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Other high-risk factors for young drivers—how graduated licensing does, doesn't, or could address them

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Abstract

Problem: Young drivers, particularly those who are newly licensed, have a very high crash risk. This paper examines the risk factors underlying their high crash rates and assesses the extent to which existing graduated licensing programs address these risks and whether improvements to these programs should be considered. *Method*: Review and synthesis of the literature. *Results*: The elevated risk among young drivers of being in an injury crash is the result of a number of factors found alone or in combination, such as risky driving, alcohol use, seat belt nonuse, driver distraction, fatigue, and vehicle choice. Nighttime and passenger restrictions, adopted widely in the United States, work by keeping drivers out of hazardous situations rather than by addressing risk factors directly. However, the risk factors remain in play in driving situations not specifically restricted by law. Although other graduated licensing components adopted around the world—more stringent exit tests (i.e., you need to pass a test to move to the next stage), hazard perception tests, and restrictions on speed, vehicle power, and roadway access—make sense based on the identified risk factors, they are not yet supported by research. Should research findings warrant it, consideration should be given to providing guidance to parents about how to keep their beginning drivers safe, including information on vehicle choice. *Impact on research, practice, and policy*: Researchers should continue to monitor and to evaluate innovative approaches to reduce the crash risk of young drivers. The effectiveness of new approaches should be established before adoption on a wider scale takes place.

Keywords: High-risk factors; Young drivers; Graduated driver licensing

1. Introduction

The rationale for graduated driver licensing (GDL) is to keep newly licensed young drivers out of harm's way by restricting driving to times and situations demonstrated to be of lower risk. Some well-known high-risk scenarios include nighttime driving and driving with teenage passengers. Consequently, many GDL programs restrict new drivers from driving at night and from driving with teenage passengers in the car.

It is widely recognized that the elevated crash rates of young drivers result from both inexperience and immaturity. GDL addresses both these factors by requiring an extended period of supervised driving and by delaying access to a full, unrestricted license until experience has been gained. With these provisions, drivers are more experienced when they are first allowed to drive unsupervised, and they are also older and hopefully more mature by the time they can obtain a full, unrestricted license.

The Williams paper presents data on two situations that represent high risks to teenagers: nighttime driving and transporting teenage passengers. As Williams points out, the increased risks associated with nighttime driving are the result of a number of different specific factors (e.g., visibility often is limited at night, drivers may be tired and may have been drinking, and nighttime driving is more likely to be recreational in nature so teenagers may take more risks). Lower belt use rates at night also can increase the risk of injury. Restrictions on nighttime driving work not so much by addressing these individual risk factors as by keeping drivers out of risky situations. The same case can be made for passenger restrictions.

The focus of this paper is to examine other risk factors for teenage drivers and to assess whether they are adequately addressed by GDL or whether additional components should be adopted. The additional risk factors to be discussed include risky driving, risk perception and evaluation, hazard perception, driver distraction, seat belt use,

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fatigue, and vehicle choice. This paper also will consider the ways in which the individual risk factors currently are dealt with, either directly or indirectly, in existing graduated licensing systems in the United States; whether these factors are addressed outside of the GDL system; or whether there are additional ways to address them within GDL. This will include a discussion of novice driver licensing requirements in other countries. The risks associated with driving after drinking alcohol are addressed by Williams, so they will not be discussed here. Furthermore, the increased risks associated with drinking and driving are dealt with separately from GDL laws in the United States through the enactment of minimum purchase age and zero tolerance laws.

How an individual drives is based on a complex combination of factors. Obviously, driving skill plays an important role, with younger and more inexperienced drivers exhibiting less skill when first licensed. Skill aside, unsafe driving may arise from different sources. Drivers may have different attitudes about driving, including their perceptions about the likelihood of being in a crash (“risk perception”). They may also differ in their beliefs about what constitutes safe driving, including beliefs about their own driving ability. There are studies that document differences in risk perception among young drivers, as well as studies that point to their riskier driving. Moreover, younger drivers tend to rate hazardous situations as less risky than older drivers. With regard to rating personal driving abilities, while it is clear that young novice drivers are less skilled in driving, there is some evidence that their perception of their skill is not commensurate with these limited abilities.

2. Risky driving

Elander, West, and French (1993) describe driving as a self-paced task in that drivers can make the task more or less difficult depending on their chosen margins of error. This is manifested as driving in a more or less risky manner (i.e., driving faster, following more closely, and so on). While this may or may not be a choice that drivers make consciously, in the case of young beginning drivers, the margins of error assumed also may have to do with driving inexperience (i.e., they do not know any better).

Differences have been observed in the choices drivers of all ages make about appropriate driving speed, following distance, gap acceptance, and so on (Wasielewski, 1984; West, Elander, & French, 1992; Wilson & Greensmith, 1983). Furthermore, a number of observational studies have found that young drivers take more risks than older drivers. For example, younger drivers tend to accept narrower gaps when pulling out into traffic (Bottom & Ashworth, 1978; McKenna, Waylen, & Burkes, 1998). They also have been observed with shorter following distances (Baxter et al., 1990; Evans & Wasielewski, 1983) and driving faster (Galin, 1981; Quimby & Watts, 1981). Studies relying on self-reported data and crash-related data have reported similar findings (Evans, 1991; Jonah & Dawson, 1987; McKenna et al., 1998).

Current GDL systems already have components that can potentially address risky driving. To the extent that risky driving is a function of inexperience (e.g., not knowing the appropriate speed for the situation, or making a faulty judgment of an approaching driver’s speed), longer periods of supervised driving ought to help. However, to the extent that risky driving is the result of youthful exuberance and a greater tendency to take risks, the problem becomes one of motivating young drivers to drive in a more cautious manner. The threat of meaningful penalties can be a powerful motivator if there is a perception that they will be applied. All jurisdictions in the United States have laws in place that penalize young drivers who do not comply with driving restrictions, or who are involved in traffic violations or at-fault crashes. Furthermore, almost all jurisdictions can delay or prohibit graduation from the licensing system if there is evidence of a poor driving record. Such a threat has the potential to motivate safe driving if drivers are aware of the provisions and their penalties, and if jurisdictions follow through when provisions are not complied with. The degree to which drivers comply with restrictions has important implications for safety. However, this is dealt with in a separate paper so it will not be addressed further here.

While GDL systems in the United States have components that potentially can address risky driving, other countries have done more. For example, some countries have provisions that prohibit novices from driving high-powered vehicles, or that limit driving speeds and access to higher-speed roadways. Drivers in Ontario, Canada, are not permitted to travel on high-speed roadways when in the learner’s stage. In New South Wales, Australia, beginning drivers are not permitted to exceed certain speed limits ranging from 80 to 100 km/h, depending on the stage they are in; and in Victoria, Australia, beginners in the probationary licensing stage are not permitted to drive vehicles that have a power-to-weight ratio greater than 125 kW/ton or with a capacity-to-weight ratio of more than 3.5 l/ton. This limitation is not very stringent and still allows novices to drive some performance cars. There is limited evidence to support the adoption of such restrictions at present. Doherty and Andrey (1997) have argued that restricting beginning drivers to lower-speed roads will have the unintended effect of increasing the crash risk of young drivers because crash rates are actually higher on lower-speed roads. Thus, transferring travel to these roads may be counterproductive.

3. Risk perception, hazard perception, and driving skill evaluation

As Brown and Groeger (1988) point out, risk perception involves not only an assessment of the potential hazards in the traffic environment but also an assessment of the abilities of the driver and the vehicle to prevent potential hazards from

becoming actual crashes. Only a small fraction of potential hazards represents any real danger for a driver in any given situation, but a more experienced driver will be better able to quantify the degree of a given danger and respond appropriately. There is evidence that novice drivers are less able to assess hazards in the traffic environment (see Brown & Groeger, 1988). Mourant and Rockwell (1972) reported that novice drivers have a different visual fixation and scanning pattern than experienced drivers, focusing less on distant hazards. McKnight and McKnight (2000) also reported deficits in the ability of young drivers to identify potential risks on the road. For example, they reported that among young drivers, inadequate search, including not watching the car ahead, contributed to a greater percent of their crashes.

There is evidence that despite their inexperience, young drivers perceive their own risk of being in a crash as significantly lower than that of their peers or older male drivers (Finn & Bragg, 1986). Furthermore, it has been well established that few drivers believe they are bad drivers—the bad drivers are other people. Thus, drivers of all ages tend to rate their own driving skills as better than average (e.g., Delhomme, 1991; Sivak, Soler, & Trankle, 1989; Williams, Paek, & Lund, 1995). In a study by Matthews and Moran (1986), young drivers consistently rated their own abilities as equal to that of older drivers and higher than that of their peers.

How can GDL address these factors? Attitudes such as drivers' perceptions of their own driving ability can be difficult to change because everyone thinks he/she is a good driver. There are two possible approaches that have been adopted to improve hazard perception skills of young drivers. One is to make the exit test more stringent, so that only those drivers who pass a prescribed battery of tests are allowed to advance to the next stage. Another approach is to try to improve hazard perception skills through training. There has been a lot of interest in the driver education community to teach hazard perception skills as a component of a second-stage driver's education course. The rationale is that driver education currently teaches only basic driving skills, and a second-stage driver education course is needed to teach higher-level skills once basic car control skills are mastered. This may make more sense as part of a multistage graduated licensing system. In the United States, only Michigan's graduated licensing system includes a second-stage driver education component intended to improve higher-level driving skills. The in-class course, although less comprehensive than first envisaged by the planning committee, does include a hazard perception component.

Although not currently part of GDL in the United States, a number of jurisdictions around the world have put in place a second-stage driver test that can consist of an additional on-road test (British Columbia and Ontario, Canada; New Zealand) or a computerized test with components that assess hazard perception (New South Wales and Victoria, Australia). In November 2002, the UK also plans to adopt as part of the driving theory test a hazard perception test made up of film clips showing real road scenes and potential hazards. Drivers will be assessed on how soon they spot the dangers.

Many of these approaches appear promising in laboratory studies, but there is no evidence as yet that they reduce crash rates among young drivers on the road. Experimental studies have reported correlations between hazard perception skills and crash involvement (Pelz & Krupat, 1974; Quimby, Maycock, Carter, Dixon, & Wall, 1986). Furthermore, a recent study indicates that while the Victoria hazard perception test has limited power to predict some types of injury crashes, there were problems with low reliability (Congdon, 1999). There is also some evidence that training can improve hazard perception skills both in the laboratory and on the road (McKenna & Crick, 1994; Mills, Hall, McDonald, & Rolls, 2002) and that drivers who are more crash-involved have significantly worse hazard perception than other drivers (McKenna & Horswill, 1999; Sexton, 2000). However, no studies have examined the effects of these programs on crash involvement. Given the failure of traditional driver education to reduce crash risk among young drivers (Mayhew & Simpson, 1996) and recent evidence that driver education within GDL actually may increase crash rates (Boase & Tasca, 1998; Mayhew, Simpson, Williams, & Desmond, 2002), adopting widespread increases in driver education is not justified until there is evidence on effectiveness. For this reason, it is important to conduct scientifically valid studies of these approaches in the communities that are experimenting with them.

4. Effects of fatigue

With evidence accumulating that teenagers often do not get enough sleep, the issue of fatigue as a risk factor is growing in prominence (National Sleep Foundation, 2000). There is evidence that adolescents' sleep patterns undergo a shift toward later times for both sleeping and waking. This shift is counter to the very early high school starting times in many jurisdictions (Wolfson & Carskadon, 1998). The result is an increase in daytime sleepiness among adolescents and an even greater potential for sleepiness at night, especially if combined with alcohol.

There also is some evidence that acute sleepiness while driving can increase the risk of an injury crash independent of the effects of alcohol (Connor et al., 2002). However, the contribution of fatigue to teenage crashes is not well established. A recent study (Akerstedt & Kecklund, 2001) reported elevated late night crash risk among younger drivers (18–24 years), excluding crashes where alcohol use was suspected, but no research to date has specifically examined the youngest drivers (16 and 17 years old).

Fatigue is not unique to teenagers, and the extent to which fatigue is greater than among older drivers is not clear. Were it to be demonstrated that fatigue represents a significant risk factor among young drivers, it is not clear how GDL could address this issue. Within current graduated

licensing systems, nighttime driving restrictions have the potential to address nighttime drowsy driving, if complied with. However, it is not clear how to address daytime fatigue within GDL. Outside the GDL realm, some high schools have adopted later start times and others are considering it. It is not known if, or how, this policy will affect crashes due to fatigue.

5. Seat belt use

Seat belts are a very effective means of reducing the risk of injury or death in the event of a crash (Evans, 1986; National Highway Traffic Safety Administration, 1984). However, there is abundant evidence from observations and crash data that teenage drivers and passengers use belts less often than older occupants (McCartt, Shabanova, & Leaf, in press; Wells, Williams, Teed, & Lund, 1989; Williams, McCartt, & Geary, in press; Williams et al., 1995; Williams & Shabanova, 2002; Williams, Wells, & Lund, 1983; Womack, Trout, & Davies, 1997). Observational studies of teenagers have reported lower use rates among males vs. females, passengers vs. drivers, passengers with teenage drivers vs. adult drivers, and occupants of pick-up trucks vs. cars (Williams et al., in press; Williams, Rappold, Ferguson, & Wells, 1997; Williams et al., 1983; Womack et al., 1997). Studies that have examined seat belt use among fatally injured teenage drivers indicate that belt use is even lower in situations of higher crash risk, such as late at night or when drivers have consumed alcohol, increasing further the potential for injury (McCartt et al., in press; Williams & Shabanova, 2002).

There is a precedent in the United States for dealing with the issue of belt use within a graduated licensing system. In one state, North Carolina, graduation to the next level is delayed for novice drivers if they are found in violation of the belt use law. In addition, a higher fine can be imposed—up to US$100 compared with US$25—for a seat belt violation within the primary belt use law. However, there is no information on the extent to which seat belt citations are issued to young drivers, or whether the applicable penalties are actually applied when belt use citations are issued. There is evidence from a number of states with nighttime and passenger restrictions that while such restrictions reduce the incidence of driving under these conditions, they still are widely flouted (Mayhew, Simpson, Ferguson, & Williams, 1998, 1999; Williams, Nelson, & Leaf, 2002). The issue of compliance is key to improving effectiveness of such laws. However, since this is the subject of another paper, it will not be discussed further here.

Probably the best opportunity for increasing belt use rates among young drivers, and drivers of all ages, is outside GDL, through the passage of statewide primary belt use laws and well-publicized enforcement of these laws (see Solomon, 2002; Solomon, Preusser, & Nissen, 2001; Williams, Lund, Preusser, & Bloomberg, 1987; Williams, Reinfurt, & Wells, 1996). Analyses of fatally injured teenage drivers and passengers confirm that use rates are much higher in primary use states (McCartt et al., in press). Primary enforcement is a component of most belt use laws outside the United States; however, only 18 US states have adopted such laws (as of July 2002).

6. Vehicle choice

A few studies indicate that teenagers are more likely than the overall driving population to drive older and smaller vehicles, a factor that can increase their chance of injury in the event of a crash (Cammisa, Williams, & Leaf, 1999; Williams, Preusser, Lund, & Rasmussen, 1987). Smaller vehicles provide less protection than larger ones, and older vehicles do not have the latest crash protection features such as front and side impact airbags. For example, among 16- to 19-year-old drivers, the risk of dying in a crash (*Fatality Analysis Reporting System, 1995–2001*, National Highway Traffic Safety Administration, 2002) is much higher if they are driving the smallest cars compared with the largest cars (26 vs. 17 deaths per 10,000 crashes). (This relationship holds for drivers of all ages but is given here for the youngest drivers for purposes of illustration.)

Why do teenagers more often drive vehicles that are less safe? Cammisa et al. (1999) interviewed parents of teenagers who recently had obtained their license. When parents were asked about the factors that influenced the choice of vehicle their teenager currently drove, the reasons were based more on practicalities (e.g., they already owned the vehicle, the vehicle was cheap, the teenager wanted it) than on safety, which was mentioned only about 1–2% of the time. Another study indicated that a family decision about which vehicle a teenager would drive once licensed placed much less importance on large size than, for example, automatic transmission, low gas mileage, and safety features such as antilock brakes and airbags (Rivara, Rivara, & Bartol, 1998). Contributing to the risk from poor vehicle choice is the fact that teenagers who own their own vehicles tend to drive more miles, report more risky driving than nonowners, and report more crashes (Cammisa et al., 1999). Although not the subject of investigation in any of the studies reported above, to the extent that teenagers drive vehicles with increased performance characteristics, this can also potentially increase their risk of being in a crash.

How can GDL address these issues? Currently, the issue of vehicle choice is not directly addressed by GDL in the United States, nor is it addressed outside of the GDL system. An increasing number of states are adopting graduated licensing systems that directly involve parents in the learning-to-drive process, by requiring parents to certify that a certain number of miles have been driven during the learning stage. Clearly, most parents have concerns about the safety of their newly licensed teenagers and are motivated to take steps to keep them safer. However, the

evidence indicates they do not have a good understanding of the importance of vehicle selection in keeping their child safe in the event of a crash. Although drivers seem to recognize the importance of large vehicle size for vehicle safety, when asked spontaneously what makes a vehicle safe, large size is mentioned much less often than vehicle safety features such as airbags and antilock brakes (Ferguson & Williams, 1996). Furthermore, as the research above suggests, when it comes to choosing a vehicle for their teenagers, more practical concerns tend to hold sway so that teenagers generally tend to drive the least safe vehicles. The potential effectiveness of parental education is not known, although a few studies are currently evaluating the effects of providing parents with educational materials (Simons-Morton, Hartos, & Leaf, 2002; Tennessee Department of Motor Vehicles, in preparation). Advice on the type of vehicle to buy should be a central component of such materials (e.g., advice on which vehicles to avoid such as the smallest vehicles, high-powered vehicles, and unstable vehicles such as sport utility vehicles).

Other countries have addressed this issue as it pertains to the speeds at which vehicles can be driven. As discussed earlier, some licensing systems place limits for the youngest drivers on vehicle horsepower (e.g., Victoria, Australia). However, there is limited evidence on its effectiveness (Baughan & Simpson, 2002).

7. In-vehicle distractions

With the proliferation of cell phone ownership and the growing evidence of an increased crash risk when people use cell phones while driving, more emphasis is being put on the issue of in-vehicle distraction. Many devices already in vehicles such as radios and CD players have the potential to distract drivers. Furthermore, manufacturers are incorporating additional technologies that may require interaction while driving, such as navigation devices. As a result, manufacturers, government regulators, and others are trying to develop standards to limit the potential distraction from in-vehicle devices. Although very few studies have examined the distracting effect of cell phone use on beginning drivers, it is possible that they may be more affected by distractions than more experienced drivers. Studies suggest that young drivers are not as efficient as more experienced drivers in processing the visual information needed to drive safely while attending to nondriving tasks at the same time (Mourant & Rockwell, 1972; Summala, 1996).

Many studies have attempted to quantify the effects of cell phone use on the driving task. These studies measured the attentional burden associated with the driving task in a number of ways, including the use of a driving simulator, driving a vehicle on an off-road track, and driving in actual traffic conditions. Overall, these studies suggest that using a cell phone while driving can impair driving performance, specifically in the maintenance of lane position, appropriate traffic speed, appropriate following distance, and gap acceptance. Using a cell phone also can reduce driver awareness of other traffic on the road and can increase reaction times (see Royal Society for the Prevention of Accidents, 2002). However, most studies have not examined the risk of cell phone use specifically for novice drivers. One study examined the length of drivers' glances away from the road while performing a secondary task, either changing a cassette, dialing a cell phone, or searching for a station on the radio, during on-the-road driving (Wikman, Nieminen, & Summula, 1998). Novice drivers showed a greater variability in glance duration, with more short and more long glances directed at the in-car task. None of the experienced drivers took glances longer than 3 s, while 29% of novices did. These longer glances were associated with greater lateral displacement of the vehicle. McKnight and McKnight (1993) examined the effects of various types of driver distraction (e.g., placing a cell phone call, carrying on a cell phone conversation, tuning the radio) vs. no distraction. Subjects aged 17–25 years were more distracted by tuning the radio than in the other conditions, and compared with older subjects.

A few studies report that cell phone use while driving is associated with increased crash risk, although there are differences in the magnitude of the estimates (Laberge-Nadeau et al., in press; Redelmeier & Tibshirani, 1997; Violanti & Marshall, 1996). Redelmeier and Tibshirani found that the relative risk associated with cell phone use was higher among drivers younger than 25 years than among older drivers; however, due to small sample sizes, this difference was not significant (relative risk for driver younger than 25 years = 6.5; 25–39 years = 4.4; 40–54 years = 3.6, >55 years = 3.3).

Legislation to ban the use of cell phones is being widely considered within the United States and has been adopted in a few jurisdictions. At least 25 countries around the world restrict or prohibit cell phone use while driving for drivers of all ages. Many US states (22 during the last year) have considered legislation to prohibit hand-held phone use while driving for all drivers. There are a number of local laws restricting cell phone use while driving, but only New York has actually banned the use of hand-held phones statewide. A recent observational survey in New York found significantly lower hand-held phone use while driving after the law, both among drivers judged to be younger than 25 years and those 25–59 years (McCartt et al., in press). This study points to the potential for laws to make a difference at least in the short term.

The National Safety Council has endorsed a ban on cell phone use for all drivers younger than 18 years. In the past year, a number of states have introduced legislation to prohibit teenage drivers from using cell phones while driving (Illinois, Iowa, Massachusetts, New York, Oklahoma, South Carolina, Tennessee, and Virginia), although none of these was enacted. One state, New Jersey, enacted a ban in August 2002 on any type of cell phone use while

driving specifically for drivers in the learner and provisional stages. It is too soon to evaluate whether the New Jersey law will affect cell phone use among this target group.

8. Conclusions

Young beginning drivers have an elevated risk of being involved in a crash and being injured or killed because of a host of different factors working either independently or in combination. These include risky driving, alcohol use, seat belt use, driver distraction, fatigue, and vehicle choice. GDL typically deals with these by keeping young drivers out of situations that are known to be especially hazardous, such as driving at night or with teenage passengers, rather than trying to address risk factors directly—a reasonable approach given the difficulty of changing driver behavior. However, these factors also are at play in driving situations not addressed by these restrictions, such as daytime driving and without passengers, so additional approaches may be warranted.

There are a number of reasons why these risk factors generally are not targeted within GDL. As Williams (1997) points out, risky driving behavior may serve important functions for young people (power, esteem, independence, peer recognition). They also are difficult to affect through interventions, as they are shaped by many social forces including parental and peer influences. In some cases, the relationship with crash risk has not been well established among beginning drivers (e.g., in the case of fatigue or in-vehicle distraction). In other cases, countermeasures are being adopted in some GDL systems but are as yet unproven. For example, it has been documented that hazard perception skills are inadequate among young drivers and a few GDL programs are trying to address this through additional driver education or more stringent tests before a full license is issued. However, it is not known whether these approaches will lead to fewer crashes. Some risk factors may better be addressed through laws that apply to all motorists, such as speed laws or primary belt use laws, where enforcement is directed at the whole driving population. One issue that could be addressed within a graduated licensing system, as part of a program that provides advice to parents about driving safety, is vehicle choice. Parents increasingly are being asked to play a more central role in the learning-to-drive process, and jurisdictions are weighing the usefulness of providing guidance as well as what additional guidance to provide. Studies currently underway should shed light on the usefulness of this approach.

One concern in adding additional components to existing laws is that the more complex the system becomes, the more difficult it will be to enforce. Parents, teenagers, and even law enforcement may not be aware of or may not remember all the components, and enforcement may become unwieldy. Before additional, unproven approaches are adopted, consideration should be given to enacting restrictions that more fully address the high-risk periods and situations and to assuring that beginning drivers are complying with them.

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