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The strength of graduated drivers license programs and fatalities among teen drivers and passengers

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Abstract

Objectives: The purpose of this study is to investigate the effects of differentially stringent graduated drivers license programs on teen driver fatalities, day-time and night-time teen driver fatalities, fatalities of teen drivers with passengers present, and fatalities among teen passengers.

Methods: The study uses 1992–2002 data on motor vehicle fatalities among 15–17-year-old drivers from the Fatality Analysis Reporting System to identify the effects of "good", "fair", and "marginal" GDL programs based upon designations by the Insurance Institute for Highway Safety. Analysis is conducted using conditional negative binomial regressions with fixed effects.

Results: "Good" programs reduce total fatalities among young drivers by 19.4% (c.i. −33.0%, −5.9%). "Fair" programs reduce night-time young driver fatalities by 12.6% (c.i. −23.9%, −1.2%), but have no effect on day-time fatalities. "Marginal" programs had no statistically meaningful effect on driver fatalities. All three types of programs reduced teen passenger fatalities, but the effects of limitations on the number of passengers appear to have had only minimal effects in reducing fatalities among young drivers themselves.

Conclusions: Stronger GDL programs are more effective than weaker programs in reducing teenage motor vehicle fatalities.

Keywords: Graduated drivers license; Motor vehicle fatalities; Teen drivers

1. Introduction

The reduction in motor vehicle fatalities has justifiably been called one of the great public health achievements of the twentieth century (CDC, 1999). This is particularly true for young adults. Between 1975 and 1992, traffic fatality rates among teens aged 16–20 declined from 39 to 28 deaths per 100,000 people (NHTSA, 2003). The fatality rates for teens and most others have leveled off since 1992. Teen fatality rates, however, continue to be three to four times higher than for middle-aged cohorts.

Many states have responded to the challenge of teenage auto fatalities by introducing graduated drivers license (GDL) programs. These programs seek to reduce fatalities by increasing the opportunity for young inexperienced drivers to obtain more supervised driving experience and to limit their exposure to risky driving situations. The three-phase programs typically require a potential new teenaged driver to obtain a learners permit that allows driving with a licensed driver, to graduate to an intermediate license that allows driving during limited hours and with a limited number of passengers, and finally to graduate to an unrestricted license.

Most studies that have examined the effects of GDL policies have focused on particular states. Florida's GDL reforms reduced the crash rates among 15–17-year-old drivers by 9%, Michigan's program reduced the crash rate for 16-year-old drivers by 25%, and North Carolina' GDL laws reduced the rate of fatal crashes involving 16-year-old drivers by 57% (Ulmer et al., 1999; Shope et al., 2001; Foss et al., 2001). Two recent studies have used national state-by-year data from the Fatality Analysis Reporting System (FARS) to estimate the effects of GDL programs controlling for other relevant laws and for unmeasured within-state and across-time trends. Eisenberg (2003) found that GDL reforms, on average, reduced total fatal-crash rates by 4% and fatal crash rates involving 16–20-year-old

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drivers by 9.4%. Dee et al. (2005) used the Insurance Institute for Highway Safety categorization of GDL laws as "good," "fair," "marginal" or "poor" to identify a dose–response effect of more stringent programs. They concluded that "good" programs reduced motor vehicle fatalities involving 15–17-year-old drivers by 19% relative to "poor" programs. "Fair" programs reduced fatalities by an estimated 6%, and "marginal" programs had no statistically significant effect on fatalities.

These two studies have only examined the overall effect of the GDL programs on motor vehicle fatalities involving young drivers. They have not investigated the extent to which the programs have affected night-time, driver and passenger deaths. Such insights are important because the states have enacted several variants of graduated license programs and would benefit from knowledge of what elements of GDL are particularly effective. Although it would be extremely helpful to know the differential impact of each element of a GDL program, the states have enacted several elements at the same time. This makes it statistically impossible to decompose the effects of each element.

This paper obtains greater insight into the effectiveness of GDL programs by examining the effects of differentially stringent programs on overall teen driver fatalities, night-time teen driver fatalities, fatalities of teen drivers with passengers present, and fatalities among teen passengers. This approach provides an evaluation of the program elements by providing an estimate of the effectiveness of the overall program at key benchmarks: teen driver fatalities, passenger fatalities, and night-time fatalities.

This study hypothesizes that: (1) more stringent GDL programs will be more effective in reducing motor vehicle fatalities among drivers aged 15–17 than will less stringent ones, (2) more stringent GDL programs will be more effective in reducing night time traffic fatalities among 15–17-year-old drivers, and (3) more stringent GDL programs will be more effective in reducing motor vehicle fatalities involving teen passengers.

2. Methods

2.1. Study population

The analyses presented here are based on a panel of annual state-level data from 1992 to 2002. The data on traffic fatalities were drawn from the Fatality Analysis Reporting System. See www.fars.nhtsa.dot.gov. The FARS data are collected by the National Highway Traffic Safety Administration. To be included in this census of crashes, a crash had to involve a motor vehicle traveling on a roadway customarily open to the public and had to result in the death of a person (either the occupant of a vehicle or a non-motorist) within 30 days of the crash. Data on the number of motor vehicle fatalities for individuals aged 15–17 by state and year were compiled from the FARS. Also extracted were the number of 15–17-year-old driver fatalities during the hours of 6 a.m. to 6 p.m. and 6 p.m. to 6 a.m., the number of 15–17-year-old driver fatalities with passengers aged 15–19 present, and the number of 15–19-year-old passenger fatalities in which the driver was a 15–17 years old. The 6 p.m. to 6 a.m. night-time period was used to provide consistency across the year and to allow for any spillover in fatalities than may occur as young drivers shift their use of a motor vehicle to earlier evening hours. Passengers were limited to those aged 15–19 based upon the Insurance Institute for Highway Safety definition of passengers as teens. Finally, total motor vehicle fatalities for those aged 15–17 was computed. Alaska, Hawaii and the District of Columbia were excluded from the analyses to be consistent with much of the prior literature. The final data set contains 11 years of data from 48 states ($n = 528$).

2.2. Graduated drivers license programs

Graduated driver licensing laws differ from prior state licensing procedures largely because they establish three distinct licensing stages. However, the exact requirements associated with each stage vary across states as well as along several dimensions. Nonetheless, a common feature of the initial "learning phase" is that young drivers are expected to log driving hours in the presence of an accomplished driver, usually a parent, over the age of 21. States implementing GDL regulations often increase the age at which teens may obtain these initial permits as well. Furthermore, GDL reforms typically require that teens hold these permits for at least 6 months, during which the driver must log 30 to 60 h of supervised driving. In the "intermediate phase", the young driver is allowed to operate a vehicle without supervision but only during daylight and early evening hours (e.g., only from 5 a.m. to 10 p.m.), and/or they are allowed to have no more than one or two passengers in the car. The "full privileges phase" begins upon the successful completion of the earlier phases and at minimum ages as high as 18. There are, of course, no data on how effectively these provisions are enforced across states.

Ideally, one would identify the salient elements of GDL programs such as the age of eligibility at each phase, the amount of supervised training, the hours of restriction, if any, the limitations on passengers, etc., and estimate the impact of each element on fatal crashes, controlling for the others. However, the states implemented packages of GDL elements and it is not possible to obtain meaningful estimates of the individual elements.

The Insurance Institute for Highway Safety (IIHS) has developed an explicit taxonomy for characterizing the overall restrictiveness of these multi-dimensional state licensing regulations. This study uses the IIHS definitions to assess whether the effectiveness of the new licensing regulations were plausibly related to their restrictiveness. Specifically, the IIHS (2005) divides state GDL licensing procedures into four categories: good, fair, marginal and poor. Table 1 provides the definitions used by the IIHS for each designation. For states and years when the IIHS ratings were not available, the published IIHS criteria were used to assign a score. Importantly, the IIHS assigns ratings based on the date a law was enacted and not when it was implemented. The published GDL ratings were revised to correspond to the dates of GDL implementation (Dee et al., 2005). Although most states introduced GDL regulations during the last decade (Fig. 1), only seven states met the IIHS standard for good procedures by 2002. Over the period 1992 through 2002, 15 states had marginal programs and 27 had adequate programs, at least at some point.

Table 1
Insurance Institute for Highway Safety taxonomy of licensing systems for young drivers

IIHS characterization	Definition
Good	Both of the following two conditions are required: -A mandatory learner's period of at least 6 months -An "optimal" restriction on the initial license that lasts until age 17 (either a night driving restriction beginning by 10 p.m. or allowing no more than one teen passenger)
Fair	Either of the following two conditions are required: -An "optimal" night-driving or passenger restriction lasting until age 17 without regard to the learner's period -A mandatory learner's period of any length and an "optimal" night-driving or passenger restriction lasting until age 161/2.
Marginal	Any of the following three conditions is required: -A mandatory learner's period of any length and either a night-driving or passenger restriction. -A mandatory learner's period of at least 6 months -Any night-driving or passenger restriction on the initial license.
Poor	A mandatory learner's period less than 6 months and no restrictions on night driving or passengers.

Source: Insurance Institute for Highway Safety www.iihs.org/safety_facts/state_laws/grad_license.htm.

Four states moved from marginal to adequate over the period, and two states moved from adequate to good.

2.3. Other variables

The analyses also control for a variety of other potentially relevant determinants varying within states over this period (Grabowski and Morrisey, 2001). This includes three binary indicators for state laws related to drunk driving (Dee, 2001). The variables indicate whether it is illegal to drive with a blood alcohol concentration (BAC) of 0.08, whether the state's licensing authority is allowed to suspend driving privileges before any court action related to a charge of drunk driving ("administrative revocation" laws), and whether it is illegal to drive with a positive BAC if the driver is not of legal drinking age ("zero tolerance" laws). One binary indicator is also included for primary enforcement of mandatory seat-belt laws. Seat-belt laws with primary enforcement allow the police to directly cite a motorist for not wearing a belt rather than only citing them if they are also charged with some other driving violation. Seat-belts laws have been shown to reduce motor fatality rates (Evans and Graham, 1991; Morrisey and Grabowski, 2005). An additional binary indicator identifies those states that have increased their rural interstate speed limit to 70 or more miles per hour. There is recent empirical evidence that higher rural interstate speed limit have increased the motor vehicle fatalities on these roads (Greenstone, 2002). The data on state motor vehicle laws were initially obtained from the IIHS. The study team then conducted a telephone survey of all state departments of motor vehicles to confirm the laws, resolve inconsistencies, and to obtain the dates of changes in the laws. In several instances, the codes of annotated state statutes and specific legislative acts, available on the web, were used to determine when laws were implemented.

The empirical model also controls for the state unemployment rate because earlier work has recognized the importance of controlling for macroeconomic factors in analyses of state motor vehicle fatality rates (Evans and Graham, 1988). The state of the economy is thought to have relevance in its effects on traffic volume and congestion. Finally, the natural log of the state 15–17-year-old population for the given age group is included as a control variable that reflects each state's exposure to risk in a given year. These data were obtained from the Bureau of Labor Statistics (2005) and the Bureau of the Census (2005), respectively. The means and standard deviations of the variables used in the study are found in Table 2. In the average state-year, there were just over 25 motor vehicle fatalities in which a 15–17-year-old driver died. Somewhat less than half of these (11.49 driver fatalities per state-year) occurred at night, and 14.53 teen passenger fatalities occurred in the average state-year when a 15–17-year-old driver was behind the wheel. Table 2 also shows

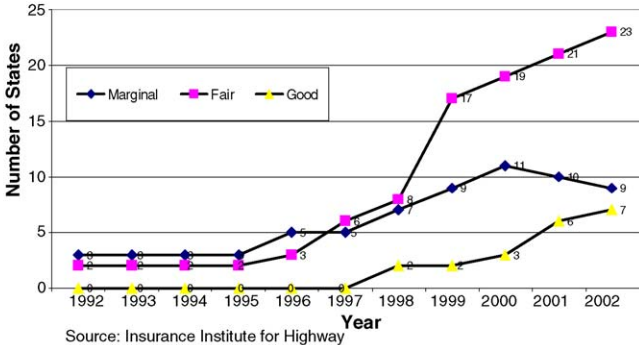

Fig. 1. Cumulative number of states with good, adequate and marginal graduated drivers license programs.

Table 2
Means and standard deviations of variables used in study

	Mean	Standard deviation
Number of fatalities		
15–17 Drivers	25.123	24.530
15–17 Drivers night-time	11.492	12.271
15–17 Drivers with teens present	9.123	7.848
Teens with 15–17 driver	14.530	14.422
15–17 Total	52.550	44.700
Proportion of 528 state-years with		
GDL programs		
Good	.033	.174
Fair	.195	.389
Marginal	.129	.328
Rural interstate speed limit >70	.354	.468
Primary seatbelt law	.236	.421
BAC .08	.289	.443
Administrative revocation law	.751	.429
Zero tolerance law	.756	.416
State-year characteristics		
Unemployment rate	.050	.014
Population aged 15–17 (1000s)	234.730	243.459

that 3.3% of our 528 state-year observations had "good" GDL programs in place, nearly 20% had fair programs. Thirty-five percent of the state-year observations had rural interstate speed limits of 70 mph or greater.

2.4. Data analysis

The initial specification for the empirical results presented here takes the following basic form:

$$F_{st} = L_{st}\beta + Z_{st}\gamma + \upsilon_s + w_t + \varepsilon_{st} \quad (1)$$

where F_{st} refers to the motor vehicle fatality count in state s of year t, L_{st} the vector of state GDL laws, Z_{st} includes an intercept and a set of exogenous controls including the other motor vehicle laws that vary within states over time, υ_s a state fixed effect, w_t a year-specific intercept, and ε_{st} is the randomly distributed error term. The state fixed effects control for any fixed, state-specific omitted variables correlated with the adoption of state motor vehicle laws and motor vehicle fatalities. Such factors may include the degree of law enforcement, the condition of roadways, and weather patterns. The year dummies control for national trends in motor vehicle fatalities that may be correlated with changes in state laws such as federal motor vehicle policies and the progress of motor vehicle and road safety technology. The identification strategy implied by this two-way fixed effect model effectively compares the changes within states that adopted new policies like graduated licensing to the contemporaneous changes in states that did not. This generalized "difference in differences" approach controls for unobserved determinants specific to each state as well as those shared determinants specific to each particular year. Thus, we essentially compare the difference in fatalities before and after implementation of a law in states that enact a version of the law with the difference in fatalities over the same time period in those states that did not enact this version of the law. It is the difference in differences that constitutes the value of the coefficients of interest in the regression. See Wooldridge (2002) for a detailed discussion of fixed-effects modeling.

Empirical studies based on specifications like Eq. (1) often construct the dependent variable as a fatality *rate*, which is denominated by population size or number of miles traveled and estimate the equation by ordinary least squares or weighted least squares. However, the evaluations presented here are based on an alternative approach. Specifically, because the fatality counts are constructed relatively finely by age and other observed characteristics, employing a conventional fatality rate could lead to weak statistical power by substantially reducing the signal-to-noise ratio. In particular, the measurement error associated with fatality rates would be exacerbated in this context by the fact that the population data specific to state, year and age cells are estimated for intercensal years. A substantial fraction of the state-year cells in our sample have only a limited number of fatalities. For example, over 15% of our state-year observations in the 15–17 year-old age driver cohort have 10 or fewer fatalities and nearly 60% have fewer than 25. Because of this, the evaluation results presented here are based on count-data models that explicitly recognize that the dependent variables are nonnegative integers. However, conventional count data models do not generate consistent estimates when cross-sectional fixed effects are introduced. Therefore, the study employs the conditional maximum likelihood approach for negative binomial models developed by Hausman et al. (1984). The estimates generated by the negative binomial model can be interpreted as the proportionate change in the given motor vehicle fatality count (Cameron and Trivedi, 1998).

3. Results

The results of the multivariable analysis are contained in Table 3. The first column shows the effects of the GDL laws on motor vehicle fatalities among 15–17-year-old drivers. GDL programs categorized as good by the Insurance Institute for Highway Safety were estimated to reduce motor vehicle fatalities among 15–17-year-old drivers by 19.4%. In the average state-year of the data, this implies a savings of 4.6 lives per state per year. Fair programs were found to reduce young driver fatalities by nearly 6% but the point estimate lacked statistical significance at the conventional levels. Marginal programs were estimated to reduce fatalities by less than 1% and the coefficient was not statistically significant.

The second and third columns report the effects of GDL programs on day-time and night-time fatalities among 15–17-year-old drivers, respectively. Good programs reduced day-time fatalities by 29%. However, fair and marginal programs appear to have had no effect on day-time fatalities; their point estimates were small in magnitude, of the wrong sign, and statistically insignificant.

In contrast, good and fair programs reduced night-time fatalities by 10 and 12.6%, respectively, although the coefficient on the good programs lacked statistical significance at the conventional levels. There was no evidence that marginal programs reduced night-time fatalities among young drivers.

There are at least two explanations for the relative ineffectiveness of the good programs during the night-time hours. The first is related to a relative lack of statistical power for the good programs. Table 4 presents the crude number of 15–17-year-old driver fatalities per 100,000 residents before and after the enactment of the laws, in good and fair program states, in day-time and night-time hours. It is clear that the reduction in fatalities per 100,000 is greater in states with good programs in both the day light and night-time periods. However, with only 15 state-years of post-implementation observations in the good program states, the difference in night-time driver fatalities was not large enough to achieve statistical significance.

The second explanation is related to the characteristics of the good programs. A program is "good" if, among other things, it restricts driving after 10 p.m. *or* it allows no more than one passenger in the vehicle. In fact, based on 2005 data, only one of the seven "good" state programs limit driving before midnight and that state sets the restriction at 11 p.m. Thus, the good programs do not explicitly restrict late evening driving and appear to obtain their night-time effects through other elements. In contrast, 39% of the "fair" programs restrict driving before midnight.

Table 3
Conditional negative binomial regressions of the effects of graduated drivers license (GDL) programs on motor vehicle fatalities

	Traffic fatalities of drivers aged 15–17	Day-time fatalities of drivers aged 15–17	Night-time fatalities of drivers aged 15–17	Fatalities of drivers aged 15–17 with teens present	Teen passenger fatalities with drivers aged 15–17	All traffic fatalities of persons aged 15–17
GDL: good	−.194* (−.330, −.059)	−.290* (−.488, −.092)	−.101 (−.297, .096)	−.033 (−.252, .186)	−.346* (−.535, −.158)	−.192* (−.281, −.102)
GDL: fair	−.054 (−.129, .038)	.017 (−.089, .123)	−.126* (−.239, −.012)	−.084 (−.209, .040)	−.138* (−.248, −.028)	−.058* (−.111, −.005)
GDL: marginal	−.007 (−.118, .103)	.011 (−.147, .169)	.016 (−.151, .183)	.103 (−.084, .289)	−.227* (−.400, −.054)	−.047 (−.128, .034)
Speed limit 70+	−.040 (−.115, .036)	−.021 (−.129, .087)	−.043 (−.157, .071)	.014 (−.109, .138)	.019 (−.088, .126)	.022 (−.031, .075)
Seatbelt law	−.040 (−.130, .050)	.012 (−.114, .139)	−.105 (−.177, .192)	−.044 (−.186, .107)	.063 (−.195, .070)	−.028 (−.091, .036)
BAC .08	−.044 (−.122, .034)	−.043 (−.156, .069)	.013 (−.104, .130)	−.082 (−.210, .047)	−.035 (−.035, .059)	−.006 (−.061, .050)
Administrative revocation	.064 (−.029, .156)	.062 (−.073, .196)	.040 (−.099, .179)	.083 (−.068, .234)	.058 (−.079, .195)	.048 (−.018, .114)
Zero tolerance	.037 (−.037, .111)	−.006 (−.113, .100)	.079 (−.034, .192)	.080 (−.039, .200)	−.004 (−.109, .101)	.027 (−.025, .078)
Unemployment rate	−1.300 (−4.687, 2.088)	−3.412 (−8.276, 1.453)	−1.070 (−6.176, 4.036)	.127 (−5.466, 5.720)	1.156 (−3.344, 6.455)	.198 (−2.175, 2.571)
ln population	.891* (.309, 1.474)	1.031* (.201, .257)	.883* (.119, 1.647)	.901 (−.039, 1.842)	.648* (.073, 1.223)	.791* (.391, 1.192)

All models also include state and year fixed effects. 95% confidence intervals are in parentheses.
* Indicates that the coefficient is statistically different from zero at the 95% confidence level.

GDL programs typically limit the number of passengers in the vehicle with the goal of reducing the distractions and negative peer influences faced by the inexperienced driver. Column 4 of Table 3 examines the effects of GDL programs in reducing fatalities among 15–17-year-old drivers when other teens (aged 15–19) are present in the vehicle. As is clear, good and fair GDL programs were estimated to reduce young driver fatalities when teen passengers were present. However, the effects were very small and lacked statistical significance. The larger estimate (for fair programs) implies a reduction of less than one such driver death averted per state per year.

In contrast, the fifth column of Table 3 shows the effects of GDL programs on fatalities among teenaged passengers in vehicles driven by teenagers aged 15–17. All of the program types were estimated to reduce fatalities, good programs by nearly 35%, fair programs by nearly 14% and marginal programs by nearly 23%.

The final column provides an overall assessment of the effectiveness of GDL programs on motor vehicle fatalities among those aged 15–17. It shows that good programs reduced overall 15–17 year-old fatalities by 19.2%; fair programs by 5.8%. Marginal programs had no statistically significant effect.

It is important to note that the other state laws included in the various specifications in Table 3 were not statistically significant despite the fact that earlier work found alcohol control and seatbelt laws to be important towards decreasing teen traffic fatalities (Dee, 2001; Eisenberg, 2003). This is only an apparent inconsistency. This study period spans the within-state variation in GDL policies, 1992 through 2002, but excludes much of the variation in other state policies. By comparison, Dee's work examined the period 1982–1998 and Eisenberg studied the period 1982–2000. The more recent study period is under-powered to precisely estimate the effects of the laws implemented earlier.

4. Discussion

In 2002, there were 2624 motor vehicle deaths among teens aged 15–17; nearly half (48.9%) of these were drivers. Graduated drivers license programs were designed to train safer teen drivers. The programs provide more supervised driving experience, limit exposure to dangerous night-time driving hours, and restrict the number of potentially distracting teenaged passengers allowed in the vehicle. The purpose of this study was to identify the components of GDL programs that are effective in reducing fatalities among very young drivers. Three conclusions emerge from the study.

First, this study, based upon the national census Fatality Analysis Reporting System data for the 1992 through 2002 period, finds that some of these programs have been very successful. In particular, programs judged to be "good" by the Insurance Institute for Highway Safety reduced young teen driver fatalities by 19.4% and total fatalities among 15–17-year-olds by 19.2%. However, while "fair" programs reduced fatalities among young drivers in some circumstances, we did not find statistically meaningful evidence that the programs saved the lives of young drivers, overall. Unfortunately, there was no evi-

Table 4
Day-time and night-time fatalities among 15–17-year-old drivers per 100,000 young residents

	Before implementation of law	After implementation of law	Difference
Good programs			
Mean day-time fatalities	10.87	9.67	2.20
Mean night-time fatalities	9.41	6.13	3.38
Number of state-years of data	72	15	
Fair programs			
Mean day-time fatalities	11.99	10.71	1.28
Mean night-time fatalities	10.22	9.26	.96
Number of state-years of data	227	96	

Before and after the implementation of selected GDL programs, 1992–2002.

dence that marginal programs reduced traffic fatalities among young drivers.

Good programs are defined as requiring a 6 month learning period, and either prohibiting driving between 10 p.m. and 5 a.m. or allowing only one passenger during unsupervised driving times, and not allowing an unrestricted license prior to age 17. Fair programs are less restrictive with respect to allowed hours of motor vehicle operation, passengers, and/or age of full licensure. Marginal programs are even less restrictive in one or more dimensions.

The magnitudes of these effects are in keeping with earlier research. An early study of the 1997 North Carolina program, judged to be "fair" by the IIHS found a 57% reduction in the rate of fatal crashes among 16-year-old drivers (Foss et al., 2001). Eisenberg (2003) reported that total fatalities among all 16–20-year-olds were reduced by 9.4% in the presence of an undifferentiated GDL program.

Second, the different effects of good and fair programs during day-time and night-time hours suggest that there are different pathways of effects at play in each type of program. Good programs reduced day-time fatalities by 29% and night-time fatalities by 10.1%, but only the day-time effect was statistically significant. In contrast, fair programs had no life-saving effects on day-time fatalities although they reduced night-time fatalities by 12.6%. Only one of the good programs had any restrictions on driving before midnight while 39% of the fair programs did so. We suspect that the night-time success of the fair programs is driven by the states with stricter night-time driving curfews. We also suspect that the day-time success of the good programs stems from the required mandatory leaning period before one may graduate to the intermediate phase. It may be that this mandatory learning period substantially improves overall driving skills. If so, it suggests that the good programs have an important educational and experiential component that has led to lower fatalities. This explanation would suggest that there would also be a night-time effect but it appears to be drowned out by our lack of statistical power to detect good program effects in the night-time setting. Our results also suggest that good programs that actually did impose a curfew on driving after 10 p.m. could have substantial lifesaving effects in both periods.

Third, the restrictions on the number of passengers do not appear to have been very effective in reducing young driver fatalities but have saved the lives of teenage passengers. The study found only very small lifesaving effects among very young drivers when other teens were present. However, it did find that the number of teen passenger fatalities was substantially reduced when a GDL program was present. It is also noteworthy that marginal programs, which we found to be otherwise ineffective in reducing young driver fatalities, do reduce teen passenger deaths. These findings suggest that passenger restrictions simply put fewer teens at risk of a fatal crash rather than substantially reducing the "distraction factor" associated with others in the vehicle.

There are limitations to this study worth noting. First, GDL programs are relatively new and "good" programs are of particularly recent vintage. Our findings with respect to good programs overall and night-time fatalities for good programs in particular should be viewed with some caution. The lack of experience with the programs affects the statistical significance of our findings. In addition, however, there is not yet a long track record from which to judge the overall effectiveness of these programs. Even though the statistical methods serve to minimize such problems, it may be that the results found here are an artifact of unique events that occurred in these states in the years subsequent to the enactment of the laws.

Second, this study like others in this field, is unable to measure the extent of enforcement of GDL provisions that are implemented. If enforcement was purely random across the states, this would merely reduce the precision of our estimated impacts. If it is systematically related to individual states, then our fixed-effects methodology effectively controls for the average enforcement level in each state and our coefficient estimates are unbiased. However, if enforcement varies with the type of GDL program and/or differs over time within a state, then our estimates are biased in an unknown direction.

Third, the available data do not assign blame for the reported crashes. Some of the fatalities reported here were undoubtedly the result of errors by other, older, drivers. It is unrealistic to expect GDL programs to eliminate these crashes. However, it may be the case that the stronger GDL programs do allow young drivers to respond better in dangerous driving circumstances. Finally, this study was only able to examine the effects of the laws on fatal crashes. There is, as yet, no national data base from which to evaluate the effects of these or other motor vehicle laws on non-fatal crashes. Nonetheless, this study provides encouraging evidence of the large lifesaving potential of stringent GDL programs.

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