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Driver Education – How Effective?

Brian O'Neill [1]

Abstract
In the early 20th century the numbers of motor vehicles in use grew rapidly in the U.S, Canada, and many European countries. By the 1930s automobile crashes and the resulting deaths and injuries had become a significant problem, and various safety organizations tried to address it with education and publicity programs aimed at changing driver behavior.

It is not clear when the high crash risks of young drivers were first identified, but in the early 1930s driver education courses began to be offered in U.S. high schools (feasible because U.S. licensing ages were 16 or younger) and soon such courses were being touted (with no evidence) as "the most obvious way" to reduce traffic crashes.

Over the years many claims were made for the effectiveness of high school driver education, however, it was not until the late 1960s that competent research studies (including randomized control trials) were undertaken. The consistent findings from these studies has been that high school driver education does not reduce crashes. Furthermore, the trained students get their licenses sooner, and because teenagers have very high crash risks, the net result of high school driver education is increased numbers of crashes

Keywords: Education, young drivers, driver licensing, countermeasures not evaluated.

1. INTRODUCTION
In 1929 there were more than 23 million passenger cars registered in the U.S. and deaths and injuries from their crashes was a growing problem. The early efforts to deal with this problem were focused on an approach called "The Three E's", standing for engineering, enforcement, and education.

The entire focus of this approach was on preventing crashes, reducing their consequences with crashworthiness designs or eliminating roadside hazards was not part of it. Thus, the engineering focus for vehicles was on brakes, steering, etc., with no consideration of features such as safety belts. Enforcement efforts were limited to catching offenders, not preventing crashes through deterrence. But above all, the principal focus was on the "education" of drivers, with educational, training, and publicity programs aimed at preventing crashes by changing road user behaviour (1).

In the 1930s, driver education courses for beginning teenage drivers in U.S. high schools was claimed (with no evidence) to be an effective way to prevent crashes. The safety establishment enthusiastically endorsed this program, proclaiming it was the <u>only</u> way to produce "safe" beginning drivers. Driver education courses became somewhat standardized in the 1940s and 50s, and included classroom instruction and supervised on-road driving.

As more and more young people in the U.S. had relatively easy access to cars there was a growing recognition that this age group had particularly high crash risks, and school-based driver education became <u>the</u> countermeasure for this problem. The key question that was not addressed with any competent studies until the late 1960s was: does high school driver education, or any other formal driver training, actually reduce the crashes of teenage drivers? In this paper I will summarize the very extensive research on this question that has been conducted since the 1970s.

The data and studies cited in this paper are almost entirely from high income countries (HICs) that have had formal driver education for beginning drivers for many years, and in some jurisdictions have required such training as a prerequisite for young drivers to get their first license. However, many of the basic conclusions can

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be expected to apply elsewhere, although the sizes of the effects may be different because driving exposure by age will differ.

2. DRIVER LICENSING AND DRIVER EDUCATION

For a long time formal education for beginning drivers was closely linked to driver licensing, with the completion of some formal training being a prerequisite for obtaining a first license in several jurisdictions. Thus, for example, in the 1960s, despite no evidence of effectiveness, the completion of a high school driver education course was a requirement for teenagers to obtain their first driver's license in a majority of U.S. states.

2.1. Driver Licensing History

In 1904 the United Kingdom was one of the first countries to require licenses to drive motor vehicles and the minimum age to obtain one was 17. Around the same time in the U.S. a few states began issuing limited numbers of chauffeur's licenses and soon most were issuing general licenses. Restrictions such as the minimum ages varied, as did requirements for testing prior to licensure. By 1921 the U.S. Uniform Vehicle Code recommended 16 as the minimum age, however, the actual minimum ages varied among the states ranging from 14 to 17. Canada and New Zealand had similar low minimum licensing ages. The original rationale for choosing one age over another is not fully clear, however, jurisdictions with lower minimum ages typically had rural economies and young people often were needed to drive farm vehicles, which probably influenced these choices.

It is unlikely that the early choices for the minimum licensing ages were influenced by driver age related crash risks, as aggregated data on crashes did not exist at that time. It is not clear when the high crash risks of young drivers were first recognized, but as they came to be recognized it reinforced the safety community's focus on high school driver education.

2.2. Driver crash risks by age

The high crash risks for teenage drivers have been documented for some time now. Figure 1 shows the U.S. passenger vehicle fatal and police-reported crashes per mile travelled by driver age in 2008 (2). The figure clearly shows the overinvolvement of 16-19-year-old drivers in both fatal and police-reported crashes. For both crash types the risks are highest for 16-year olds, and for each subsequent year of age the risks decrease until about age 25. Beginning at about age 70 they increase again (2).[2]

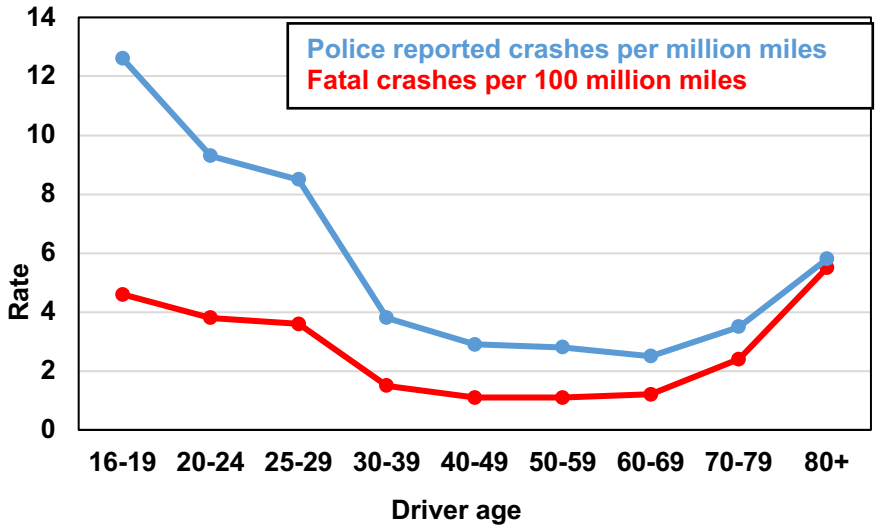

Figure 1: Passenger vehicle driver crash rates per mile traveled by driver age - U.S. 2008

[2] The reasons for the increases for older drivers in police-reported crashes relate to their decreasing abilities to handle traffic, and for fatal crashes their greater fragility means they are more likely to sustain injuries, such as complicated fractures, that would not be serious for younger drivers but can be fatal for the elderly.

Similar results showing the high crash risks for young drivers have been documented in European countries using data from national travel surveys which measure the on-the-road exposure by different age groups, either in terms of miles travelled or hours spent on vehicle travel (3-6).

2.3. Crash risks and minimum licensing ages

It has been claimed that the high crash rates for 16-year-old drivers is primarily due to driving inexperience, so that if the minimum age for licensure is set at 17 instead of 16, for example, beginning 17-year-old drivers would have crash risks comparable to beginning 16-year-old drivers. The variations in minimum licensing ages in the U.S. provide natural experiments to explore this claim.

A 1983 study compared the fatal crash involvement of teen drivers in three states with different minimum ages for licensure: New Jersey (age 17), Massachusetts (age 16½), and Connecticut (age 16). It reported that New Jersey's 17-year-old minimum licensing age was associated with "greatly reduced fatal crash involvement" (7).

The evidence is strong that immaturity is an important factor in the high crash risks of 16-year-olds, and that for each subsequent year in age as teens become somewhat more mature their crash risks decrease. However, as Figure 1 illustrates, the crash risks continue to decline for drivers into their 30s.

Clearly, young beginning drivers are a safety problem to themselves and other road users and effective countermeasures to this problem are needed.

3. FORMAL DRIVER EDUCATION

3.1. History

From the very early days of motoring the formal training of beginning drivers was widely supported. The British School of Motoring was founded in 1910 and offered training and courses in driving skills, as well as vehicles for drivers who wished to practice. However, in those days when vehicles were relatively expensive, it is likely that most beginners were adults, it was somewhat later when the focus of driver education shifted to beginning teenage drivers.

Driver education in high schools was largely a North American phenomenon, in large part because teenagers could get driver's licenses at 16 or younger, when they were still in school. In the European countries that were following the U.S. with relatively rapid motorization, teenagers could not get a driver's license until 17 or 18, which was after most of them had left secondary school, so making driver education a school class was not feasible for most students.

In North America high school students were an easy group to target for driver education because their training was in schools and it was "free". Also, the U.S. car industry recognized that teaching high school students to drive was good marketing, and consequently made cars available for these courses.

3.2. Early assessments of driver education

There were no scientific evaluations of the effectiveness of driver education until the late 1960s, however, prior to that time there were many claims made by its advocates and some insurance companies that these courses produced large reductions in the crash rates of young drivers.

These early assessments of driver education, however, had absolutely no validity. In all of them enrolment in the courses was voluntary, and in some cases, there was additional selectivity based on academic performance. As Peck noted in his 2011 review of driver education studies:

> "Subsequent research confirmed that self-selected volunteers had much more favourable characteristics than did comparison groups of non-trained students. Thus, any differences on subsequent record were confounded by variables such as socio-economic status, gender, social adjustment, grade point and intelligence…No attempt was made in these early assessments to adjust subsequent differences in crash rates for the aforementioned biases" (8).

These differences (or biases) relate to young drivers, however, in all kinds of driver training programs, including programs aimed at older drivers, there are inevitable differences between the groups who "volunteer" for training and those who do not. Some of these differences are related to driving behaviours and crash rates.

3.3. Scientific evaluations

In the late 1960s the failures of the early assessments were recognized, and since that time more competent research designs have been used to estimate whether or not driver education programs reduce the subsequent crash rates of the students.

Such studies have included retrospective or quasi-experimental designs that compare trained and untrained drivers using analyses that attempt to adjust for the pre-existing conditions. These kinds of studies require detailed information on the students in each group and are still subject to errors if the data used for the adjustments are insufficient.

The ideal designs are randomized control trials (RCTs) in which assignment to trained and untrained groups is random. However, RCTs of driver education are difficult to implement, for example, creating untrained control groups that don't have biases can be complicated. Plus, such studies are expensive because large sample sizes are needed in order to be able to detect relatively small differences.

3.3.1. Randomized control studies

Two comprehensive RCT studies of high school driver education were completed in the mid-1970s (in England) and in the late-1970s and early-80s (in the U.S.). The English study was conducted in the north of England and it involved 1,800 16-17-year-old sixth-form students, approximately half took a school driver education class and half received no training (9, 10).

This was the first time that formal driver education was offered in schools in England, and the curriculum was based on U.S. programs. It included class instruction, simulator training, and in-car instruction for students who were 17. Unlike in U.S. schools, the in-car instruction was provided by a commercial driving school. The conclusion from this study was that there "was no evidence at all that driver education has been successful in reducing the accident rate per mile." However, the total crash involvement per person of the group that had the driver education was higher than the untrained group because the driver education group more often obtained driver's licenses.

The U.S study was conducted by the National Highway Traffic Safety Administration (NHTSA). The study was prompted by the large number of believers in driver education and a smaller group of skeptics. The first step was the development of a "state-of the-art" driver education program, which as referred to as the Safe Performance Curriculum (SPC), which included 70 hours of instruction including classroom, simulator instruction, closed course (with evasive manoeuvres), and on-road training (including at night).

This study was conducted in Dekalb County, Georgia, and involved 16,000 students who were randomly assigned to one of three groups: the SPC; a shorter Pre-Driver Licensing Curriculum (PDL) with minimal training (20 hours of classroom and one hour of on-road training); and no formal driver education (reference). The driver education community expected this study to conclusively show that a model driver education program such as the SPC would reduce the crashes of beginning drivers.

The study addressed the volunteer effect by identifying students who intended to become licensed and agreed to participate in the study. The students were matched on academics, gender, socioeconomic status and then randomly assigned to one of the three groups.

The data on the subsequent crash rates for the three groups in the study have been subjected to a number of analyses. Comparisons of the crash rates for the three groups for the 24 months following their assignments showed no statistical differences between the groups (11). There were a number of additional analyses of the DeKalb data one of which compared the three groups from the date of their 16th birthday rather than the date of the assignment (12). This analysis reported a significant increase in crash rates for the SPC group compared to the control group, the crash risk differences between the PDL and the control group were not significant. A later analysis with two additional years of data reported that the controls had significantly fewer crashes than either of the training groups in year one, and that none of the differences between the controls and the trained groups were significant in years two through four (13).

As with the English study, the DeKalb study also found that the trained groups obtained their licenses sooner than the control group.

3.3.2. Cochrane review of school-based driver education

In 2001 a Cochrane review considered three RCTs "comparing school-based driver education to no driver education and assessing the effect on licensing and road traffic crash involvement" (14). In addition to the DeKalb county study, there was an Australian and a New Zealand study included in this review (15, 16).

The Strang et. al. study involved only 742 drivers who had been randomly assigned to one of three treatments, but the small sample size meant that even large effects on crash rates were unlikely to be detected. Similarly, the Wynne-Jones study also had a small sample size (561 trained and 227 controls) such that it would have been unlikely to detect a training effect. However, both males and females in the trained group in this study obtained their licenses earlier than the untrained students.

The Cochrane authors conclusions were:
"The results show that driver education in schools leads to early licensing. They provide no evidence that driver education reduces road crash involvement, and suggest that it may lead to a modest but potentially important increase in the proportion of teenagers involved in traffic crashes."[1]

3.3.3. The challenges for RCTs of driver education

It may seem surprising that there have been so few RCTs of driver education, however, these are difficult and expensive studies to conduct. As both the DeKalb county and the English study recognized, simple random selection was not feasible because of the volunteer effect. Another big challenge is the need for large sample sizes, only the DeKalb county study had sample sizes adequate to detect relatively small training effects. Peck in his review of driver education studies concluded that, based on California accident rates for 16-17-year old students, it would require 17,500 students in each group to detect a 10 percent effect with a 12-month follow-up (8). The DeKalb study, which is by far the biggest RCT involved a total of 16,000 students who were followed for 4 years. The cost of this study was over $4 million in the late 1970s.

3.4. Skid pad training for teenagers

Test track training aimed at preventing skids is a feature of many advanced driving courses. Evaluations of such courses in the U.S., Norway, and Finland, however, "suggest that this type of advanced skill training actually has a detrimental effect, especially for young males – i.e. it is associated with an increase, rather than a decrease, in crash involvement" (17). It appears that the reasons for the increased crash rates is that the trained drivers become overconfident of their abilities as a result of the course.

4. CONCLUSIONS FROM DRIVER EDUCATION EVALUATIONS

4.1. The effects on crashes

There have been numerous evaluations (of varying quality) around the world of the effects of formal teenage driver education on subsequent crash risks, and the overwhelming conclusion that can be drawn from them is that there is no convincing evidence that these courses reduce the crash involvements of the trained drivers, see for example, RACV (18) and Peck (8).

Despite the strong evidence of the ineffectiveness of formal driver education, there are continuing efforts to reinvent/modify such programs because the "believers" are unwilling to accept the conclusions that a few classroom hours and limited on-road training do not reduce the crash involvements of beginning young drivers. Thus, for example, a recent evaluation of beginning driver education in Oregon was "cautiously optimistic" that there could be a small beneficial effect from the training (19). However, the authors acknowledge that "only a few factors" that may differ between the trained and untrained drivers "could be controlled in the analysis."

4.2. Licensure acceleration

The finding from the 1975 English RCT that driver education accelerates licensure, was the first indication that such courses had negative effects on safety. The Cochrane review also highlighted the problem of teenage licensure acceleration resulting from formal driver education courses. Many other studies have documented this effect.

In the U.S. a 1978 study reported that "About 80 percent of the 16-17-year-olds who took high school driver education obtained licenses that they would not otherwise have obtained until 18 or thereafter" (20). At the time NHTSA and the driver education establishment reacted furiously to this conclusion claiming it was based on

[1] This 2001 review was edited in 2008 with no change to the conclusions and republished in Issue 4.

faulty statistics (while apparently ignoring the same finding from the English RCT which had been reported in the Robertson and Zador paper). A subsequent NHTSA analysis reached the same conclusion, but with a smaller effect than reported by Robertson et. al.

The findings that high school driver education was not reducing crashes together with high school budget squeezes led a number of US states to eliminate driver education classes. A 1980 study assessed the effect of eliminating these classes on driver licensure in several communities in Connecticut, it reported substantial reductions in the numbers of 16-17-year-olds who became licensed, and as a result, substantial reductions in the numbers of crashes involving 16-17-year-old drivers (21).

4.3. Overall effects

The post-1970s driver education evaluations provide no convincing evidence of crash risk reductions associated with the training, but strong evidence that the training accelerates the licensure of teen drivers, and as a result driver education has had a negative overall effect on safety.

5. CRASH RISKS FOR TEENAGE DRIVERS

If driver education does not work, what can be done to reduce the crash risks for young drivers? It is clear that delaying teen driver licensure will reduce crashes, and a safety case can be made that minimum license ages should be increased, especially in jurisdictions with 16-year-old or lower ages, but such changes have proven to be difficult to accomplish politically. So what other countermeasures could be considered for the young driver problem? To answer this question, it is helpful to understand some of the driving scenarios that pose high risks for young drivers.

5.1. Night-time crash risks for teenagers

Figure 2 shows fatal passenger vehicle crash rates per 100 million miles travelled by driver age separated into night-time and daytime events (2). It shows elevated fatal crash risks for night-time travel for all age groups, but the risks for drivers under 30 are very high. These night-time risks, in part, reflect the problems of alcohol-impaired driving. Teens are less likely than adults to drive after drinking alcohol, but their crash risk is substantially higher when they do and is thought to result from their relative inexperience with both drinking and driving, and combining the two.

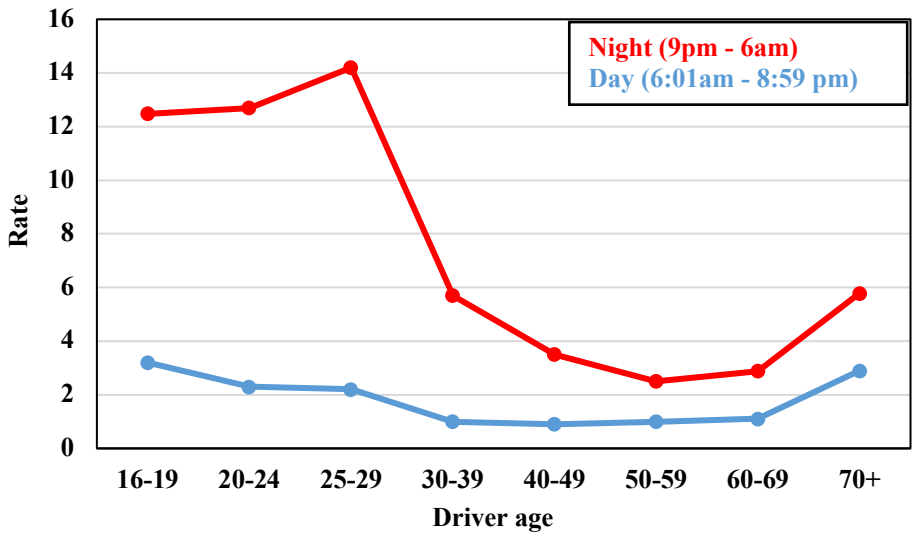

Figure 2. Passenger vehicle driver fatal crash rates per 100 million miles travelled by driver age and day vs night - U.S. 2008

5.2. Crash risks for teenagers transporting passengers

Another particularly high-risk scenario for beginning teenage drivers is when they transport other passengers, especially other teenagers. Figure 3 shows the risks of fatal crash involvement in the U.S. from 1990 to 1995 for drivers by themselves compared to when they have passengers. The risks shown are relative to the risks for 30 to 59-year-old drivers (22). For age groups under 30 the presence of passengers increases the fatal crash risks, and these increases are especially high for 16-year-olds, but also substantial for 17,18, and 19-year old drivers. In contrast for drivers over 30 passenger presence has essentially no effect on their fatal crash risks.

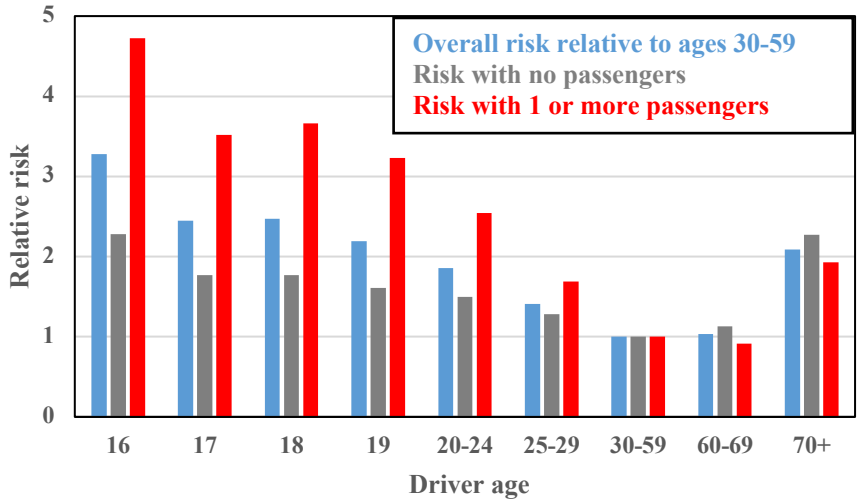

Figure 3. Relative risk of fatal crash involvement by driver age and passenger presence - U.S. 1990 to 1995

Figure 4 shows how the fatal crash risks for teen drivers increases dramatically with more passengers. It shows driver deaths per 10 million trips for 16-, 17-year-old, and 30-59-year-old drivers by the number of passengers. The teen drivers have dramatically increasing fatality risks as the numbers of passengers in their vehicles increases. In contrast, the 30-59-year-old driver fatal crash risks show no change as the number of passengers increases (23).

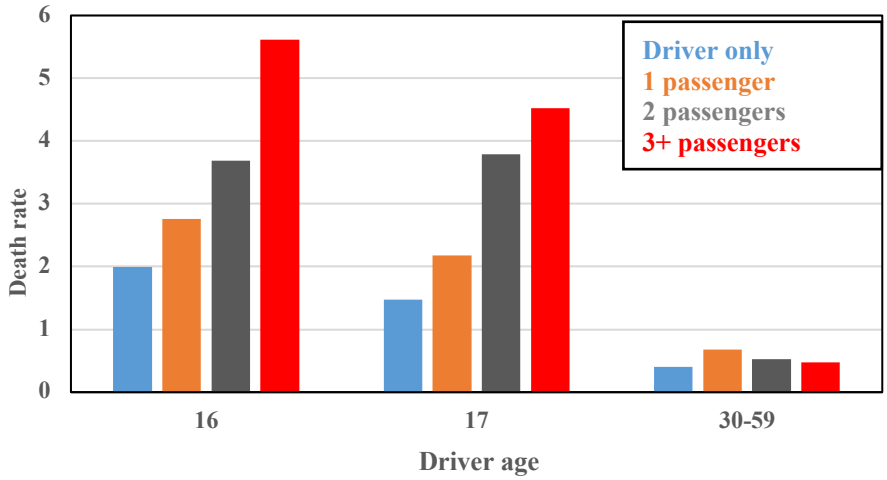

Figure 4. Driver deaths per 10 million trips by number of passengers and driver age - U.S. 1992 to 1997

6. DRIVER LICENSING TODAY

Minimum licensing ages around the world have varied from 14 to 18. There is no question that higher licensing ages would save many lives by reducing teenage driving exposure. As noted earlier, the crash rates of young drivers decline rapidly with each yearly increase of age. Furthermore, research looking at teen driver crash rates by months since licensure has shown that teen driver crash rates declined dramatically during the first six months of driving. These rates also varied by age, 16-year-old-drivers had the highest initial crash rates, and also the most rapid drop in the first six months (24). It is clear that both age and experience are independent factors contributing to the high crash rates of teen drivers.

Despite some public support for higher licensing ages, only a few jurisdictions have actually raised the minimum ages (25). Some jurisdictions have made the licensing process difficult or costly, effectively raising the minimum ages for licensure. In England, for example, with a minimum age of 17 (lower than most other European countries) has difficult written and driving tests (with many failures) and high costs for training and testing. As a result, in 1999-2001 only 41 percent of males 17-20-year-olds had full licenses, and 31 percent of females (26).

6.1. Graduated drivers licensing

An alternative licensing process (and probably fairer, because it doesn't involve any economic discrimination) is an approach referred to as Graduated Drivers Licensing (GDL). GDL delays unrestricted driving by starting the licensing process with a supervised learning period during which new drivers are allowed to drive, but only with a supervising adult for either a given period of time or minimum number of hours. Following this, drivers move to an intermediate license, which allows driving without adult supervision. During this phase there are some driving restrictions, including nighttime restrictions and limits on passengers. Typically, there are also low BAC thresholds for teen drivers during this period. At the end of the process drivers can then get an unrestricted license, and in most cases, this will be at a higher age than in the earlier licensing systems.

New Zealand was the first country to introduce such a system in 1987. Today many jurisdictions, including U.S. states, Canadian provinces, and Australian states have GDL. The lengths of learner and intermediate phases vary among jurisdictions, the most common practice requires the learner's license to be held for a minimum of six months, although there are longer learner periods of 12 months in some jurisdictions. The durations of the intermediate phase can vary from six months to two years.

Despite the evidence that driver education is ineffective, in some jurisdictions the learner permit period can be shortened by taking a driver education course.

6.2. The effectiveness of graduated licensing

GDL does not directly address the risks that are associated with immaturity, but it does address the issue of inexperience by allowing on-the-road driving, while avoiding some particularly high-risk scenarios. How well GDL reduces the high risks for teen drivers depends on the restrictions and the compliance of the teen drivers. Compliance with the GDL restrictions will not be perfect, and just as young drivers with higher risks of crashing typically are less likely to volunteer for driver education courses, some of the same driver characteristics – rebelliousness, over-confidence, less parental involvement, etc. – probably result in less compliance with the GDL restrictions.

The components of GDL programs vary significantly among jurisdictions with differing lengths for each phase, differing requirements for supervised driving, restrictions for night driving, and numbers of passengers, etc. In some cases, the restrictions are very weak, for example, nighttime driving restrictions starting at 1am.

An early evaluation of the New Zealand GDL reported that there were significant reductions in traffic-related injuries among young people since it was introduced (27). A later study focused on the three main driving restrictions, the night-time restrictions, no carrying of young passengers, and a low blood alcohol limit. The results indicated that the night-time restrictions in particular contributed to a reduction in serious crashes involving young drivers (28).

Evaluations of graduated licensing systems in U.S. states and Canadian provinces have shown they reduce crashes. A 2007 review of 21 GDL studies from 14 jurisdictions, and 6 nationwide studies concluded that "GDL programs have reduced the youngest drivers' crash risk by roughly 20 to 40%" (29). A later comprehensive review of GDL in the U.S. confirmed the substantial crash reductions associated with GDL at ages 16 and 17, especially 16. In addition, one possible concern had been that by keeping 16-17-year-olds from some high-risk situations there could be negative effects on crashes at ages 18 and 19 when the restrictions are lifted, this later review found such concerns to be unwarranted (30).

Although GDL has reduced the crash risks of teenage drivers, differences in these programs among jurisdictions influences their effectiveness. The Insurance Institute for Highway Safety has developed a rating system for the various U.S. programs based on their components, the ratings are based on: minimum ages; permit holding periods; required practice hours; nighttime and passenger restrictions; durations of the restrictions; etc. Laws were rated as good, fair, marginal, or poor. The study reported that "Compared with licensing laws rated poor, laws rated good were associated with 30 percent lower fatal crash rates among 15- 17-year-olds (31). So, there is considerable room to improve many of today's GDL systems.

7. CONCLUSIONS

Formal driver education was the countermeasure aimed at reducing the high crash risks of beginning teenage drivers for many decades when its effectiveness was not questioned. It was some 60+ years before competent research showed that not only did it fail to reduce the crashes of young drivers, but that it directly led to increases in crashes (including fatal ones) by increasing the driving exposure of the highest risk age groups.

This happened because in the early days of motoring, highway safety countermeasures were not subjected to any scientific evaluations, and when some effectiveness assessments were attempted, they were not competent. Despite the evidence of adverse effects, there still is a community of "true believers" who assert that driver education still has an important role to play in addressing the crash risks of beginning teenage drivers. Thus, for example, in 2000 the British government launched a road safety plan which included a significant role for driver education, despite the earlier British RCT study showing it to be harmful. Another example involves BMW which in 2003 introduced a free student driving program, which included instruction in skid control and emergency recovery that research has shown increases crashes (32).

In the U.S., NHTSA (a very important vehicle and highway safety agency that is largely science-based) has prepared a Driver Education Toolkit "with the assistance from national driver education community of experts and practitioners. Taken together, this impressive assembly of information and guidelines should give the States their best chance to produce safe young drivers." This Toolkit also asserts that "Driver education and training should be an integral part of the GDL system." There is no research support for these claims.

As noted in section 6.1, one unfortunate consequence of the continuing influence of driver education advocates is the fact that in some GDL programs the learner permit period can be shortened by taking a driver education course, a provision that has no scientific justification and can only reduce the effectiveness of GDL.

There are salutary lessons from this experience that go beyond driver education. Driver education was adopted in the U.S. decades before countermeasures were scientifically evaluated. By the time competent evaluations were undertaken there was a very large community of driver education teachers and their trade groups[1] with a vested interest in continuing this program, and it is clear that their influence is still strong.

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