

# Preventing Teen Motor Crashes

## Contributions from the Behavioral and Social Sciences and Summary of the Report of the National Research Council and Institute of Medicine

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### Introduction: A Critical Public Health Problem

In July 2003, Joshua Brown, a high school senior from Cartersville, Georgia, who had recently been accepted by the Berklee School of Music in Boston, was killed in a car crash. His death was tragic for his family, and it represented a tragic loss for the nation. Joshua was one of 3657 young drivers who died in car crashes in the U.S. in 2003. When the additional deaths of teen passengers and pedestrians are included, motor-vehicle crashes emerge as the leading cause of death for this age group in that year (accounting for 5988 deaths among youth aged 16 to 20). These crashes were responsible for more adolescent deaths than the next four causes combined.<sup>1,a</sup>

Young people in the U.S. are at greater risk of dying or being injured in an automobile than their peers around the world, in part because they are licensed to drive earlier and with less experience than youth in other countries.<sup>2,b</sup> If current trends continue, a cumulative total of more than 100,000 adolescents and young adults (aged 16 to 24) who are alive today will die in car crashes in the next 10 years.<sup>3,c</sup> Furthermore, nearly two of every three people killed in teen-driver crashes are people other than the teen driver.<sup>4</sup> By any measure,

then, automobile crashes are one of the most critical public health problems in the U.S.

States, counties, school districts, the federal government, private organizations such as the Insurance Institute for Highway Safety, advocacy groups such as Mothers Against Drunk Driving, and others have addressed the problem in a variety of ways. Fatalities and injuries overall and for teenagers have been reduced substantially over the past 30 years as a result of changes in state laws, such as seatbelt requirements and increases in the legal drinking age.<sup>5</sup> Changes in licensure requirements, public information campaigns, and strategies for encouraging parent involvement in the training of new drivers are other valuable approaches that have been used to improve driving safety for teens. Although the impact of these efforts is evident, novice drivers continue to have the highest rates of crashes, injuries, and fatalities of any group; the sheer magnitude of the injuries and fatalities that continue to result from teen crashes shows that current prevention efforts are inadequate.

The aim of public health efforts focused on reducing motor-vehicle crashes involving teen drivers is not to prevent the activity altogether (as it is with many other public health initiatives) but to help teens drive more responsibly. Knowledge about how and why teen motor-vehicle crashes happen is the key to developing countermeasures to reduce their number—and a significant body of applicable knowledge, produced over several decades, exists. However, few effective mechanisms are available for using that knowledge to directly influence teen behavior or to convert it into effective interventions. In addition, many of the current efforts to reduce teen crashes are hampered by a lack of evidence as to which prevention strategies are most effective. Driving is a complex activity, mastery of which develops slowly over time, despite the fact that for most adults it seems largely automatic. It is a social and cognitive activity as well as one that draws on a complex array of physical and cognitive abilities that are still developing in teenagers.

Consequently, an understanding of teenage driving would be enhanced by a systematic review of contributions from the behavioral, cognitive, social, health, and

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<sup>a</sup>The next four leading causes of death in 2003 for youth aged 16 to 20 were homicide (2489), suicide (1813), accidental poisoning (752), and malignant neoplasms (749).

<sup>b</sup>The risks of teen driving are nevertheless a serious concern in other countries, and a significant body of research from other countries exists. Interested readers are directed to a September 2006 report titled *Young Drivers: The Road to Safety*, prepared by the Transport Research Centre, a collaborative venture of the Organisation for Economic Co-operation and Development and the European Conference of Ministers of Transport.

<sup>c</sup>Estimate based on an analysis of 2003 data for adolescents and young adults (aged 16 to 24) from the Fatality Analysis Reporting System (FARS). Fatality information derived from FARS includes motor-vehicle traffic crashes that result in the death of an occupant of a vehicle or a nonmotorist within 30 days of the crash.

biological sciences. These disciplines have shed light on distinctive aspects of teenagers: their approach to risk assessment, learning processes, skill development, brain functioning, reward incentives, and interactions with peers and adults. Applying this understanding to the development of prevention strategies holds significant promise for improving safety.

Although many fields of research have produced relevant studies, this body of knowledge has not been synthesized in ways that highlight key findings to be applied effectively in policy and practice. Furthermore, opportunities for collaboration among researchers from diverse fields to address questions about teenage driving are rare. Research studies are often published in specialized journals that are not widely read by others working in different disciplines or diverse professional environments, and current citation indexing systems make it difficult to integrate research from fields as diverse as public health, traffic safety, adolescent development, and social psychology.

### **Charge to the Committee**

To address this void, the Board on Children, Youth, and Families, under the auspices of the National Research Council and the IOM, and in collaboration with the Transportation Research Board, formed the Committee on Contributions from the Behavioral and Social Sciences in Reducing and Preventing Teen Motor Crashes to plan a workshop at which experts from the relevant fields could share information and consider ways to put their combined expertise to work. A public- and private-sector partnership funded this work, including the Office of Behavioral and Social Science Research of the NIH, the National Center for Injury Prevention and Control at the CDC, and State Farm Insurance Foundation. The committee met in person and collaborated extensively by phone and e-mail to review the kinds of evidence that are available and identify objectives for the workshop as well as the experts who could best help meet them. The committee was not charged with developing specific recommendations for ways to reduce teen motor crashes, but rather with exploring three questions:

- How do theories and evidence from the behavioral, cognitive, social, health, and biological sciences inform understanding of both the risk factors that increase teen motor-vehicle crashes and the protective factors that reduce such crashes?
- How can theories and evidence from the behavioral, cognitive, social, health, and biological sciences inform improved prevention, program, and policy interventions to reduce risky teen motor-vehicle driving behaviors, as well as promote responsible teen driving?

- What research and interventions are most likely to advance teen motor-vehicle safety over the short and the long term?

The committee organized a workshop in May 2006 to address these questions. The participants included a multidisciplinary group who shared information and insights on topics ranging from adolescent development to emerging technology for studying, monitoring, and controlling driving behavior. The workshop convened researchers who had not addressed studies of teen driving, but who might have unique insights in the field of adolescent development and other areas of social and behavioral research, with experts who have deep experience in the field of highway safety.

The workshop demonstrated that a wealth of available information can be used to save lives and reduce injuries from teen driving—from statistics that fill out the picture of how teenagers are harmed in crashes; to insights about how their physical, cognitive, and emotional development affects their behavior; to cutting-edge technology for making vehicles safer and improving training. As participants sifted through this material, two key points emerged. First, using this wealth of information to reduce the number of teens killed in crashes requires purposeful coordination among a variety of actors and, second, several important questions still require research.

### **Moving Forward Need for Synthesis, Coordination, and Application**

Each of the workshop discussions—whether focused on aspects of adolescent development, the errors teen drivers make, or strategies for improving safety—referred frequently to omissions in skills and judgment. The stark data showing the drop-off in crash rates after the first few months or few hundred miles on the road suggest the relevance of a growing body of knowledge from cognitive psychology on the development of expertise, which is different from the simpler acquisition of skills or experience.

It takes considerable time in almost any context for expertise to develop. True expertise entails not only the development of particular sets of physical skills, but also the development of judgment about how and when to apply particular skills and knowledge. Essential to the process, again regardless of the context, is learning from errors. Errors made while learning to drive can be fatal, but the experience of the Ache people of eastern Paraguay was presented as an example of building expertise in coping with a dangerous environment. They have addressed the risks inherent in learning to hunt in a way strikingly similar to graduated driver licensing (GDL). In that tribe, at approximately age 13, youngsters begin to learn to hunt, but they are allowed

to track only certain kinds of game. The process of learning encompasses several levels of increasing difficulty and risk, and it culminates in a status akin to full certification as hunter.

Some studies indicate that it can take up to 10,000 hours of focused, goal-directed effort to develop real expertise in acquiring a complex, modern skill. The processes needed to develop expertise are linked to the development of self-regulation in adolescents. Critical to the capacity to develop and successfully deploy the judgment and skills that come with growing expertise is the capacity to regulate one's attention, emotions, and social behavior, which is still developing in teenagers. The relevance of each of these domains to driving is clear, but no purposeful strategy is available to address them in preparing young drivers. Moreover, the development of the prefrontal cortex in the brain during adolescence regulates these capacities. During adolescence the prefrontal system emerges as the governor of other brain systems. Neural pathways that will influence development and behavior are established in the brain, partly dictated by experience—thus providing the basis for a lifetime of safe driving habits.

In related work, some researchers have pointed out that adolescence is a period during which the basic neural pathways are established for accomplishing complex tasks through the formation of representational, psychological, and neural models that allow them to capture the "gist" of the task without requiring them to consciously decide each component of a complex endeavor each and every time. The frequent rehearsal of these tasks allows for greater speed of execution and also allows the models to become embedded in the brain's architecture and chemistry so that the execution of repetitive tasks (such as acceleration and braking) becomes automatic. It is during the formative period of the representational model and neural circuitry that prevention strategies, hazard assessment skills, and safe driving practices acquire special significance.

The significance of these points for teen driving is twofold. First, they demonstrate the importance of evidence-based advocacy. Although policymakers may not need to delve into the intricacies of brain development in adolescence, it is important that advocates recognize and use the full range of knowledge that supports the push for a strategy such as GDL. No one at the workshop dissented from the view, mentioned numerous times, that there is no good reason to license young people to drive at age 16. But gaining support for further restraints or delays on what is commonly accepted as a natural rite of passage for adolescence would require a crisp summary of the implications of the developmental status of youngsters at this stage for driving and an evidence base that could demonstrate the costs and benefits associated with different ages of licensure. Even with teens aged 18 years, the crash rates in the first few months following licensure are very

high. The work of pulling together this kind of knowledge from the behavioral and social sciences and considering its practical application to driver education and other tools is only just beginning.

An ideal comprehensive approach to safe teen driving was presented in the workshop. Such a system would include:

- driver education that uses computer technology and is integrated with a strict GDL program;
- departments of motor vehicles that implement and enforce comprehensive GDL programs and modern methods of testing for licensure that address the range of skills that teens need to develop;
- supports for parents that guide them in managing their teen's driving and supervising their practice driving hours;
- law enforcement that makes sure teens recognize that laws and restrictions will be enforced; and
- comprehensive community health program for driving safety that links healthcare practitioners, public health messages, and data-collection strategies.

This list illustrates both that a wide range of knowledge must be incorporated into thinking about ways to keep teens safe when they drive, and that new opportunities are also needed for a range of individuals and groups to collaborate and apply this complex set of knowledge in consistent, effective ways. Possibilities include in-depth reviews of the research literature, such as those conducted in the course of ad hoc consensus studies by the National Academies, as well as occasional workshops, roundtables, or forums on topics of common interest. The critical need is to create sustained opportunities for researchers, policymakers, advocates, and stakeholders to engage in dialogue and critical examination of emerging research and to examine ways to apply it both to public policy and to the development of new prevention programs. Such gatherings could also stimulate the development of new public- and private-sector partnerships that would build on and strengthen existing prevention efforts, fostering consensus about innovative strategies. Although the success of GDL and other measures demonstrates the possibilities for further reducing crash rates, the synthesis and collaboration that are needed to move forward will not happen automatically.

### Specific Research Needs

Despite the significant research findings and promising strategies highlighted at the workshop, participants identified a number of gaps in the existing research base. Members of the workshop committee subsequently generated a list of key questions to guide future efforts.

**What happens during the first few months of driving?** What, exactly, changes and how does this change occur in different age groups? Further insight into crashes

that involve newly licensed drivers and identification of the essential skills that driver education should instill in novice drivers are both needed. How can minor driving mishaps or near misses be used as teachable moments? What can be learned from naturalistic studies of teen driving behavior? What are the characteristics of adolescents who drive safely from the start? What cognitive, sensory, or behavioral factors might influence the formation of safe driving practices and stimulate the development of expertise in this realm?

**What are the benefits and possible risks of new technologies?** Can technology be used in more individualized ways, for example to track driver progress over time and to provide feedback that strengthens error correction and hazard detection? Can technologies such as global positioning systems provide more insight into the environmental conditions and settings that foster risky behaviors or encourage safer driving practices?

**What are the best ways to influence parents' behavior?** What can be done to support parents and other adults in guiding and supervising their teens and also increase parents' motivation to monitor and enforce responsible teen driving behaviors? How might adolescents' health-care providers be coached to increase their counseling on driving safety and to assess the effectiveness of their efforts?

**What are the best ways to influence teens' behavior?** What can be done to foster and reward safe driving as normative behavior for teens? Which adolescent characteristics can work as protective factors, and how might they best be harnessed? What is known about teens' own attitudes toward driving safety and potential solutions? What role do the media play now, and how might the influence of the media and commercial vendors (such as the automotive and communications industries) be harnessed to foster responsible driving practices? What is known about the effectiveness of current media campaigns? How might law enforcement and the insurance industry play a bigger, more proactive role in improving safety?

**What are the best ways to influence policymakers and the public?** To the extent that the research community can reach consensus on the need for further changes in laws and public policies, as well as attitudes and expectations among parents and the public, what social marketing and other strategies from other contexts might be applied to driving policies and regulations?

**How are new and existing programs performing?** Evaluations that encompass new findings about teenagers and driver behavior are needed to improve (1) the quality of existing driver education programs, including advanced skills training, and (2) other approaches that draw on new research on adolescent development, behavior, and decision-making processes.

**What are the costs and benefits of different types of interventions?** Linking specific interventions or strategies to selected costs and benefits is a daunting challenge. Large study samples are required to examine the effects of certain approaches with selected cohorts of teen populations, taking into account significant individual and demographic variables. Interventions that entail costs that accrue to individuals (such as the fees associated with driver education or the installation of new technology in automobiles) may offer major benefits to society through the reduction of injury and improvement of safety. These relationships deserve further consideration in the design of incentives and regulatory frameworks.

**What policies might best address the problem of sleep deprivation?** The cycles associated with teen sleep patterns are well known, but this research has not been applied in any consistent manner to the design of licensure standards, driver education programs, or public health messages for teens and their parents. Health-care providers and educators are important but undeveloped assets who are in a position to guide teens and parents about the importance of adequate sleep in preventing risky and dangerous behaviors.

This set of research questions provides the starting point for further exploration of these complex issues. Many workshop participants expressed the hope that additional opportunities will emerge—through new public and private partnerships—for interdisciplinary collaboration in the development of prevention strategies for teen drivers. The workshop demonstrated that a wealth of information is now available that has not been brought to bear on a public health issue of immense proportions.

The papers that follow in this supplement to the *American Journal of Preventive Medicine*<sup>6–16</sup> are based on initial presentations from the May 2006 workshop. They provide a thoughtful foundation for the formation of new strategies and public–private partnerships to support expanded prevention efforts in this field.

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