



Motor Vehicle Crashes and Injuries Involving Teenage Drivers

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TRANSPORTATION RESEARCH
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**Motor Vehicle Crashes
and Injuries Involving
Teenage Drivers**

Future Directions for Research

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**Motor Vehicle Crashes and Injuries
Involving Teenage Drivers**
Future Directions for Research

Prepared by
Allan F. Williams

for the
Young Drivers Subcommittee
Operator Education and Regulation Committee
Transportation Research Board

December 2013

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Foreword

This TRB circular includes a summary of the discussions by national and international experts on teenage driving. These took place at a midyear 2008 meeting and workshop organized by the Subcommittee on Young Drivers convened to identify research that is needed to answer the most critical and timely scientific questions about teenage drivers. The workshop was developed and structured by an ad hoc planning committee consisting of C. Raymond Bingham, Robert D. Foss, Daniel V. McGehee, Jean T. Shope, Ruth A. Shults, and Bruce G. Simons-Morton. A special thanks to Allan F. Williams for preparing this e-circular, which was reviewed by the Planning Committee. Special appreciation goes to Charles Niessner, National Cooperative Highway Research Program (NCHRP), for supporting development of this e-circular as part of NCHRP Project 17-18 AASHTO Strategic Highway Safety Plan Implementation Support.

During the meeting, full-group discussions were intermixed with smaller subgroup deliberations. Each of these sessions involved a particular goal for the participating groups. The intent of this structure was to elicit and discuss as many research-specific issues as the participants considered important for identifying needed research in the young driver field.

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Formation of the TRB Young Driver Subcommittee

The high crash rate of teenage drivers and the concomitant attention it is now receiving by the general public invites a broadening focus on research and evaluation activities. Although attention to teenage driving issues will continue to fall within the scope of Transportation Research Board's (TRB's) Operator Education and Regulation Committee (ANB30), an affiliated group devoted exclusively to teen driving is likely to be more effective in applying the expertise needed to guide local, state, and national efforts toward scientifically and conceptually sound interventions. This was the premise for the launching of the Young Driver Subcommittee in 2007.

Research on teenage drivers has grown dramatically in the past decade, but there is still a great deal that needs to be learned. Many critically important questions have not been asked, let alone adequately addressed. Consequently, most present efforts to reduce teenage driver crashes are not grounded in scientific principles, lacking a conceptually sound approach, evidence of likely effectiveness, or both. A formal entity within TRB, whose explicit focus is to promote solid research on teen driving issues, can, and should, help to enhance the quality of the nation's efforts to address teenage driver crashes.

The subcommittee's focus is limited to drivers younger than age 20. Its mission is to undertake activities designed to improve and extend research on the nature of teen driving, including broad social, psychological, cultural, and biological issues; teenage driver crash causation; the role of parents and peers in teenage driving; and the effective translation of broad scientific understanding into policies and programs to reduce teenage driver crash rates.

The unifying goal of this subcommittee is to foster both conceptually and empirically informed programs and policies to reduce teenage driver crashes. This includes the following, more detailed objectives:

- Promote the growth of high-quality research that is theoretically informed and that reflects a multidisciplinary approach toward the understanding and reduction of teenage driver crashes.
 - Reinforce efforts to develop a conceptual and empirical underpinning for continuing efforts to devise more-effective training approaches for beginning teenage drivers.
 - Reach out to researchers in academic settings to foster broader involvement in teenage driver safety research, to encourage new researchers to join the field, and to stimulate the training of new researchers.
 - Stimulate interest in funding for scientific research on teenage driver issues by national and state governments, philanthropic foundations, and the private sector.

Research Agenda Planning Meeting *July 28–29, 2008*

To further the goals of the subcommittee, a workshop was held in the summer of 2008 to discuss research issues and needs. There were 23 attendees, including subcommittee members and invited participants. These individuals are identified in Appendix B, along with those subcommittee members who were unable to attend. Although the participants included many of the world's leading authorities on teenage driving issues, there were no formal presentations. The intent was to draw upon the collective knowledge, insight, and perspective of those in attendance and to forge a plan to guide research toward the most critical questions.

The meeting was structured to encourage coverage of a wide range of issues, but also to ensure thorough discussion of the most important matters. Each attendee was asked to provide in advance ideas about the most pressing research needs for advancing understanding of teenage drivers, driving behavior, crash risks, crash causation factors, and approaches that might reduce crashes and injuries. Prior to the meeting these suggestions were sorted into two logical categories, with subgroups:

1. Basic understanding of teen driving (e.g., learning to drive, improved measurement, driver risk factors, parental role) and
2. Intervention and policy [e.g., approaches to training, graduated driver licensing (GDL), technology].

On the first day of the 1½-day meeting, research ideas within these two categories were discussed by the attendees in an open session, facilitated by members of the planning committee. Subsequently, to encourage substantial input from all participants, smaller group discussions were held with each group providing its top choices for research emphasis separately within the two domains listed above. Although each group was asked to provide suggestions by the end of their discussion, these first-day activities were meant to stimulate thinking and exchange of ideas rather than to produce resolutions.

On the second day, attendees listed their individual top choices of needed research. This activity was followed by small group discussions with the explicit goal of producing within-group agreement on the few issues considered to be of greatest research importance. These issues were shared with and discussed by the full group. Subsequent to the group discussions, individual participants were asked to provide a list of their final personal priorities. The goal for the second day of the meeting was to obtain a sense from the assembled group about the most important issues to be studied, without resorting to a voting process, and also to retain the ideas of individuals who were not persuaded by the group discussions.

To set the context for consideration of the research needs identified during the meeting, it is important to review ways in which the teenage driver problem has been addressed, how approaches have developed and changed over time, and to comment on the past and present status of research in this area. The following section reflects themes that emerged from the free-flowing discussions that took place at the meeting.

Growth in Attention to Teenage Driver Crashes

Motor vehicle crashes and injuries involving teenage drivers constitute a longstanding health problem in North America, but for many years this problem received scant attention from researchers, traffic safety professionals, policy makers, or the general public. That situation has changed. As graduated licensing systems began to be introduced in Canada and the United States in the mid-1990s, interest in the problem climbed. In the United States, 49 states and the District of Columbia have enacted a three-stage graduated licensing system (only North Dakota has not done so). Two-thirds of these (34) are classified as “good” according to the Insurance Institute for Highway Safety’s (IIHS) rating system (1). Public and media interest in the problem have ramped up, and many more researchers have begun to address questions and issues related to motor vehicle use by teenagers.

Despite the surge in research activity on motor vehicle crashes and injuries, the quantity of this research pales in comparison with that addressing other important adolescent health issues, such as alcohol and tobacco use. A rough indicator of this disparity is revealed by querying Google Scholar, which identifies the most relevant research on a topic across the world of scholarly research. As of March 2009, 12,888 references were found for articles dealing with teen smoking and 7,730 for teen drinking during the years 1985 through 2009; by comparison only 1,601 references dealing with teen driving were found. [Note: The search involved the terms “teen, teenage, adolescent” combined with “smoker, smoking, tobacco use,” for smoking, “drinker, drinking, alcohol use,” for drinking and “driver, driving, car use, auto use, automobile use” for driving.] This is part of a broader pattern, in which injury prevention in general—and highway safety in particular—does not receive societal attention or resources commensurate with its contribution to the overall health burden in the United States. This state of affairs was the subject of extensive discussion in the recent compendium of articles published by the AAA Foundation for Traffic Safety (2) on improving traffic safety culture in the United States. It is a prime reason why inadequate knowledge exists about many fundamental issues involving young drivers that could be addressed by research.

There is substantial research evidence concerning relative risk, based on comparisons of teenage driver crashes with those of adults, and male versus female drivers. However, there is a decided lack of theoretically grounded inquiry, naturalistic observation studies, and experimental research that would help to explain these risks and give guidance as to how they might be addressed.

PRESENT STATE OF KNOWLEDGE

A common theme spanning discussions among participants at the summer workshop concerned the importance of advancing the science base for interventions, programs, and policies. Although a substantial amount of research has been conducted, this research has not been sufficiently systematic or extensive to provide sound guidance for programs and policies. Partly as a result of this limited state of knowledge, a scientifically grounded approach to dealing with the teenage driving problem has not been adopted by practitioners. Researchers new to this topic will encounter a field in need of (a) broader conceptualization, (b) more methodologically sound

research, and (c) efforts to ensure that important findings are translated into policies and programs.

Progress in addressing teenage driver crashes has been impeded by several myths and misconceptions among researchers, policy makers, and practitioners about adolescents and the underlying reasons for their behavior. There has also been a lack of conceptual coherence, even a certain degree of naïveté, about the causes and prevention of crashes and injuries associated with teenage driving. This has led to poorly conceptualized programs, many of which have not been scientifically evaluated. If evaluated, most of these would probably be found to be ineffective or perhaps even counterproductive. Moreover, there are too many instances of poorly designed, scientifically weak evaluations that can cloud public understanding of what works and what does not to reduce the problem.

Teenage drivers are an extremely heterogeneous group, despite the brief age span involved. Early studies generally grouped young drivers as 16 to 19 year olds or even 16 to 25 year olds. This grouping conceals dramatically different driving patterns, problems, and crash profiles that are revealed when teenagers are disaggregated by single year of age (3). Teens 18 to 19 years of age are generally much more experienced at driving; most are no longer novices. They also drive more and, because many live separately from parents, they are exposed to a wider range of conditions that influence driving behaviors and risks. There are also substantial developmental changes during the years from 16 to 19. Accordingly, grouping them all together for study, analysis, reporting, or intervention makes little sense. As Arnett, Irwin, and Halpern-Felsher (4) point out "...the difference between 16–17 year olds and 18–19 year olds is so stark that they should be considered to be in two separate periods of life." These differences need to be kept in mind when discussing and studying teenage drivers.

There is a widespread belief that young people are hard to influence because they think they are invulnerable or immortal and, therefore, feel free to take excessive risks. However, research suggests that they are no more likely than adults to harbor the perception that they are either invulnerable or less vulnerable than others (5–8). Similarly it is often assumed that adolescents do not understand or appreciate risk or the consequences of risky actions, but there is compelling evidence that they do (8–10). These kinds of misconceptions have encouraged the proliferation of fear-based programs, which try to convince adolescents that they are indeed vulnerable by displaying crashed vehicles at high schools or through the use of mock death notifications or mock funerals. These programs and others that use shock tactics in attempts to arouse fear, or a sense of vulnerability, have not been evaluated in a scientific manner. The literature on behavior change principles suggests that fear-based approaches will not reduce crashes or injuries among adolescents, even though they may have a temporary emotional effect (11, 12).

Driver education or training is another area in which there are misconceptions that have created unnecessary controversy. Since its inception, driver education has been thought of by many not only as a way to educate novices about driving (teaching rules of the road and basic driving skills) but to make them safer drivers who are less likely to crash than those without formal training. Waller (13) pointed out long ago the unrealistic expectations this places on high school driver education teachers compared with the way teachers of other subjects are judged. She noted the many factors other than knowledge influence subsequent driving behavior and posed the question "Should the driver education teacher be responsible only for whether the student *can* drive adequately or whether he actually does drive in this manner?"

Behavior change principles, as well as a review of the broader health education literature as to what works and what does not, indicate that there is little chance that standard driver

education programs can influence crash likelihood (14). Decades of research in the United States and elsewhere have confirmed this lack of effect on crashes (15). The most appropriate goal for formal driver education is that it be the best way to teach basic driving skills and generally educate students about driving. It is clear, however, that neither the ability to handle a vehicle nor knowledge of rules of the road equate to driving safety. Although the development of skills is largely dependent on experience, the actual driving behavior of young novices is shaped by many other factors, including personal dispositions, motivations, lifestyle, decision-making abilities, neurocognitive development, and the influence of parents and peers along with the behavior of other drivers on the road.

Nonetheless the notion that the key to adolescent driving safety is to provide novices with better education and training remains pervasive. This can be attractive not only to policy makers and practitioners but also to new researchers entering the field. This notion is fueled by another commonly held, but mistaken, view that the majority of adolescents are sufficiently mature and that their primary crash risk factor is driving inexperience. There is lack of appreciation in this view for the complexity of the driving task, the nature of adolescent behavior, and how features of adolescent development can interact with driving inexperience to heighten crash risk (16, 17). As Dahl (18) notes “it appears that adolescents are especially vulnerable to affective influences in some social situations and contexts that make them more prone to risk taking, novelty seeking, sensation seeking, and strong emotional influences on decision making.” The majority of adolescents are not thrill seekers deliberately taking risks as they are sometimes portrayed. Nevertheless, at the same time that adolescents are learning to drive, the self-regulatory capabilities that give them control over emotions and behavior are not fully formed. Given these still-developing abilities, group settings with other teenagers can be a particularly challenging environment (9, 19, 20).

A key misconception in the field is that teenage driving risk results from poor vehicle handling skills. Yet it has been demonstrated, and is well understood by driving instructors and parents who have supervised their children’s driving, that vehicle handling is quickly learned by most teenagers. Management of the in-vehicle environment and of the driver’s behavior while in the vehicle is a far more demanding skill and is learned or mastered only over a long period of time. The assumption that vehicle handling skills are deficient among teenage drivers contributes to the widespread availability of programs that presume to train adolescent drivers how to handle vehicles in emergency situations. These typically involve 1-day or half-day sessions that mix instruction with some vehicle-handling practice in large parking lots. The idea is to teach teenagers how to manage skids, swerves, and other maneuvers believed to be helpful in avoiding crashes, supplementing the basic training received in driver education courses. One-time sessions, however, are unlikely to accomplish this goal, since (a) they are too brief to truly train drivers, especially inexperienced drivers, in such skills, and (b) even when learned, skills that are rarely used tend to decay (21).

Some studies in Scandinavia and the United States found that drivers who received skid training, especially young men, actually had more crashes than untrained groups (22–24). This is presumably because such training decreases caution or, put differently, increases risky driving behaviors (25). A key issue in safety for all drivers, regardless of age, is to minimize the chance that a last-moment avoidance maneuver might be required. Brief programs that focus on training emergency maneuvers may inadvertently reduce cautious behavior by increasing drivers’ confidence that they would be able to avoid a crash at the last moment through evasive tactics. Unfortunately, such programs have become popular in the United States, even though no sound

scientific evaluations of these recent programs have been conducted to determine whether they are beneficial, harmful, or have no effect on crash risk. Some program proponents have produced their own self-serving, but scientifically unsound, evaluations involving incomparable groups (26–28). Were a pharmaceutical company to present this type of research as evidence of the efficacy and safety of a drug before it was approved for public use, it would be summarily dismissed as unacceptable. Yet the potential consequences of “treating” individuals with this kind of training are equally profound. Moreover, consumers—in this case parents of teenage drivers—are in no better position to assess the effects of such programs than they are to judge the effects of an untested drug.

Finally, the misconception exists that the teenage driving problem belongs to the “safety community,” when it is actually a public health problem that emanates from human behavior on a large scale, thus requiring the attention of the broad public health and scientific community. Notably, until recently, few behavioral scientists have addressed teenage driver issues (5, 29, 30). That situation is beginning to change. The National Research Council and the Institute of Medicine combined to form the Committee on Contributions from the Behavioral and Social Sciences in Reducing and Preventing Teen Motor Vehicle Crashes. The committee sponsored a workshop in 2006 to address teenage driver issues. As an outgrowth of that workshop, a special 2008 issue of the *American Journal of Preventive Medicine* was devoted to the topic. Some participants were relatively new to the young driver field and it is hoped that the workshop proceedings provided some guidance toward the most pressing research questions.

The increased involvement of scientists and researchers from the social and behavioral sciences will add breadth and depth to researchers’ efforts to grapple with the range of issues involved in teenage driver behavior. Many of the issues traditionally thought of as teenage driving matters are, in reality, simply matters of behavior that happens to occur while driving or riding in a vehicle and which may differ between teenagers and adults. These issues need to be understood and approached as matters of behavior rather than simply as driving skills to be learned or driving misbehaviors to be controlled through formal sanctions. Tapping the perspectives and understanding embodied in the accumulated literatures of adolescent, cognitive, and social psychology; behavioral economics; biology; cultural anthropology; political science; sociology; mass communication; and others stands to advance the understanding of teenage driving, and how it might be influenced, more quickly. To proceed without heeding relevant well-established principles from these fields will unnecessarily limit progress.

THE NATURE OF DRIVING

Driving a motor vehicle is analogous, in many ways, to playing continuous action sports like basketball, soccer, or hockey at a level practiced by adolescents, not elite athletes. Although driving is certainly more dangerous, the rudimentary skills involved in each of these are fairly simple. With a little instruction, training, and practice most individuals can quickly learn them. However, being genuinely competent at these endeavors involves far more than the ability to perform the requisite basic maneuvers. To do any of these well takes a large amount of practice, over a long period of time in realistic conditions, because there is a great deal more than basic skills to be learned. These activities involve interacting with others, whose behavior is generally, though not entirely, predictable as they will follow most of the important rules and generally accepted norms of behavior. This interaction occurs while all involved are moving at varying

speeds and requires integrating one's own actions smoothly with those of others, simultaneously dealing with continually changing positions, and varying trajectories and speeds of oneself and others. All this is done in physical environments that also vary. Individuals need to develop an understanding of how the varying conditions in which the activities take place affect them and others. They also need to acquire a deeply ingrained, intuitive sense of the many kinds of situations that will occur and how these are appropriately handled.

Reflecting on the similarities of these sports to driving, it not difficult to recognize that amassing hundreds of hours of practical experience in realistic “game-like” conditions is necessary for new drivers to reach a point where they are able to routinely and smoothly handle all but the most atypical driving situations. Most novices can learn simple maneuvers such as starting, stopping, reversing, and turning a vehicle within a few hours and become fairly good at them in a matter of days. But in the same way a person who can dribble and shoot a basketball is not ready to play a full-speed game, a person who can handle a vehicle well is far from being a full-fledged driver. A great deal more understanding and ability is needed to drive competently and safely. For example, drivers need to be able to routinely identify and react to a vast array of potentially hazardous situations, maneuver the vehicle in complex traffic situations, avoid being distracted at critical times, and deal with passengers, to name only a few. Each trip involves unique situations that demand near-constant attention and instantaneous decisions.

In a complex environment, where things happen quickly—often with no option for a “time out”—novice drivers are particularly vulnerable to mistakes and their consequences. The need for experience driving in real conditions in order to learn creates the dilemma that doing so puts the novice and others at risk of a collision (31, 32). There is hope that some kind of nonroad training, involving simulation or immersive virtual reality techniques that attempt to mimic real driving situations, can help to develop an intuitive sense of the complexities of driving that will transfer to actual driving. If this can be done successfully, and it remains to be demonstrated, then no-risk learning can be achieved. This approach might also be a way to reduce the time it now takes new drivers to fully digest all that they need to know. At present this process seems to take at least 18 to 24 months of independent (unsupervised) driving, at least partly because the only place to learn is through real-world experience.

Licensing Policies Before Graduated Driver Licenses

Prior to 1996—that is, before the graduated licensing era—most states’ licensing requirements were easy to satisfy quickly, allowing drivers with little experience to obtain full driving privileges at a young age. These policies did little to address the risks associated with inexperience or youthful age, thus contributing to the problem rather than helping to control it. As Waller (33) noted, the licensing procedures used prior to the mid-1990s “violate everything we know about learning.”

Graduated Licensing

GD^L works differently, providing novices with a protective environment while they are learning along with strong encouragement to obtain plenty of practical experience. Graduated licensing systems do not attempt to train drivers or to educate them as to how they should drive. They merely encourage novices to drive at times and in situations known to entail lesser risk, so that they gain essential practical experience as safely as possible.

The concept of graduated licensing was introduced in the early 1970s, but it did not catch on until more than two decades later. Its emergence in the mid-1990s and enormous subsequent popularity is somewhat of a mystery (34). There was, however, an accumulation of research and advocacy over the years that encouraged its adoption. Studies that disaggregated crash rates by single year of age, showing that 16 year olds had especially high crash risk, helped draw attention to the problem of young novice drivers. Simultaneously there was increasing recognition that reliance on driver education and training alone was not warranted, as extremely high crash rates were seen among novices who had successfully completed driver education courses. And the appeal of graduated licensing was that it made great sense as a way to introduce novices into the driving environment. Whatever the reasons, there was clearly a more receptive social climate for graduated licensing in the mid-1990s.

The success of graduated licensing is well documented. It has produced crash reductions substantially larger than is the case for most successful highway safety countermeasures, with crash reductions of 20% to 40% in several studies (35). The move to graduated licensing by nearly all states has reduced, but by no means eliminated, the teenage driver crash problem. Legislative attention to the issue continues in many states, but research guidance for those efforts is lacking.

Recent Legislative Activity

Much of the recent focus in efforts to deal with the teen driving problem has involved legislative action. Many states have changed their driver licensing systems, amending the original GDL legislation. This action has often been in response to the realization that even though they have implemented graduated licensing, teenage driver and passenger crash fatalities continue with distressing frequency.

Many of the changes made involve alterations in learner period requirements or rules regulating nighttime driving or passengers. Some legislators have proposed raising the licensing age. Others have raised the licensing age de facto, while also trying to provide more supervised practice for beginners, by increasing the length of learner period. Yet others have taken a quite different approach, trying to deal with teenage drivers with the same, largely unsuccessful, approach used to address the problem of impaired driving: increasing penalties. For example, Connecticut recently enacted a policy that includes a 48-h administrative license suspension for violations of night and passenger restrictions, excessive speeding, reckless driving as well as driving under the influence of alcohol or drugs.

Challenge to the Research Community

The continued legislative attention to teenage driver crash risks is encouraging. However, unlike most policy-making efforts during the past decade to enact or upgrade state GDL systems, recent efforts are being undertaken with inadequate guidance from the research community. Presently, there is little empirical evidence to suggest the optimal form or duration for learner period requirements or night and passenger restrictions. In 1999, the IIHS and the Traffic Injury Research Foundation of Canada combined to produce a document to guide states and provinces in constructing graduated systems, laying out the research basis for various provisions (36). Although recommendations could be made on the basis of known risky conditions (e.g., travel with passengers should be limited), empirical evidence for more specific recommendations was almost entirely lacking (e.g., no more than one nonfamily member under age 20 for the first 6 months of licensed driving). There continues to be little evidence to suggest the potential value of more refined or different approaches.

Raising the licensing age would likely have beneficial effects on safety (37), although research is needed on the potential unintended consequences and also the political feasibility of doing so. Little is known about the effects of policies used primarily in other countries that reduce or alter exposure, for example, having challenging driving tests that require substantial advance preparation to pass. Other countries apply GDL to all beginners. Only two U.S. states—Maryland and New Jersey—apply GDL provisions beyond age 17, and no state has changed its testing policies in an attempt to better gauge driver readiness under GDL rules, as has been done in Australia, Canada, and New Zealand.

Recent actions in some states to institute stronger penalties are a departure from graduated licensing principles. GDL represents a significant conceptual advance beyond the probationary licensing systems that followed this punitive approach prior to the move to graduated licensing systems. The failure of this approach is one of the main reasons that researchers, followed by policy makers, began to embrace a different paradigm, heeding Waller's (33) reminder that "There is no evidence in the literature on learning that increasing threat helps inexperience."

GDL differs in spirit from previous efforts, seeking to provide the experience necessary to develop and refine the complex skills needed to become a competent, reasonably safe driver and to ensure that this experience is obtained under conditions that are both realistic and as safe as possible (38). Threatening punishment, including license suspension, fails to address the nature of the fundamental problems extant among teenage drivers: lack of a fully developed understanding of all that driving involves and a limited ability to control impulses (9, 16, 33). Nonetheless, penalty-based approaches appeal to policy makers. Recent indications that there may be a trend away from GDL principles and back toward punitive approaches that have proved ineffective in the past suggests an urgent need to examine the effects of these experiments. Studies are needed to determine whether more stringent laws can, or will, be enforced. Research is also needed to document whether such laws achieve the intended reduction in crashes, produce no effect, or result in undesirable side effects such as increases in unlicensed driving.

To inform future efforts meant to enhance teenage driver licensing systems and to provide guidance for interventions that fall beyond the bounds of licensing approaches, the present knowledge base must be substantially expanded. Research is urgently needed on

particularly salient issues where there is presently no valid evidence. A prime example is the need for scientifically sound evaluations of the brief “advanced driving skills” courses for teenagers that are becoming ubiquitous, but which may harm rather than help. Additional studies are also needed in important areas where some limited research already exists. For example, a rapid decline from an initially very high crash risk during the first 6 to 18 months of licensed driving has been documented, but the reasons for this decline are not understood, nor are the causes of the higher crash risk when teenage drivers transport other teenagers known. Further inquiry into these matters will help to enhance our understanding of the nature of these phenomena, providing the needed foundation upon which policies and programs can be built to continue the downward trend in teenage driver crashes that the widespread, science-based move to GDL systems has set in motion.

Critical Research Needs *Five Priority Areas*

The context and state of existing knowledge described above led to the identification of the following areas of research as most critical:

1. Advancing the science of teenage driving;
2. Learning to drive safely: how competence develops;
3. Teenage driving exposure issues;
4. Parenting issues: how parents influence teenage driving; and
5. Passenger issues: how passengers influence teenage driving and crash risk.

During the meeting, numerous perspectives and ideas were discussed and debated, but as the meeting progressed, the focus narrowed to the smaller number of crucial research topics listed above.

Following the meeting, members of the planning committee developed potential research topics and specific items for suggested research in the five priority areas, based on contributions from the group. It is hoped that the results of this exercise will provide current and future young driver researchers with useful ideas as they decide the kinds of studies to undertake. It is also hoped that laying out the many important, unanswered research questions, may also attract more colleagues to a field that is in great need of an expanded cadre of researchers.

Advancing the Science

As described above, the present knowledge base in the young driver field is inadequate and desperately needs to be expanded. Programs that proliferate and become institutionalized without research guidance, programs based on misconceptions about teenage drivers and their crash risk, and programs that persist even when competent research indicates they may cause harm, have held the field back. Poor policy making and program development, based on little or no science, waste money, time, and, ultimately, the lives they fail to protect. Accordingly, there is an urgent need to increase the scientific research base that is necessary to support the development of evidence-based policies and programs. The following describes the most pressing issues for which solid evidence is needed.

RESEARCH PRIORITY

Advance the science base for programs and policies to reduce teenage driving risk.

NATURE OF THE PROBLEM

Reducing teenage driver risk is a priority and various strategies are being implemented to address the issue. Some of these lack an explicit conceptual model of how they would influence teen driving behavior. Others are inconsistent with established theoretical or empirical principles of behavior. Moreover, most widely implemented strategies have not been adequately evaluated. Many of these programs are probably ineffective and some may have unintended, hazardous consequences. More research to advance the science base for new and existing approaches to address teen driving risk is needed to guarantee that programs perform as intended without causing harm.

One of the most widely implemented and effective approach to reducing teen crashes is GDL. As of April 2009, 49 states had adopted a three-stage GDL system (1). Additionally, state legislatures continue to amend their licensing regulations in an effort to improve GDL systems. Coupled with strategies to enhance compliance with GDL, these measures could further reduce teen crashes (39, 40). However, to date community-based interventions to increase compliance have met with limited success (40). Also, important questions about the long-term effects of GDL can now be explored. For example, are adults who were licensed under GDL systems safer drivers than their counterparts who were licensed under pre-GDL licensing systems?

Communities and schools implement various campaigns and programs to address teen driving risks (41, 42). Because few of these campaigns and programs have been adequately evaluated, decisions about which approaches to implement are often based on anecdotes and unsupported common sense beliefs. Likewise, brief courses that focus on emergency vehicle handling skills such as skid recovery have gained popularity. These programs often publish testimonials from satisfied parents and teenagers as confirmation of their safety value. However, the few evaluations conducted to date have demonstrated either no safety benefit or an increased risk of crash among some teenage drivers who take these courses (22, 23, 25). Further research is needed to determine whether these and similar approaches to reducing teen crashes actually have

any safety benefit. Finally, while the negative effect of cell phone use on driving performance among adults is increasingly well documented (43), developmental issues among teenage drivers likely exacerbate the risks of cell phone use. Research on this problem is presently lacking.

OBJECTIVE

Determine the effectiveness of new and existing strategies to reduce teenage driver crashes

IMPORTANT RESEARCH QUESTIONS

1. Can better integration of accepted principles of adolescent development and behavior improve the effectiveness of strategies to reduce teenage driving risk? For example, can knowledge of how adolescents perceive and interpret risk (17), or respond to social influence from peers and parents, be used to develop programs that reduce risky driving?
2. How does safe driving behavior develop and can the rate at which this occurs be increased?
3. What are the mechanisms by which GDL influences teenage driving? For example, is there a greater net safety benefit from zero-passenger limits, with which compliance may be low, or is there greater overall benefit in allowing one passenger, which may result in greater compliance and somewhat greater risk of crash?
4. What are the unintended effects of teenage driver improvement programs? For example, does advanced driver training involving evasive or emergency maneuvers result in higher-risk driving? Does GDL encourage unlicensed driving?
5. Are technology-based approaches that are being promoted to parents, legislators and others effective in reducing teenage driving risk? For example, do programs that provide feedback to teenage drivers or to their parents, reduce crash risk? Can high-fidelity simulation or virtual reality enhance teenage driving performance and behavior through more or better practice obtained in highly realistic, but safe, conditions?
6. Do vehicle-based or carry-in technologies have differential effects on teenage drivers? For example, does onboard Internet access or use of mobile devices increase driving risk differentially for teenagers and adults? Do technologies such as collision warning devices, that have been shown to have beneficial safety effects for adults, have detrimental effects for teenage drivers?

Learning to Drive Safely

Understanding how driving competence develops is surprisingly limited. Consequently, it is difficult to know how the learning process might be accelerated, or how to optimize the structure of GDL systems (e.g., how long should a learner period or night driving restriction last? What should parents do during the learner period?). It is well established that crash risk jumps markedly at the point when unsupervised driving begins. The first month of licensure is the highest crash risk period in a person's life. This is followed by a relatively rapid decline over the following 18 to 24 months of licensed driving (44–46). Until the reasons for this dramatic change are better understood, legislators and traffic safety practitioners will remain adrift, with little scientific guidance for efforts to develop programs, policies, or interventions to reduce novice driver crash rates.

RESEARCH PRIORITY

Determine what teenage drivers learn that sharply reduces crashes during the initial months of unsupervised driving.

NATURE OF THE PROBLEM

Over time, crash rates decline following teenage driver licensure and extending into adulthood. The pattern of decline is indicative of a learning process but the elements that contribute to this process, the role of experience, and how learning occurs among novice drivers have not been investigated. To better understand how learning and experience relate to changes in crash rates it will be necessary to examine variables reflecting multiple issues, including, but not limited to behavioral, cognitive, affective, psychosocial factors and contextual elements. For example, the development of expertise, regulatory competence, risk perception skills, and the use of those skills to minimize risk are components of cognition that may play important roles in teenage driving.

Research indicates that three elements are essential for the development of expertise with a complex skill such as driving (16, 17). The first is effortful, focused practice and rehearsal of the skills to be learned (47–49). Although formal driver training and supervised practice driving are important in learning to drive, they are not sufficient. The second essential element is devotion of time to the task (47–50). Mastery of a complex set of skills, such as those needed to drive safely, develops gradually with experience gained over a significant period of time. A substantial amount of independent (unsupervised) experience in real driving conditions over a lengthy interval of time appears to be necessary for safe operation to become routine. The third element, which is related to the first two, is automaticity (16). Attention and appropriate responses become “automatic,” requiring little or no conscious attention with sufficient experience. Hence, an experienced driver will generally respond to subtle external events that warn of possible risk, while inexperienced drivers are less likely to do so (51, 52). Until safe driving becomes routinized, expertise has not been achieved. As expertise develops, so does regulatory competence, which involves the ability to perform a skill while dealing with the complexities and obstacles present in real-world settings (16). Understanding how the acquisition

of driving expertise occurs may shed light on approaches and policies that could enhance or accelerate this process.

In general, the ability to identify risks, their severity, and likelihood of occurring are relatively well developed among 16 year olds (4, 8, 10, 53). However, teenagers appear to be less likely to manifest these abilities in their driving behavior (9). A better understanding of this process may also inform approaches and policies that would aid teenagers in learning to drive.

Affect and self-regulation while driving may also be important elements in the learning process that leads to safer driving (16). Learning to regulate one's own emotions and their potential influence on driving may play a role in teenagers becoming safer drivers. Management of emotions like anxiety, anger, or excitement so that they do not interfere with one's focus on the driving task may be a learned skill that contributes to teenagers improved driving during the early months of licensure. Although the literature on adolescent development is generally informative about these matters, little is known about the emotional regulation of novice teenage drivers. Little is known about how driving differs between teenagers and experienced (adult) drivers, between teenage males and females, and the extent of variability among teenagers of the same age and level of driving experience.

Finally, psychosocial variables relating to the influence of peers and parents on how teenagers learn to drive may also play a significant role in the development of driving behaviors. Little is known about how self control, attentional capacity, and other developmental considerations may be associated with how quickly one learns to drive safely. It may well be that one of the most important "advanced skills" required for safe driving is the ability to minimize the effect of distractions—either managing, or adapting to, variations in the social environment to remain focused on driving—especially in situations that are particularly risky. This may develop only with age and experience.

Driving is a complex task, requiring the routine application of a wide range of psychomotor, cognitive, social and emotional skills. Although the ability to manage the vehicle is essential, it may be that developing the ability to manage oneself and the in-vehicle social environment is equally important. Managing oneself and the social environment is probably more difficult, and may take much longer, than mastering vehicle handling and the perception of roadway risks. Research culminating in greater understanding and knowledge of the process and critical elements involved in learning to drive safely is essential to the design of grounded driver education and training programs, policies, and initiatives to support, facilitate or accelerate the learning process.

OBJECTIVE

Understand the nature of learning to drive to inform evidence-based interventions and programs.

IMPORTANT RESEARCH QUESTIONS

1. What aspects of safe driving are learned and which represent behavioral dispositions that cannot be taught, but may be influenced in other ways?
2. Do pre-existing factors, such as age, sex, personality, and maturity, influence the rate and types of improvement in teenage driving?

3. What individual changes occur during the first years of independent driving that influence teenage driving behavior and crash rates? Issues to be examined include the assessment of hazards, management of distractions, as well as self-assessment and control.

4. What contextual factors, such as parental involvement, peer behavior, socioeconomic status, urban–suburban–rural residence, influence improvements in driving, and the rate at which those improvements occur during the first years of driving?

5. Which methods or approaches to licensing, driving supervision, practice driving, training, or other aspects of learning to drive, if any, increase the rate of improvement in teenage driving?

Teenage Driving Exposure to Various Conditions

Researchers' ability to assess teen driving risks and to measure the effects of programs and policies is dependent on the existence of high-quality exposure data. The only adequate denominator currently available that can be used to compute estimates of crash risk is the total population of particular age groups, allowing the creation of per capita rates. Estimates of miles driven currently available by age are out of date (2001–2002). New national estimates of miles driven, from the National Household Travel Survey, will not be available until at least 2010, nor will they contain the detail needed to examine many important questions. Driving in inclement weather is sometimes mentioned as a particularly risky condition for beginners and is a concern to some parents. Without knowing amounts of exposure to various inclement weather conditions, it is not possible to verify this suspicion.

Self-report data can be useful for measuring simple clearly-delineated behaviors (e.g., number of trips taken, number of passengers per trip). Such data are needed for large representative samples of teenage drivers as a function of specific year of age, time since independent driving began, type of license held (e.g., one with a passenger or night restriction), and residential location (rural, suburban, or urban). Studies that obtain both self-report and objectively measured information could provide the opportunity to determine what kinds of self-report data may be relied upon, what kinds of technologic measurement are particularly useful (e.g., time with eyes off the road) and which may be less so (e.g., time above speed limit on controlled-access urban roadways, where travel speed is more strongly influenced by surrounding traffic rather than driver intent).

In addition to the lack of detailed driving data, there is currently no national database that reliably documents the number of licensed teenaged drivers, so questions about trends in licensure, the extent to which adolescents rush to obtain a license as soon as possible (a common perception), and how this may have changed over time cannot be addressed on a national scale. It is not generally known how graduated licensing systems have affected licensing patterns, but this is important for assessing its effects. In the absence of such data, speculation abounds.

Once high-quality measures of exposure have been developed and deployed it will be possible to answer questions regarding a wide range of conditions and behaviors currently thought to be risky, but with little empirical evidence to support such beliefs.

RESEARCH PRIORITY

Document the amount and type of teenage driving under various conditions.

NATURE OF THE PROBLEM

To understand the nature and magnitude of crash risks associated with various behaviors and driving conditions, it is necessary to employ measures that adjust for exposure (54). Ideally, this would be miles driven or time spent driving in varying conditions. To calculate risk it is essential to know (a) crash incidence under the condition of interest (e.g., at night, with passengers, on rural two-lane roads) and (b) exposure to that condition (e.g., miles driven or time spent driving at night, with passengers on rural two-lane roads). Crash data files contain a wealth of information about crash

events (incidence). By contrast, little is known about the proportion of teenage driving that occurs under various conditions to the extent to which they engage in various behaviors while driving. Because objective measures of exposure are often lacking, risk estimates currently are extremely crude, or non-existent.

Presently, even the most basic information on driver exposure (number of licensed teenage drivers) does not exist at the national level (55). Valid data on the numbers of licensed teenage drivers are available only in individual state licensing databases. Periodically the National Household Travel Survey (NHTS) obtains some useful information about amount, type and distance of travel of a representative sample of the U.S. population, including teenagers (56). This is helpful for estimating the number and characteristics of teenage driver trips (57), but the small number of younger drivers sampled prevents the conduct of detailed analyses, such as the comparison of crash risk per hour of day for 16 year-old drivers living in urban versus rural areas. Moreover, the NHTS does not obtain information on nonhousehold passengers, making it difficult to estimate the risk of driving with teen passengers.

Self-report information is useful for some research questions, but is inherently limited in that individuals cannot reliably recall (or even know) many important details about travel (58, 59). Many of the behaviors and conditions of most interest to young driver researchers cannot be adequately measured with self-report data. Reports of incidence, where something was done or ever experienced during a particular trip, may be possible to obtain reliably, but this information is not adequate for most important research questions (38). Devising adequate self-report measures of prevalence is far more challenging. For example, the proportion of total driving time spent using a mobile phone, or the percent of time or distance driven on two-lane rural roads are exceedingly difficult for most individuals to report accurately.

Similarly, the proportion of total driving time during which various presumed risky behaviors are engaged in (e.g., driver talking on or manipulating a cell phone, not looking at road ahead) is unknown. Some recent studies have begun to examine these kinds of issues using in-vehicle recording devices (51, 60, 61). To date, all of these involve small samples and only two have focused on teenage drivers. Additional studies, using inexpensive recording devices that can be deployed in larger, geographically dispersed samples are needed.

OBJECTIVE

Develop objective measures of teenage drivers' exposure to conditions thought to be risky.

IMPORTANT RESEARCH QUESTIONS

1. What are the most valid and useful methods for measuring various types of exposure among teenage drivers?
2. What is the nature of teenage driver exposure and how does this vary across important categories (e.g., time since licensure; urban versus suburban versus rural residence; jurisdictions with varying proscriptions on particular behaviors; driver age, sex, and socioeconomic status; family structure)?
3. How are the nature, progression, and variability in exposure related to teenage driver safety?

Parenting Issues

Parents' behavior is important in licensing decisions for their teenagers and potentially in teenagers' compliance with GDL provisions. Certain parenting practices – mainly setting limits on driving conditions – are associated with lower crash risk for their teenagers (62). Simply telling parents what they should do has no demonstrable effect on their behavior, but many parents can be persuaded to adopt important limits on their newly licensed teenage children (63). There is little information presently about how parents handle the licensing process, particularly the learner period, nor how this may differ among various types of families, for example, in two- versus one-parent households, or parents with higher versus lower crash risk. Nor is there much understanding of the extent to which parents follow or override GDL requirements and why they do so. The complexities of parent–teen communication generally, and especially regarding driving-related matters, are inadequately understood. Efforts to influence parents are limited by these knowledge gaps. In a developing trend, legislators in Connecticut and Virginia have recently enacted provisions requiring parents to attend initial orientation sessions at the time their teenager begins supervised driving. The effects of requiring this kind of parent involvement can be evaluated, but it would be preferable for such policies to be research based from the outset. In particular, the content of such required parental participation will likely be critical to its success or failure. Evidence concerning the most appropriate information and presentation mode would be helpful, but at present this kind of guidance is lacking.

RESEARCH PRIORITY

Determine how parents influence teenage driving.

NATURE OF THE PROBLEM

Parents are generally considered to have great potential to influence young driver behavior and performance (62, 64) in the same manner that parents can protect their adolescent children from experimenting with alcohol or tobacco and involvement with other problem behaviors, through consistent application of appropriate parenting practices (65). However, data on the nature of parental influence are limited and few studies have evaluated methods of increasing effective parenting practices. Similarity between teen and parent driving has been shown in driving records (66), crashes (67), and self-reported driving behaviors (68), although these associations are weak and no causal mechanism has been established. Teens may tend to drive like their parents due to shared genetics or environment, with children learning from their parents through specific instruction, modeling, and lifelong parenting practices.

Parents can directly influence teenage driving by supervising practice driving, determining when teens can apply for a license, and managing the first year or so of driving (62). Parents clearly provide substantial amounts of supervised practice driving, but it is not clear just what this should involve, or what effect parent supervised practice might be on driving outcomes (69). Parents tend to favor GDL policies (70), but it is not clear how active they are in adhering

to these policies. Moreover, they tend to set and maintain few limits on their newly licensed teenage drivers (71).

Several studies have shown that it is possible to increase parent limit setting on newly licensed teenagers and that these increases are associated with lower rates of risky driving and citations (62). It appears that parental perceptions of teenage driving risk and their expectations about limiting the conditions under which their novice teenagers drive are associated with parent management practices (72) and that it is possible to increase parental management by affecting these variables (73). However, a great deal more needs to be learned about the nature of parenting during the novice teen driving period, about the effects of parenting on teenage driving outcomes, what parents might do that would be most helpful, and how to facilitate effective parental involvement in teenage driving.

OBJECTIVE

Understand the nature of parental influence and involvement in the early stages of teenage driving.

IMPORTANT RESEARCH QUESTIONS

1. Do parents' driving styles influence their teenagers' driving? If so, what are the causal mechanisms that transmit parental driving styles to their children?
2. What is the progression and variability of parent involvement in
 - a. Teaching and supervision of practice driving;
 - b. Determining readiness for licensure; and
 - c. Managing the early driving experience (including vehicle access, adherence to GDL provisions, and driving privileges)?
3. How does the variability in parental involvement in supervised practice driving, driver education, and provisional licensure relate to teenage driving behavior and performance?
4. How are parental adherence to state mandates for supervised practice driving and expectations that their teenagers adhere to GDL restrictions related to teenage driving behavior?
5. What approaches to improving parental involvement during the supervised driving period or management of the early driving experience improve teenage driver safety?

Passenger Issues

The association between teenage passenger presence and crash risk is well known, as is the fact that teen passengers are often victims in teenage driver crashes. Currently, more 16-year-olds die as passengers than as drivers. Passengers can hinder drivers but also can help them. Among adult drivers passenger presence is associated with somewhat lower crash risk (74). The ways in which these positive or negative influences operate are not understood. Consequently, approaches that might reduce the crash risk associated with carrying passengers are currently difficult to devise. In-vehicle studies using camera technology may provide some guidance in understanding the mechanisms by which passengers increase crash risk for teenage drivers. More information would be useful, particularly in regard to passenger age, gender, relationship to the driver, and how these are associated with crash risk for male and female teenage drivers. Presently, it is not known whether passenger restrictions that allow no passengers are superior to those that allow one, because of differences in compliance. Nor is there any understanding of whether, or how, young family members—who are generally exempted from GDL passenger limits—influence crash risks for teenage drivers. Both observational and experimental research on this topic is greatly needed.

RESEARCH PRIORITY

Determine how passengers influence teenage driving and crash risk.

NATURE OF THE PROBLEM

The presence of passengers, both teenagers and young adults, appears to increase crash risk among teenage drivers. Whether this represents a causal effect or a spurious association resulting from shared antecedents, and how passengers of different ages and sexes contribute to this association, are not well enough understood to provide guidance for potential interventions.

Several studies have reported a higher risk of both fatal and non-fatal crashes among teenage drivers (especially the youngest) carrying passengers compared to those not carrying passengers (75–79). This finding stands in contrast to the generally benign or possibly protective effect of passengers on driving safety among more experienced, adult drivers (80). Both male and female teenage drivers experience an increased crash risk associated with carrying young passengers (75, 76). Teenage drivers' risk of crashing increases as the number of passengers increases (75, 76, 79). The higher crash risk is especially notable when drivers 16 to 20 years old are transporting same-age peers (77–79, 81), while adult passengers seem to reduce the risk (77). Passenger sex is also related to teenage drivers' crash risk. Crashes are more likely among teenage drivers when male passengers are present (75) and this seems particularly common with young male drivers (77). Finally, the crash risk when teenage drivers carry passengers is greater at night (76). In recent analyses estimating and accounting for exposure, higher relative fatal crash risks were noted for both male and female teenage drivers transporting a teenage, or 21 to 34-year-old male passenger (82).

To better understand the higher crash risks noted above, one observational study (83) examined the association of passengers' age and sex with risky behaviors of teenage drivers.

Teenage drivers drove faster than the general traffic and allowed shorter headways, particularly in the presence of a teenage male passenger, compared to an adult passenger.

Most states have included passenger restrictions in their graduated driver licensing systems, based on the crash data cited above and the potential benefits of such restrictions (84). Although the details of passenger restrictions vary widely (1), they may be effective in reducing crashes among 16-year-old drivers (85, 86).

Passenger restrictions are not currently based on a thorough understanding of how passenger presence increases the likelihood of teenage driver crashes. A more complete understanding of the nature of passenger effects could help to fine-tune passenger restrictions and might lead to other beneficial interventions as well (74). Beyond the interaction of teenage passenger presence with age or experience of the driver, little is known about the mechanisms by which passengers affect the behavior of teenage drivers. Is it mostly just the tendency for youthful passengers to unintentionally create distractions, more the result of encouragement to engage in risky behaviors, or is the easy distractibility of younger drivers the central feature? Are certain driving behaviors more risky in the presence of passengers? Are there demographic, developmental, or subcultural factors that interact with the presence of passengers to increase crash risk? What can we learn from studies of the role of peer influence in other behavioral domains? Might knowledge about adolescent socialization, decision making, and peer selection inform interventions to reduce teenage driver crash risk? A more thorough understanding of the process that leads to the increased crash risk associated with transporting same-age peers is essential to the development of more effective strategies to reduce this risk.

OBJECTIVE

Understand the nature of passengers' influence on teenage driving and crash risk.

IMPORTANT RESEARCH QUESTIONS

1. How do the characteristics of passengers, including but not limited to age of passengers, sex of passengers, and the passengers' relationship to the driver, affect teenage driving?
2. What aspects of teenage driving are influenced (either positively or negatively) by passengers? Do these influences vary by age, sex, and the passengers' relationship to the teenage driver and, if so, how?
3. How do teenage passengers increase crash risk for teenage drivers? Is it the passengers' distracting effects, active encouragement of risky behaviors, or does it result from their mere presence, perhaps through the driver's perceptions of the passengers' expectations? How do these effects vary by context, including time of day, number of passengers, and trip purpose?
4. Can teenage drivers be trained to manage the effects of passengers' presence and, if so, how?
5. Can teenage passengers be trained to enhance the safety of teenage driving, and, if so, how?

Discussion and Conclusions

Quality research cannot be done without adequate funding, and the young driver research field is hampered by a paucity of funds and funding agencies. Unlike with diabetes, cancer, alcohol use, smoking, and numerous other risks to the health of young Americans, there is no dedicated funding source for scientifically rigorous research to address the main killer of teenagers – motor vehicle crashes. Because funding is so sparse, it is particularly important that the small amount of research that is possible with these limited resources focus on questions of greatest import – be they basic or applied (though the distinction between these is an artificial one). It is hoped that this report will be helpful in guiding both funding agencies and researchers toward the research questions that are most critical to efficient progress in reducing the magnitude of this problem.

Although adequate funding is essential to rapid progress in any field, it is worth noting that many carefully conceived, well designed studies can be done without large budgets for original data collection. Numerous existing databases such as the Fatality Analysis Reporting System, state crash files, trauma registries, and hospital discharge databases are readily available to researchers at little or no cost. Many of the issues noted above can be informed by the careful application of sophisticated statistical techniques to data from these existing sources. Although answers to the crucial question of whether one has found causal effects or merely spurious associations can rarely be answered using such data, in many areas even these basic associations have not been discovered or examined. With a few issues, it is time for the conduct of randomized controlled trials, but for many others, rigorous observational–cross-sectional analyses can provide much needed insight into the understudied phenomenon of teenage driving.

The substantial media and legislative attention to the continuing high crash rate among teenage drivers has brought new researchers into the field. This document is intended to provide both new and veteran researchers with a guide to research questions whose answers are of particular importance for efforts to reduce motor vehicle crashes, injuries, and deaths involving teenage drivers.

References

1. Insurance Institute for Highway Safety. *U.S. Licensing Systems for Young Drivers*. Arlington, Va., 2009. Available at http://www.iihs.org/laws/pdf/us_licensing_systems.pdf. Accessed May 18, 2009.
2. AAA Foundation for Traffic Safety. *Improving Traffic Safety Culture in the United States: The Journey Forward*. Washington, D.C., 2007.
3. Williams, A. F., D. P. Preusser, R. G. Ulmer, and H. B. Weinstein. Characteristics of Fatal Crashes of 16-Year-Old Drivers: Implications for Licensure Policies. *Journal of Public Health Policy*, Vol. 16, 1995, pp. 347–360.
4. Arnett, J., C. Irwin, and B. Halpern-Felsher. Developmental Sources of Crash Risk in Young Drivers. *Injury Prevention*, Vol. 8, Supplement 2, 2002, pp. ii17–ii23.
5. Irwin, C. E. Adolescent Development and Driving: Does Driving Differ from Other Health Damage Behavior? *New to the Road: Reducing the Risks for Young Motorists* (H. Simpson, ed.), Youth Enhancement Services, Los Angeles, Calif., 1996, pp. 51–70.
6. Irwin, C. E., V. Igra, S. Eyre, and S. Millstein. Risk-Taking Behavior in Adolescents: The Paradigm. *Annals of the New York Academy of Sciences*, Vol. 817, 1997, pp. 1–35.
7. Millstein, S. G., and B. L. Halpern-Felsher. Perceptions of Risk and Vulnerability. *Journal of Adolescent Health*, Vol. 31, No. 1, 2002, pp. 10–27.
8. Reyna, V. F., and F. Farley. Risk and Rationality in Adolescent Decision Making: Implications for Theory, Practice, and Public Policy. *Psychological Science in the Public Interest*, Vol. 7, No. 1, 2006, pp. 1–44.
9. Steinberg, L. Risk Taking in Adolescence: New Perspectives from Brain and Behavioral Science. *Current Directions in Psychological Science*, Vol. 16, 2007, pp. 55–59.
10. Weinstein, N. D., and M. Nicolich. Correct and Incorrect Interpretations of Correlations Between Risk Perceptions and Risk Behaviors. *Health Psychology*, Vol. 12, No. 3, 1993, pp. 235–245.
11. DeJong, W., and L. Wallack. A Critical Perspective on the Drug Czar’s Antidrug Media Campaign. *Journal of Health Communication*, Vol. 4, No. 2, 1999, pp. 155–160.
12. Elliott, B. K. The Use of Fear (Threat) to Reduce Adolescent Risk Taking: A Literature Review. Prepared for VicRoads Victoria, Australia, 2005.
13. Waller, P. F. Driver Education: Where Does It Belong? *Journal of Traffic Safety Education*, Vol. 25, No. 1, 1977, pp. 7–9.
14. *NCHRP Research Results Digest 322: Public Information and Education in the Promotion of Highway Safety*, Transportation Research Board of the National Academies, Washington, D.C., August 2007.
15. Williams, A. F., and Ferguson. Driver Education Renaissance? *British Medical Journal*, Vol. 10, No. 1, 2004, pp. 4–7.
16. Keating, D. P. Understanding Adolescent Development: Implications for Driving Safety. *Journal of Safety Research*, Vol. 38, No. 2, 2007, pp. 147–157.
17. Keating, D. P., and B. L. Halpern-Felsher. Adolescent Drivers A Developmental Perspective on Risk, Proficiency, and Safety. *American Journal of Preventive Medicine*, Vol. 35, No. 3S, 2008, pp. 272–277.
18. Dahl, R. E. Biological, Developmental, and Neurobehavioral Factors Relevant to Adolescent Driving Risks. *American Journal of Preventive Medicine*, Vol. 35, No. 3S, 2008, pp. 278–284.
19. Allen, J. P., and B. B. Brown. Teens, Peers, and Automobiles: The Perfect Storm. *American Journal of Preventive Medicine*, Vol. 35, No. 3S, 2008, pp. 289–293.
20. Gardner, M., and L. Steinberg. Peer Influence on Risk Taking, Risk Preference, and Risky Decision Making in Adolescence and Adulthood: An Experimental Study. *Developmental Psychology*, Vol. 41, No. 4, 2005, pp. 625–634.

21. Adams, J. A. Historical Review and Appraisal of Research on the Learning, Retention, and Transfer of Human Motor Skills. *Psychological Bulletin*, Vol. 101, No. 1, 1987, pp. 41–74.
22. Glad, A. *Phase 2 Driver Education, Effect on Accident Risk*. Transport Institute, Oslo, Norway, 1988.
23. Jones, B. *The Effectiveness of Skid-Car Training for Teenage Novice Drivers in Oregon*. Driver and Motor Vehicle Services, Salem, Ore., 1993.
24. Keskinen, E., M. Hatakka, A. Katila, and S. Laapotti. *Was the Renewal of the Driver-Training Successful?* No. 94, 1992.
25. Katila, A., E. Keskinen, and M. Hatakka. Conflicting Goals of Skid Training. *Accident Analysis and Prevention*, Vol. 28, 1996, pp. 785–789.
26. Carney, D. Extra Training Helps Teens Avoid Crashes: Contrary to Perceived Wisdom, Data Suggest Tuition Improves Safety. 2007. Available at <http://www.msnbc.msn.com/id/16947504/>. Accessed February 12, 2007.
27. *Drivers Edge*. General Program Information and Background. 2004. Available at www.driversedge.com.
28. Wilson, K. A. Ignorance Is Not Bliss. *Autoweek*, August 27, 2007.
29. Arnett, J., and R. Jessor. Reckless Behavior in Adolescence: A Developmental Perspective. *Developmental Review*, Vol. 12, No. 4, 1992, pp. 339–373.
30. Jessor, R. Risky Driving and Adolescent Problem Behavior: An Extension of Problem-Behavior Theory. *Alcohol, Drugs and Driving*, Vol. 3, No. 3–4, 1987, pp. 1–11.
31. Warren, R. A., and H. M. Simpson. *The Young Driver Paradox*. Traffic Injury Research Foundation of Canada, Ottawa, Ontario, 1976.
32. Williams, A., S. Ferguson, and J. Shope. Rationale for Graduated Licensing and the Risks It Should Address. *Injury Prevention*, Vol. 8, No. 2S, 2002, pp. ii9–ii16.
33. Waller, P. F. The Genesis of GDL. *Journal of Safety Research*, Vol. 34, No. 1, 2003, pp. 17–23.
34. Williams, A. F. The Fall and Rise of Graduated Licensing in North America. In *Transportation Research Circular E-C072: Implementing Impaired Driving Countermeasures: Putting Research into Action*, Transportation Research Board of the National Academies, Washington, D.C., 2005, pp. 143–149.
35. Shope, J. T. Graduated Driver Licensing: Review of Evaluation Results Since 2002. *Journal of Safety Research*, Vol. 38, No. 2, 2007, pp. 165–175.
36. Insurance Institute for Highway Safety. *Graduated Licensing: A Blueprint for North America*. Arlington, Va., 1999.
37. Williams, A. F. Licensing Age and Teenage Driver Crashes: A Review of the Evidence. *Traffic Injury Prevention*, Vol. 10, No. 1, 2009, pp. 9–15.
38. Foss, R. D. Improving Graduated Driver Licensing Systems: A Conceptual Approach and Its Implications. *Journal of Safety Research*, Vol. 38, No. 2, 2007, pp. 185–192.
39. Blachman, D. R., and D. Abrams. Behavioral and Social Science Contributions to Preventing Teen Motor Crashes: Systems Integrative and Interdisciplinary Approaches. *American Journal of Preventive Medicine*, Vol. 35, No. 3S, 2008, pp. S285–S288.
40. Williams, A. F., and D. R. Mayhew. Graduated Licensing and Beyond. *American Journal of Preventive Medicine*, Vol. 35, No. 3S, 2008, pp. 324–333.
41. Hedlund, J. H., R. G. Ulmer, and D. F. Preusser. *Determine Why There Are Fewer Young Alcohol Impaired Drivers*. National Highway Traffic Safety Administration, Washington, D.C., 2001. Available at www.nhtsa.dot.gov/people/injury/research/FewerYoungDrivers.
42. National Highway Traffic Safety Administration. *Increasing Teen Safety Belt Use: A Program and Literature Review*. Washington, D.C., 2005.
43. McCartt, A. T., L. A. Hellinga, and K. A. Bratiman. Cell Phones and Driving: Review of Research. *Traffic Injury Prevention*, Vol. 7, No. 2, 2006, pp. 89–106.
44. Foss, R. D., and S. V. Masten. Effect of the North Carolina Graduated Driver Licensing System on Licensed Driver Crash Risk: A 5-year Survival Analysis. University of North Carolina Highway Safety Research Center, 2009.

45. Howard, E. Victoria's Experience and Young Driver Safety Issues. Presented at the Young Driver Safety Forum, Canberra, Australia. Available at <http://arrivealive.vic.gov.au/node/208>. Accessed March 13, 2009.
46. Mayhew, D. R., H. M. Simpson, and A. Pak. Changes in Collision Rates Among Novice Drivers During the First Months of Driving. *Accident Analysis and Prevention*, Vol. 35, No. 5, 2003, pp. 683–691.
47. Ericsson, K. A. Attaining Excellence Through Deliberate Practice: Insights from the Study of Expert Performance. *The Pursuit of Excellence Through Education* (M. Ferrar, ed.), Erlbaum, Mahwah, N.J., 2002, pp. 21–55.
48. Ericsson, K. A. Recent Advances in Expertise Research: A Commentary on the Contributions to the Special Issue. *Applied Cognitive Psychology*, Vol. 19, No. 2, 2005, pp. 223–241.
49. Ericsson, K. A. An Introduction to the Cambridge Handbook of Expertise and Expert Performance: Its Development, Organization, and Content. *The Cambridge Handbook of Expertise and Expert Performance* (K. A. Ericsson, N. Charness, R. R. Hoffman, and P. J. Feltovich, eds.), Cambridge University Press, New York, 2006, pp. 3–19.
50. Ericsson, K. A., and N. Charness. Expert Performance: Its Structure and Acquisition. *The Nature–Nurture Debate: The Essential Readings* (S. J. Ceci and W. M. Williams, eds.), Blackwell, Malden, Mass., 1999, pp. 199–255.
51. Lee, S. E., S. G. Klauer, E. C. B. Olsen, B. G. Simons-Morton, T. A. Dingus, D. J. Ramsey, D. J., and M. C. Ouimet. Detection of Road Hazards by Novice Teen and Experienced Adult Drivers. In *Transportation Research Record: Journal of the Transportation Research Board*, No. 2078, Transportation Research Board of the National Academies, Washington, D.C., 2008, pp. 26–32.
52. Pradhan, A. K., K. R. Hammel, R. DeRamus, A. Pollatsek, D. A. Noyce, and D. L. Fisher. Using Eye Movements to Evaluate Effects of Driver Age on Risk Perception in a Driving Simulator. *Human Factors*, Vol. 47, No. 4, 2005, p. 840.
53. Halpern-Felsher, B. L., S. G. Millstein, J. Ellen, N. Adler, J. Tschann, and M. Biehl. The Role of Behavioral Experience in Judging Risks. *Health Psychology*, Vol. 20, 2001, pp. 120–126.
54. Szklo, M., and J. Nieto. *Epidemiology: Beyond the Basics* (2nd ed.), Jones & Bartlett Publishers, Inc., 2007.
55. Ferguson, S. A., E. R. Teoh, and A. T. McCartt. Progress in Teenage Crash Risk During the Last Decade. *Journal of Safety Research*, Vol. 38, No. 2, 2007, pp. 137–145.
56. National Household Travel Survey. 2001–2002. Available at <http://nhts.ornl.gov/publications.shtml>.
57. Massie, D. L., K. L. Campbell, and A. F. Williams. Traffic Accident Involvement Rates by Driver Age and Gender. *Accident Analysis and Prevention*, Vol. 27, No. 1, 1995, pp. 73–87.
58. Babbie, E. *The Practice of Social Science Research* (10th ed.), Wadsworth, Belmont, Calif., 2004.
59. Leaf, W. A., B. M. Simons-Morton, J. L. Hartos, and V. S. Northrup. Driving Miles Estimates by Teen Drivers: How Accurate Are They? *Injury Prevention*, Vol. 14, 2007, pp. 59–61.
60. Neale, V. L., T. A. Dingus, S. G. Klauer, J. Sudweeks and M. Goodman. *An Overview of the 100-Car Naturalistic Study and Findings*. 2005. Available at http://www-nrd.nhtsa.dot.gov/pdf/nrd-12/100Car_ESV05summary.pdf.
61. Stutts, J., J. Feaganes, D. Reinfurt, E. Rodgman, C. Hamlett, K. Gish, et al. Driver's Exposure to Distractions in their Natural Driving Environment. *Accident Analysis and Prevention*, Vol. 37, No. 6, 2005, pp. 1093–1101.
62. Simons-Morton, B. G., M. C. Ouimet, and R. F. Catalano. Parenting and the Young Driver Problem. *American Journal of Preventive Medicine*, Vol. 35, No. 3S, 2008, pp. S294–S303.
63. Simons-Morton, B. Parent Involvement in Novice Teen Driving: Rationale, Evidence of Effects, and Potential for Enhancing Graduated Driver Licensing Effectiveness. *Journal of Safety Research*, Vol. 38, No. 2, 2007, pp. 193–202.
64. Shope, J. T., P. F. Waller, T. E. Raghunathan, and S. M. Patil. Adolescent Antecedents of High-Risk Driving Behavior into Young Adulthood: Substance Use and Parental Influences. *Accident Analysis and Prevention*, Vol. 33, No. 5, 2001, pp. 649–658.

65. Ary, D. V., T. E. Duncan, S. C. Duncan, and H. Hops. Adolescent Problem Behavior: The Influence of Parents and Peers. *Behaviour Research and Therapy*, Vol. 37, No. 3, 1999, pp. 217–230.
66. Wilson, R. J., W. Meckle, S. Wiggins, and P. J. Cooper. Young Driver Risk in Relation to Parents' Retrospective Driving Record. *Journal of Safety Research*, Vol. 37, No. 4, 2006, pp. 325–332.
67. Ferguson, S. A., A. F. Williams, J. F. Chapline, D. W. Reinfurt, and D. M. De Leonardis. Relationship of Parent Driving Records to the Driving Records of their Children. *Accident Analysis and Prevention*, Vol. 33, No. 2, 2001, pp. 229–234.
68. Bianchi, A., and H. Summala. The “Genetics” of Driving Behavior: Parents' Driving Style Predicts their Children's Driving Style. *Accident Analysis and Prevention*, Vol. 36, No. 4, 2004, pp. 655–659.
69. Goodwin, A. H., M. W. Waller, R. D. Foss, and L. H. Margolis. Parental Supervision of Teenage Drivers in a Graduated Licensing System. *Traffic Injury Prevention*, Vol. 7, No. 3, 2006, pp. 224–231.
70. Williams, A. F., L. A. Nelson, and W. A. Leaf. Responses of Teenagers and Their Parents to California's Graduated Licensing System. *Accident Analysis and Prevention*, Vol. 34, No. 6, 2002, pp. 835–842.
71. Hartos, J. L., P. Eitel, D. L. Haynie, and B. Simons-Morton. Can I Take the Car? Relations Among Parenting Practices and Adolescent Driving Practices. *Journal of Adolescent Research*, Vol. 15, 2000, pp. 352–357.
72. Simons-Morton, B. G., J. L. Hartos, W. A. Leaf, and D. F. Preusser. Do Recommended Driving Limits Affect Teen-Reported Tickets and Crashes During the First Year of Teen Independent Driving? *Traffic Injury Prevention*, Vol. 7, 2006, pp. 1–10.
73. Simons-Morton, B. G., J. L. Hartos, W. A. Leaf, and D. F. Preusser. The Effects of the Checkpoints Program on Parent-Imposed Driving Limits and Crash Outcomes Among Connecticut Novice Teen Drivers at 6-Months Post-Licensure. *Journal of Safety Research*, Vol. 37, No. 1, 2006, pp. 9–15.
74. Williams, A. F., S. A. Ferguson, and A. T. McCartt. Passenger Effects on Teenage Driving and Opportunities for Reducing the Risks of Such Travel. *Journal of Safety Research*, Vol. 38, No. 4, 2007, pp. 381–390.
75. Chen, L. H., S. P. Baker, E. R. Braver, and G. Li. Carrying Passengers as a Risk Factor for Crashes Fatal to 16- and 17-Year-Old Drivers. *Journal of the American Medical Association*, Vol. 283, No. 12, 2000, pp. 1578–1582.
76. Doherty, S. T., J. C. Andrey, and C. MacGregor. The Situational Risks of Young Drivers: The Influence of Passengers, Time of Day and Day of Week on Accident Rates. *Accident Analysis and Prevention*, Vol. 30, No. 1, 1998, pp. 45–52.
77. Fu, H., and C. G. Wilmot. Effect of Passenger Age and Gender on Fatal Crash Risks of Young Drivers. In *Transportation Research Record: Journal of the Transportation Research Board*, No. 2078, Transportation Research Board of the National Academies, Washington, D.C., 2008, pp. 33–40.
78. Lam, L. T., R. Norton, M. Woodward, J. Connor, and S. Ameratunga. Passenger Carriage and Car Crash Injury: A Comparison Between Younger and Older Drivers. *Accident Analysis and Prevention*, Vol. 35, No. 6, 2003, pp. 861–867.
79. Preusser, D. F., S. A. Ferguson, and A. F. Williams. The Effect of Teenage Passengers on the Fatal Crash Risk of Teenage Drivers. *Accident Analysis and Prevention*, Vol. 30, No. 2, 1998, pp. 217–222.
80. Bedard, M., and J. R. Meyers. The Influence of Passengers on Older Drivers Involved in Fatal Crashes. *Experimental Aging Research*, Vol. 30, 2004, pp. 205–215.
81. Aldridge, B., M. Himmler, L. Aultman-Hall, and N. Stamatiadis. Impact of Passengers on Young Driver Safety. *Transportation Research Record 1693*, TRB, National Research Council, Washington, D.C., 1999, pp. 25–30.
82. Ouimet, M. C., B. Simons-Morton, P. Zador, N. Lerner, et al. Estimation of Passenger Characteristics' Effects on Teenagers' Fatal Crash Risk Involvement with Partially Missing Driving Exposure Data. Unpublished manuscript.

83. Simons-Morton, B., N. Lerner, and J. Singer. The Observed Effects of Teenage Passengers on the Risky Driving Behavior of Teenage Drivers. *Accident Analysis and Prevention*, Vol. 37, No. 6, 2005, pp. 973–982.
84. Chen, L. H., E. R. Braver, S. P. Baker, and G. Li. Potential Benefits of Restrictions on the Transport of Teenage Passengers by 16 and 17 Year Old Drivers. *British Medical Journal*, Vol. 7, No. 2, 2001, pp. 129–134.
85. Preusser Research Group. Passenger Restrictions in Graduated Driver Licensing Programs. National Highway Traffic Safety Administration, No. 337, 2007.
86. Williams, A. F. Contribution of the Components of Graduated Licensing to Crash Reductions. *Journal of Safety Research*, Vol. 38, No. 2, 2007, pp. 177–184.

Additional Resource

- Foss, R. D., A. H. Goodwin, A. T. McCartt, and L. A. Hellinga. Short-Term Effects of a Teenage Driver Cell Phone Restriction. *Accident Analysis and Prevention*, Vol. 41, No. 3, 2009, pp. 419–424.

APPENDIX A

Other Research Questions Submitted to the Subcommittee for Discussion

1. What is the relationship between the amounts of supervised practice driving obtained during the learner phase and subsequent crash risk?
2. What is the relationship between driving skill, risk taking, and crashes? Are more skillful drivers safer drivers?
3. Teenage driving issues in rural areas, e.g., are parents less likely to provide supervised driving practice if their teen has already been driving in connection with farming activities?
4. What are ways to accelerate the acquisition of hazard perception, recognizing and responding to potentially dangerous situations on the road?
5. What are the effects of starting education–training earlier, prior the time of learner permit acquisition, e.g., at ages 14 or 15?
6. What are the effects of cell phone use and text messaging on driving behavior and crashes among teens?
7. What is the relationship between trip purpose (e.g., to and from school, to or from work, family errands, recreational) and crash risk?
8. Peer-to-peer programs and their potential effects, e.g., can teens be motivated to take action in ways that positively affect the driving behavior of their peers?
9. What are the effects of recent additions, such as enhanced penalties or required programs for parents, to GDL programs?
10. Given the increasing availability of technologies that provide in-vehicle monitoring (vehicle location, speed, rapid accelerations, etc.), how can we best use these technologies to promote novice driver safety, taking into account parent–teen attitudes toward their use?
11. What are the factors related to vehicle choice, which is a critical issue in injury prevention, especially given the tendency of teens to drive older and smaller (i.e., less safe) vehicles than adults?
12. Are there specific kinds of behind-the-wheel practice with parents or types of behind the wheel situational driving practices that lead to lower levels of crash involvement among novice drivers?
13. What is the optimal period for the learner license?
14. What are key issues for disadvantaged communities, such as low SES, Native American–indigenous populations and remote communities, and how can we best address them?

APPENDIX B

Attendees

**TRB Young Driver Subcommittee
Midyear Meeting, July 28–29, 2008**
Woods Hole, Massachusetts

Ray Bingham
University of Michigan

Jeff Caird*
University of Calgary

Richard Compton
National Highway Traffic Safety Administration

Donald Fisher
University of Massachusetts at Amherst

Robert Foss
University of North Carolina at Chapel Hill

Arthur Goodwin*
University of North Carolina at Chapel Hill

James Hedlund
Highway Safety North

Charlie Klauer
Virginia Tech Transportation Institute

Anne McCartt
Insurance Institute for Highway Safety

Dan McGehee
University of Iowa

Craig Morris*
Bureau of Transportation Statistics–RITA–
U.S. Department of Transportation

Marie Claude Ouimet
National Institute of Child Health
and Human Development

Richard Pain*
Transportation Research Board

John Palmer*
St. Cloud State University

David Preusser
Preusser Research Group

Teresa Senserrick
The George Institute for International Health

Jean Shope
University of Michigan

Ruth Shults
Centers for Disease Control

Bruce Simons-Morton
National Institute of Child Health and Human
Development

Brian Tefft*
AAA Foundation for Traffic Safety

John Ulezycki*
National Safety Council

Kimberly Vachal*
North Dakota State University

Allan Williams
Allan F. Williams LLC

* Invited guests

COMMITTEE MEMBERS NOT ATTENDING

Tsippy Lotan
Or Yarok (Israel)

Dan Mayhew
Traffic Injury Research Foundation

James McKnight
Annapolis, Maryland

Barry Watson
Queensland University of Technology

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