their particular program area (i.e., driver education, high school curricula/programs, middle school curricula/programs, or community-based programs).

1) What is the current focus on sleep/sleep deprivation in this environment?

2) Where would sleep education naturally fit into this environment?

3) What audiences need to be reached in this environment?

4) What messages are needed?

5) What factors* exist that would **help** to incorporate sleep education (or to achieve adequate sleep) in this environment?

6) What factors* exist that would **hinder** sleep education (or the attainment of adequate sleep)?

7) Which organizations could be involved in implementing sleep education in this environment?

*Some factors to consider:

a) Knowledge and attitudes (of students, teachers, parents, others)
b) School schedules
c) Athletics
d) Employment
e) Driver licensing/curfews/regulations
f) Others (specify)

******Part 2:*** The small groups will brainstorm about ideas for integrating sleep education messages into their program area, as well as possible organizations to implement activities. They then will score and rank the ideas according to: a) the idea's likelihood of success (1-10 points where 1= not very likely to succeed and 10= very likely to succeed); and b) its ease of implementation (1-10 points where 1= not at all easy to implement and 10= very easy to implement).

The four small groups will present their "top" ideas, and possible organizations to implement them, to the full group in the afternoon for general discussion and further refinement.

THE WORKSHOP'S VISION

1) That youth and those around them become more knowledgeable about the importance of adequate sleep to good health, and the consequences of sleep deprivation;

2) That youth obtain adequate sleep;

3) That drowsy driving decreases among youth, including that

   a) They avoid getting into a drowsy driving situation, and that
   b) They know what to do if faced with a drowsy driving situation;

4) That youths' support systems (including parents, teachers, coaches, employers, school health personnel and others) are well informed about sleep needs and the consequences of sleep deprivation, especially the danger of drowsy driving.

OBJECTIVES

1) To identify strategies and recommend priorities for educating youth regarding the importance of sleep and the danger of drowsy driving for the NCSDR and other organizations to consider.

2) To identify opportunities for partnering and coordination among organizations having an interest in the education of youth about sleep and sleep deprivation.

STRATEGY DEVELOPMENT WORKSHOP ON EDUCATING YOUTH ABOUT SLEEP AND DROWSY DRIVING

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