Graduated Driver Licensing in Michigan
Early Impact on Motor Vehicle Crashes Among 16-Year-Old Drivers

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Context  Graduated driver licensing (GDL) programs are being adopted in many states to address the high rate of motor vehicle fatalities among teens by requiring teenaged drivers to gain experience and maturity under conditions of relatively low crash risk before gaining full driving privileges.

Objective  To evaluate the early impact of Michigan’s GDL program on traffic crashes among 16-year-old drivers.

Design, Setting, and Subjects  Analysis of Michigan motor vehicle crash data from 1996 (before GDL program implementation) vs 1998 and 1999 (after GDL program implementation) for 16-year-olds, adjusting for trends among persons 25 years or older.

Intervention  Michigan’s GDL program, instituted April 1, 1997, for teens younger than 18 years entering the driver license system, includes 3 licensure levels, each with driving restrictions and requirements to progress to the next level. Requirements include extended, supervised practice in the learning level, 2-phase driver education, and night driving restrictions in the intermediate level.

Main Outcome Measures  Rates in 1996 vs 1998 and 1999 for all police-reported crashes; for fatal injury, nonfatal injury, and fatal/nonfatal injury combined crashes; for day, evening, and night crashes; for single-vehicle and multivehicle crashes; and for alcohol-related crashes.

Results  Overall, the rate of 16-year-old drivers (per 1000 population) involved in crashes declined from 154 in 1996 to 111 in 1999 (relative risk [RR], 0.72; 95% confidence interval [CI], 0.71-0.73). After adjusting for populationwide trends, the overall crash risk for 16-year-olds was significantly reduced in 1999 from 1996 by 25% (adjusted RR, 0.75; 95% CI, 0.74-0.77). There were also significant reductions for nonfatal injury and combined fatal and nonfatal crashes; for day, evening, and night crashes; and for single-vehicle and multivehicle crashes. Fatal crashes declined from 1996 to 1999, but not significantly (RR, 0.74; 95% CI, 0.49-1.14), and alcohol-related crashes continued at a low rate (RR, 1.01; 95% CI, 0.80-1.29).

Conclusions  Analysis of the first 2 full calendar years following Michigan’s GDL program implementation indicates substantial crash reductions among 16-year-olds. Future research is necessary to determine if these reductions are maintained and if other jurisdictions achieve similar results.

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tions of low risk before progressing to more risky driving situations.

Several key elements of a comprehensive GDL program for novice drivers younger than 18 years have been recommended. First, licensure should be staged to phase drivers into on-the-road driving. The stages should include a supervised learner’s period, an intermediate licensing stage that permits unsupervised driving only in less risky situations, and a full-privilege license when the conditions of the first 2 stages have been met. Second, the learner’s stage should be long enough for adequate practice in increasingly challenging situations and should require fairly extensive adult supervision of that practice. Third, the intermediate stage, when independent driving begins, should also be of substantial length and include restrictions on such risky activities as driving at night and with teenage passengers. Fourth, programs should ensure competence before passage through each stage, using an integrated 2-phase driver education program (1 phase before the first stage and 1 phase before the second stage), written and road tests, and delays in progress if traffic violations or at-fault crashes occur.

Knowledge about the effect of Michigan’s comprehensive law, implemented April 1, 1997, on young drivers’ traffic crashes has been anticipated because nearly all the recommended GDL components are included. The purpose of our study was to evaluate the early impact of Michigan’s GDL program through examination of the crash rates of 16-year-old drivers before and after GDL implementation.

METHODS

Michigan’s GDL Program

Prior to GDL, 16- and 17-year-olds in Michigan could obtain a full driver’s license 30 days after completing a driver’s education course and passing a written test. Under the new GDL program for drivers younger than 18 years entering the licensing system on or after April 1, 1997, 3 levels of licensure were instituted. Level 1 is the learner’s stage (requiring extensive supervised practice); level 2 is the intermediate stage (including a night driving restriction); and level 3 is full licensure (although still under the state’s existing 3-year probationary period for all new licensees). Driver’s education under GDL is conducted in 2 phases, the first phase required before obtaining level 1 licensure and the second phase required before obtaining level 2 licensure. Teens progress through the levels only with parental approval, and parents can request that their teen be retained at any level. Minimum requirements for obtaining licensure under the previous licensing system and at each level of the new GDL program are shown in Table 1.

**Design**

The evaluation design of this administrative policy change, the introduction of GDL, is a before and after comparison of crashes involving 16-year-old drivers, using Michigan State Police crash data, which are available for each calendar year. One full year before the implementation of GDL, 1996, was selected to be compared with the 2 full calendar years following its implementation, 1998 and 1999. The year 1997 was omitted because of potentially unusual levels of licensing activity taking place just before and just after the law was implemented, as well as the time it took for new young drivers to acquire their level 2 licenses.

In addition to before and after, comparisons were done between crashes of 16-year-old drivers and crashes of drivers 25 years or older, to control for the possibility that populationwide changes in crash rates caused observed changes in crash rates of 16-year-old drivers.

**Data Collection**

Data on motor vehicle crashes in Michigan in 1996, 1998, and 1999 were obtained from the Michigan State Police. The police-reported crash files in Michigan for these years contained records for all crashes reported to local or state police agencies. Crashes are required to be reported if there is a personal injury or property damage of $400 or more. These requirements did not change during the

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**Table 1. Minimum Requirements for Michigan Driver Licensure for Drivers Younger Than 18 Years Before Graduated Driver Licensing (GDL), During Transition, and Under GDL**

<table>
<thead>
<tr>
<th>Before GDL</th>
<th>During Transition</th>
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<tr>
<td>Full licensure</td>
<td>Full licensure (if started driver education program before April 1, 1997)</td>
</tr>
<tr>
<td>Completed driver education program (20 hours classroom and 6 hours behind-the-wheel instruction) at least 30 days prior</td>
<td>Requirements as above</td>
</tr>
<tr>
<td>Be at least 16 years old</td>
<td>Pass road skills test</td>
</tr>
<tr>
<td>Have parent sign application</td>
<td></td>
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<tr>
<td>Pass written test</td>
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<td>Pass vision examination and meet health standards</td>
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**Under GDL Beginning April 1, 1997**

**Level 1: Learner licensure (may drive only with licensed parent/guardian or designee 21 years or older)**

- Complete segment 1 of driver education program that includes 24 hours classroom and 6 hours behind-the-wheel instruction (must be at least 14 years 8 months old to begin segment 1)
- Pass vision examination and meet health standards
- Have parent sign application

**Level 2: Intermediate licensure (may drive only with licensed adult 21 years or older between midnight and 5 AM)**

- Be at least 16 years old
- Complete 6 months at level 1
- Complete segment 2 of driver education program that includes 6 hours of classroom instruction
- Be violation/crash free for previous 90 days
- Have parent certify that 50 hours of supervised driving (10 hours at night) have been completed
- Pass road skills test
- Have parent sign application

**Level 3: Full licensure (no restrictions)**

- Be at least 17 years old
- Complete 6 months at level 2
- Be violation/crash free for previous 12 months
years under study. Injury severity data are coded in Michigan crash reports using the “KABCO” injury severity scale. K-level injuries are injuries caused by the crash that result in death within 90 days of the incident. A-level injuries are incapacitating injuries that prevent injured persons from walking, driving, or normally continuing the activities they were capable of performing prior to the injury. B-level injuries include nonincapacitating injuries that are evident to observers at the scene of the crash in which the injury occurred. C-level injuries are possible injuries reported or claimed that are not fatal, incapacitating, or nonincapacitating evident injuries. O-level refers to incidents in which no occupants were injured (property damage only). For our analyses, K-level injuries were used for fatal crashes, and A-level, B-level, and C-level injuries were used in combination for nonfatal injury crashes.

Outcomes

Outcomes of interest included all crashes, as well as various types: fatal injury, nonfatal injury, and a combination of those crashes; day (5 AM to 8:59 PM), evening (9 PM to 11:59 PM), and night (midnight to 4:59 AM) crashes (to capture the period covered by the GDL night restriction as well as the evening hours that are not covered); single-vehicle and multivehicle crashes; and alcohol-related crashes (“had been drinking” was on the police crash report).

Crash counts were examined, as well as crash rates based on the population of 16-year-olds in Michigan for each year of interest, obtained from the US Census Bureau. Crash rates per 1000 16-year-olds in Michigan were used to control for changes in the size of the population. Crash rates were based on population rather than licensed drivers because of a difference in recording licenses before and after GDL. Before GDL, learner permits were not included in the Michigan driver license database, whereas after GDL, level 1 (learner) licenses were included. The study was approved by the institutional review board at the University of Michigan. Informed consent was not necessary because we used archived data that did not contain private, identifying information.

Analysis

To estimate the crude change in crash risks between 1996 and 1998 among Michigan’s 16-year-olds, relative risks (RRs) and 95% confidence intervals (CIs) for each year for each crash type were computed, and the crash rates after GDL implementation were compared with the crash rates before GDL.

To adjust for the possibility that populationwide changes in crash rates were the underlying cause of observed changes in the 16-year-old crash rates between 1996 and 1998, the RR ratios and CIs comparing the RRs between 1998 and 1996 of 16-year-olds and of those 25 years or older were computed, similar to Mayhew et al12 and Ulmer et al.13 Similar analyses were conducted comparing the RRs of the 2 groups between 1999 and 1996. This RR ratio is the net impact of GDL assuming that changes in the crash risk of 16-year-olds in 1996 vs 1998 and 1999 would have exactly paralleled those 25 years or older in the absence of GDL. Hence a ratio of less than 1 would be indicative of a positive effect of GDL on the risk of crash for 16-year-olds relative to adults 25 years or older. This approach is slightly limited by the fact that improved driving and fewer crashes among 16-year-olds affects crash rates of all drivers to the extent that 16-year-old drivers are involved in crashes with older drivers. Nonetheless, it is a reasonable approach as a comparison and has been used by others.12,13

Analyses were performed with SAS version 8 (SAS Institute Inc, Cary, NC.)

RESULTS

Based on driver history data from a single point in time each year, the proportion of the 16-year-old Michigan population who were licensed to drive independently was 59.7% in 1996 (pre-GDL license), 38.1% in 1998 (6.3% pre-GDL license plus 31.8% GDL level 2 license), and 37.5% in 1999 (0.2% pre-GDL license plus 37.3% GDL level 2 license), resulting in a 22.2 percent-age point decrease from 1996 to 1999. It is also of interest to determine the mean age that 16-year-olds became licensed. Again based on driver history data, the mean age that licensed 16-year-olds had obtained a full license under the old system in 1996 was 16.2 years (median, 16.0 years). The mean age of obtaining a GDL level 2 license in 1998 was 16.3 years (median, 16.1 years), and in 1999 was 16.3 years (median, 16.2 years). The increased age of licensure among 16-year-olds to drive under GDL in 1999 represents about a 1.3-month delay in licensure to drive independently compared with 1996.

The GDL system was clearly being implemented among new teen drivers. In January 1998, 70.2% of 16-year-old drivers in Michigan had unrestricted licenses under pre-GDL regulations, 28.6% were in GDL level 1, and 1.2% were in GDL level 2. By January 1999, 6.8% of 16-year-old drivers in Michigan had unrestricted licenses under pre-GDL regulations, 42.8% were in GDL level 1, and 50.4% were in GDL level 2.

Data on the crash experience of 16-year-old Michigan drivers, before and after the introduction of GDL, are presented in Table 2. Numbers of crashes, crash rates per 1000 16-year-old population, and RRs of crash involvement for crashes overall and for selected subtypes of crashes are included. Sixteen-year-olds in 1998 and 1999 had significantly lower risks of being involved in a motor vehicle crash than 16-year-olds in 1996 (1998 RR, 0.74; 95% CI, 0.72-0.75; 1999 RR, 0.72; 95% CI, 0.71-0.73). Reviewing just comparisons of 1999 with 1996, significant reductions in risk of crash involvement were found for all subtypes of crashes except fatal and alcohol-related crashes. The greatest reduction in risk occurred for night crashes (RR, 0.43; 95% CI, 0.38-0.48), the period of time covered by the GDL level 2 night driving restriction. Similar patterns were found when comparing 1998 with 1996, although reductions were slightly less in that first year following the introduction of GDL.

Crash risks of 16-year-olds were compared with those of persons 25 years or
older to control for populationwide changes in crash rates that may have contributed to changes in the 16-year-old crash rates (Table 3). Ratios comparing the RRs of 16-year-olds with persons 25 years or older between 1998 and 1996 and 1999 and 1996 were calculated. The risk of overall crash involvement for 16-year-olds relative to those 25 years or older for all subtypes of crashes, except fatal and alcohol-related crashes. Fatal crashes declined, but the number of fatal crashes was small. In contrast to other crash types where 16-year-olds had higher rates of each type of crash compared with older persons, it can be seen that 16-year-olds had and maintained much lower rates of alcohol-related crashes in 1996, 1998, and 1999 (RR, 0.43, 0.42, 0.44, respectively). Comparing the RR ratios in Table 3 with the RRs in Table 2 shows that controlling for populationwide trends tempered the significant post-GDL reductions in risk of each crash type for 16-year-olds by a factor of 3 to 9 percentage points.

**COMMENT**

The reductions in crash risk among Michigan's 16-year-olds following implementation of GDL are impressive, even after the adjustment for populationwide changes among persons 25 years or older tempered the impact somewhat. Taking into account these general population trends, the risk of being involved in a motor vehicle crash in 1999 was 25% lower than in 1996 for 16-year-olds, a statistically significant difference. Significant reductions in risk were also found for nonfatal injury crashes (24%) and combined fatal and nonfatal injury crashes (24%); for day (24%), evening (21%), and night crashes (53%); and for single-vehicle (29%) and multivehicle crashes (23%). The decrease seen in the risk for fatal injury crashes (26%) was desirable, although not statistically significant, likely due to the relatively small numbers of such crashes. No change was observed in risk of alcohol-related crashes.

The sharp drop in risk of night crash involvement relative to day or evening crash involvement suggests that the night driving (midnight to 5 AM) restriction during the intermediate stage of licensure has been very effective. The drop in evening (9 PM to midnight) crashes is less than the drop for overall crashes, suggesting that a driving restriction that in-


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<tbody>
<tr>
<td>All</td>
<td>22625 (154)</td>
<td>16810 (113)</td>
<td>16500 (111)</td>
<td>0.74 (0.72-0.75)</td>
<td>0.72 (0.71-0.73)</td>
</tr>
<tr>
<td>Fatal injury</td>
<td>54 (0.37)</td>
<td>41 (0.28)</td>
<td>37 (0.25)</td>
<td>0.75 (0.50-1.13)</td>
<td>0.68 (0.44-1.03)</td>
</tr>
<tr>
<td>Nonfatal injury</td>
<td>6365 (43.3)</td>
<td>4611 (31.1)</td>
<td>4347 (29.2)</td>
<td>0.72 (0.69-0.74)</td>
<td>0.67 (0.65-0.70)</td>
</tr>
<tr>
<td>Fatal plus nonfatal injury</td>
<td>6419 (43.7)</td>
<td>4652 (31.3)</td>
<td>4384 (29.4)</td>
<td>0.72 (0.69-0.74)</td>
<td>0.67 (0.65-0.70)</td>
</tr>
<tr>
<td>Day (5 AM−8:59 PM)</td>
<td>19200 (130.7)</td>
<td>14339 (96.6)</td>
<td>14234 (96.5)</td>
<td>0.74 (0.72-0.75)</td>
<td>0.73 (0.72-0.75)</td>
</tr>
<tr>
<td>Evening (9 PM−11:59 PM)</td>
<td>2505 (17.0)</td>
<td>1965 (13.2)</td>
<td>1869 (12.5)</td>
<td>0.78 (0.73-0.82)</td>
<td>0.74 (0.69-0.78)</td>
</tr>
<tr>
<td>Night (midnight−4:59 AM)</td>
<td>920 (6.3)</td>
<td>506 (3.4)</td>
<td>397 (2.7)</td>
<td>0.54 (0.49-0.61)</td>
<td>0.43 (0.38-0.48)</td>
</tr>
<tr>
<td>Single vehicle</td>
<td>5560 (37.8)</td>
<td>3866 (26.0)</td>
<td>3717 (24.9)</td>
<td>0.69 (0.66-0.72)</td>
<td>0.66 (0.63-0.69)</td>
</tr>
<tr>
<td>Multiple vehicle</td>
<td>17055 (116)</td>
<td>12944 (87.2)</td>
<td>12781 (85.8)</td>
<td>0.75 (0.74-0.77)</td>
<td>0.74 (0.72-0.76)</td>
</tr>
<tr>
<td>Alcohol related</td>
<td>152 (1.03)</td>
<td>129 (0.87)</td>
<td>127 (0.85)</td>
<td>0.84 (0.66-1.06)</td>
<td>0.82 (0.65-1.04)</td>
</tr>
</tbody>
</table>


### Table 3. Comparative Relative Risks (RRs) and RR Ratios of Drivers 16 Years vs Drivers 25 Years or Older: 1998 and 1999 vs 1996

<table>
<thead>
<tr>
<th>Crash Type</th>
<th>Drivers 16 y vs Drivers ≥25 y, RR (95% CI)</th>
<th>Drivers 16 y vs Drivers ≥25 y, RR Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>2.17 (2.14-2.20)</td>
<td>1.70 (1.67-1.72)</td>
</tr>
<tr>
<td>Fatal injury</td>
<td>1.74 (1.32-2.28)</td>
<td>1.41 (1.03-1.93)</td>
</tr>
<tr>
<td>Nonfatal injury</td>
<td>2.41 (2.35-2.47)</td>
<td>1.86 (1.80-1.91)</td>
</tr>
<tr>
<td>Fatal plus nonfatal injury</td>
<td>2.40 (2.34-2.46)</td>
<td>1.85 (1.80-1.91)</td>
</tr>
<tr>
<td>Day (5 AM–8:59 PM)</td>
<td>2.12 (2.09-2.15)</td>
<td>1.65 (1.63-1.68)</td>
</tr>
<tr>
<td>Evening (9 PM–11:59 PM)</td>
<td>3.19 (3.06-3.32)</td>
<td>2.74 (2.62-2.86)</td>
</tr>
<tr>
<td>Night (midnight–4:59 AM)</td>
<td>1.89 (1.77-2.02)</td>
<td>1.12 (1.03-1.23)</td>
</tr>
<tr>
<td>Single vehicle</td>
<td>2.32 (2.26-2.39)</td>
<td>1.78 (1.72-1.84)</td>
</tr>
<tr>
<td>Multiple vehicle</td>
<td>2.12 (2.09-2.15)</td>
<td>1.67 (1.65-1.70)</td>
</tr>
<tr>
<td>Alcohol related</td>
<td>0.43 (0.37-0.51)</td>
<td>0.42 (0.35-0.50)</td>
</tr>
</tbody>
</table>

*Relative risk ratios adjust the RR for populationwide changes in crash rates. CI indicates confidence interval.
cludes at least some evening hours might enhance GDL’s effect further, as recommended by Foss.9 The expected lack of change in alcohol-related crashes over the 3-year period and low levels compared with drivers 25 years or older were very likely due to Michigan’s zero tolerance law, implemented in 1994, whereby any alcohol involvement by teens can result in the loss of their driver license. The 1999 crash risks were lower than the crash risks in 1998, as expected. The new cohort of teen drivers subject to the GDL program had to work its way into the 16-year-old driving population, with 1998 having about two thirds of the 16-year-olds under the new licensure system, and 1999 having nearly all the 16-year-olds under the system.

Some reduction in crashes could be explained by teens delaying GDL licensure.14 Indeed, Michigan experienced a 22.2 percentage point decrease from 1996 to 1999 in the statewide proportion of 16-year-olds licensed to drive independently. Reductions in crashes, however, exceeded that decrease, especially in the case of night crashes. The analyses reported herein could not assess the GDL level of drivers who experienced a crash. When this can be done, a more precise understanding of the changes in crash risk can be achieved. Sixteen-year-old drivers who obtained a license did so somewhat later, an increase of about 1.3 months from 1996 to 1999 in age of licensure to drive independently. Monitoring licensure levels and crashes over the next few years will shed light on the contribution that delay in licensure makes to crash reductions.

These results are among the first in the United States to evaluate a complete changeover among teen novice drivers into a comprehensive GDL system that includes a 2-phase driver education requirement and also requires certification by a responsible adult that a young driver has received extended supervised practice. Driver education completion is documented by the instructor for segments 1 and 2 and presented to the secretary of state’s driver license office by the applicant when application is made for levels 1 and 2 licensure. Parental certification of the supervised practice is required when application is made for level 2. Michigan does not require the actual number of practice hours to be recorded, but a survey of 814 parents of level 2 applicants in July 199815 found that most parents reported having spent more time (mean = 75.3 hours; 21.4 hours at night) supervising their child’s driving than the required 50 hours, with 10 hours at night. Many had also kept a written record of their child’s driving practice even though that is not explicitly required by law. Parents were extremely positive about the supervised practice requirement and the new GDL program in general. Although no information is available about the hours of teens’ driving practice under the previous licensing system, it is likely to have been considerably less.

Although a comprehensive approach to GDL for young novice drivers was proposed as early as the 1970s,16 only recently has the concept begun to gain widespread acceptance in the United States. Graduated driver licensing was first implemented in 1987 in New Zealand and subsequently spread to Australia and Canada. In the United States, legislative initiatives for GDL generally began in the late 1990s. Thirty-four states and the District of Columbia in the United States have now adopted a 3-level GDL system for new drivers, and other states and jurisdictions have some elements of GDL but not 3-stage systems.17 Comparisons among program evaluations are difficult because of differences in previous laws, differences in GDL laws, and differences in the methodology used to assess changes following GDL. Florida’s GDL program, introduced in July 1996, restricts night driving of 16-year-old intermediate licensees (11 PM to 6 AM) and limits the number of traffic violations that can be accumulated. Evaluation of the program, using before and after comparisons and a reference group of older persons unaffected by the program, found an 11% reduction in fatal and injury crash rates among 16-year-olds between 1995 and 1997.18 A supervised driving requirement was not added until October 2000.17 North Carolina’s GDL program, implemented in December 1997, restricts driving between 9 PM and 5 AM during the intermediate stage, but does not contain a requirement for minimum hours of supervised driving. Preliminary evaluation of the North Carolina program found a 26% reduction in crashes among 16-year-olds in 1999 compared with 1997.19 Ohio’s GDL law includes a night driving restriction, supervised practice, and a passenger limitation. Preliminary evaluation found a 23% reduction in the crash rate.20 Results from evaluations of GDL programs outside the United States have indicated declines in crashes among young novice drivers ranging from 7% to 37%.12,19-21

There are several limitations to this analysis. First, other than for night crashes, the individual effects of each GDL component could not be separated. Instead, the evaluation has examined GDL’s overall impact. Apparently, the combined effect of all its components, including requirements for practice, time in each stage of licensure, and other elements, including requirements for practice, time in each stage of licensure, and night driving restriction, has resulted in substantially fewer crashes among 16-year-olds in Michigan. Second, no driving mileage exposure data are available for 16-year-olds before and after GDL to determine whether decreased mileage contributes to the decreased crash risk. Exposure between midnight and 5 AM is presumed to have been less due to the restriction in the law, which parents and law officers are responsible to enforce. Third, additional driving restrictions may have been imposed by some parents on teens, but such data are unavailable. Indeed, the state’s written material for parents encourages this practice, sometimes in the form of a parent-teen contract. Fourth, and perhaps the most unfortunate limitation, is that the GDL license level is not recorded on the crash report, so that analyses of crashes by GDL level cannot readily be conducted. Each crash record must be individually matched with the driver license file and the data on GDL levels by date. Fifth, it was not feasible for the study design to include comparison states. But one can compare Michi-
gan's fatal crash rates with national fatal crash rates over the study years (fatal crashes are the only types of crashes for which full national counts are available). Using data for 16-year-old drivers from the Fatal Analysis Reporting System (FARS)\textsuperscript{22} with extrapolated estimates of the 16-year-old population from the US Census Bureau,\textsuperscript{11} fatal crashes occurred nationally at a rate of 0.34 per 1000 in 1996 and 0.29 per 1000 in 1999, a reduction of 15%. Michigan's 32% reduction in the 16-year-old fatal crash rate was twice the reduction in the national rate.

Future analyses will address crash risk by GDL level, as well as length of time and age in each GDL level. As more teen drivers move into and progress through the Michigan GDL system, efforts to assess the longer-term effects can be conducted. Analyses will extend crash data through 2000, at which time every 16-year-old and nearly all 17-year-olds will have been subject to GDL. The crash data on 17-year-olds will be of particular interest because if they have a level 3 license, they can drive without a night restriction, and their driving behavior will more completely reflect the full effect of the GDL system. Crashes occurring during each evening hour can also be examined as a basis for reviewing the effectiveness of the limited night restriction currently in place.\textsuperscript{8} Future analyses will also examine effects of the sex of the driver, as well as violations, safety belt use, and the presence of young passengers\textsuperscript{30} on the crash experience of teen drivers before and after the introduction of GDL to determine whether these behaviors were positively, if indirectly, affected by GDL. There is strong evidence that young male drivers and drivers transporting passengers in their vehicles are at increased risk for crashes and death.\textsuperscript{23,24} Safety belt use by young drivers is also of interest because failure to use safety belts may be part of a constellation of risk-taking behaviors that can increase crash risk.\textsuperscript{25-27}

In conclusion, Michigan's comprehensive GDL program was a major change from the previous teen driver licensing system, and substantial reductions in motor vehicle crashes among 16-year-old drivers were subsequently observed that may be attributable to GDL. While these early results in preventing crashes among young drivers are impressive, evaluation over the longer term is needed to see if the crash reductions are maintained as new cohorts of teen drivers enter and progress through the system. In addition, evaluation results from other jurisdictions are needed to determine if such positive results are achieved elsewhere. Other jurisdictions' evaluations will also help assess the relative contributions of the different components to the overall effect of GDL. This task will be complex, given the variations among former licensing laws, as well as the considerable differences in the GDL programs being adopted. Nonetheless, a GDL system for licensing young drivers seems an extremely promising approach to reducing injury from motor vehicle crashes among teenagers.

Author Contributions: Study concept and design: Shope, Molnar, Elliott, Waller. Acquisition of data: Shope, Molnar. Analysis and interpretation of data: Shope, Molnar, Elliott, Waller. Drafting of the manuscript: Shope, Molnar, Waller. Critical revision of the manuscript for important intellectual content: Shope, Elliott. Statistical expertise: Molnar, Elliott. Obtained funding: Shope. Waller. Administrative, technical, or material support: Shope, Waller. Study supervision: Shope.

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