Graduated Driver Licensing and Fatal Crashes Involving 16- to 19-Year-Old Drivers

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Context In the United States, graduated driver licensing (GDL) systems allow full, unrestricted licensure for drivers younger than 18 years only after an initial period of supervised driving and an intermediate period of unsupervised driving that limits driving at night, transporting multiple young passengers, or both.

Objective To estimate the association of GDL programs with involvement in fatal crashes among 16- to 19-year-old drivers.

Design, Setting, and Participants Pooled cross-sectional time series analysis of quarterly 1986-2007 incidence of fatal crashes involving drivers aged 16 to 19 years for all 50 states and the District of Columbia combined.

Main Outcome Measures Population-based rates of fatal crash involvement for 16-, 17-, 18-, and 19-year-old drivers. Rate ratios and 95% CIs comparing state-quarters with stronger (restrictions on both nighttime driving and allowed passengers) or weaker (restrictions on either nighttime driving or allowed passengers) GDL programs with state-quarters without GDL.

Results Fatal crash incidence among teen drivers increased with age, from 28.2 per 100 000 person-years (16-year-old drivers) to 36.9 per 100 000 (17-year-olds), before reaching a plateau of 46.2 per 100 000 (18-year-olds) and 44.0 per 100 000 (19-year-olds). After adjusting for potential confounders, stronger GDL programs were associated with lower incidence of fatal crashes for 16-year-old drivers, compared with programs having none of the key GDL elements (rate ratio, 0.74 [95% CI, 0.65-0.84]). However, stronger GDL programs were associated with higher fatal crash incidence for 18-year-old drivers (rate ratio, 1.12 [95% CI, 1.01-1.23]). Rate ratios for 17-year-olds (0.91 [95% CI, 0.83-1.01]), 19-year-olds (1.05 [95% CI, 0.98-1.13]), and 16- to 19-year-olds combined (0.97 [95% CI, 0.92-1.03]) were not statistically different from the null.

Conclusions In the United States, stronger GDL programs with restrictions on nighttime driving as well as allowed passengers, relative to programs with none of the key GDL elements, were associated with substantially lower fatal crash incidence for 16-year-old drivers but somewhat higher fatal crash incidence for 18-year-old drivers. Future studies should seek to determine what accounts for the increase among 18-year-old drivers and whether refinements in GDL programs can reduce this association.

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Motor vehicle crashes are the leading cause of death in the United States for teenagers.[1] From 2000-2008, more than 23 000 drivers and 14 000 passengers aged 16 to 19 years were killed.[2] Crashes are more common among 18- and 19-year-olds, but adjusted for miles driven, rates are highest among younger teens.[3] The fatal crash rates per mile driven for 16- and 17-year-olds are 150% and 90% greater, respectively, than those for 18- and 19-year-olds.[2,4]

Graduated driver licensing (GDL) systems have now been adopted in all 50 states and the District of Columbia to reduce crashes among teenaged drivers. Graduated driver licensing is structured to ensure that young novices gain extensive experience driving in low-risk conditions before they "graduate" in steps to driving in riskier conditions.[5,6] Graduated systems in the United States allow full, unrestricted licensure for drivers younger than 18 years only after they complete a lengthy learner period allowing driving only while supervised by an adult, followed by an intermediate license period that allows unsupervised driving but continues protection against the highest-risk conditions by limiting driving at night, driving with multiple young passengers, or both.[7,8] This approach is meant to allow the extensive learning that occurs during the initial several months of driving to be gained in realistic—yet the safest possible—conditions. Previous licensing systems left novices completely exposed to the full range of risk while they learned, with the consequence of high crash rates in the early months of driving.[9-11]

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Numerous studies in several states have confirmed that GDL is associated with reductions in crashes involving young teens.[12-15] Unlike in other countries, GDL programs in the United States apply only to beginning drivers younger than 18 years.[16] The question remains whether the benefits of GDL among drivers to whom provisions directly apply (16- and 17-year-olds) continue, are reduced, or may even be reversed, among older teenagers for whom the effects are only second-

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ary.[17,18] Previous attempts to quantify the result of GDL for all teenaged drivers across multiple states have experienced methodological difficulties that rendered conclusions unclear.[19-22] The present study was designed to overcome difficulties experienced in previous multistate analyses and estimate the total association of GDL with driver involvement in fatal crashes for 16- to 19-year-olds combined and for 16-, 17-, 18-, and 19-year-olds separately.

METHODS

Data Sources

Counts of all drivers of passenger cars, light pickup trucks, vans, and sport-utility vehicles involved in fatal crashes were obtained from the Fatality Analysis Reporting System for the period 1986-2007.[2] The system contains information on drivers, vehicles, and crash circumstances for all motor vehicle crashes in the United States that involve a death within 30 days of the incident. Fatal crashes involving drivers were examined because no census on nonfatal crashes in the United States exists. The crashes were aggregated by state, driver age (16, 17, 18, or 19 years), and quarter (January-March, April-June, July-September, and October-December for each year from 1986-2007). Data for drivers younger than 16 years were excluded because few states allow unsupervised driving by 15-year-olds,[23-26] and these data were too sparse to permit meaningful analysis.[2] To compute rates, midyear population estimates by state and age were obtained from the United States Census Bureau, and quarterly values were interpolated.[27-29] Rates using counts of licensed drivers as the denominator were not used, because driver-based rates underestimate changes in crashes that result from altered exposure, and part of the intended effect of GDL is to reduce high-risk exposure.[30]

The study period of 22 years, multiplied by 4 quarters and 51 states (including the District of Columbia), yields 4488 state-quarters for each teen age group. To classify the quarters according to the type of teen licensing system in effect in each state during each quarter, information on state driver licensing requirements was obtained from archival compilations of licensing requirements.[23-26] A minimum learner permit period, followed by initial nighttime and passenger restrictions during unsupervised driving, are the defining features of GDL programs.[7] Accordingly, these were used as the key elements to categorize quarters into types of teen licensing systems (Table 1).

Table 1. Teen Driver Licensing System Characteristics, Number of Quarters for Each Age Group in Each Category, and Number of Unique States Contributing at Least 1 Quarter to Each Category, United States, 1986-2007

Driver Licensing System Characteristics	GDL System	No. (%) Quarters (n = 4488)[a]	No. (%) Unique States[b]
No mandatory learner permit holding period or initial license restrictions	No	1989 (44.3)	39 (76.5)
Mandatory learner permit holding period but no initial license restrictions	No	1013 (22.6)	25 (49.0)
Initial license restrictions but no mandatory learner permit holding period	No	448 (10.0)	10 (19.6)
GDL with 1 license restriction during unsupervised driving[c]	Weaker	578 (12.9)	24 (47.0)
GDL with 2 license restrictions during unsupervised driving[d]	Stronger	460 (10.2)	26 (51.0)

Abbreviation: GDL, graduated driver licensing.
[a] There are 4488 quarters per teen age group, for a total of 17 952 quarters.
[b] Includes District of Columbia. Counts sum to greater than 51 because some states changed driver licensing systems over time.
[c] Mandatory learner permit holding period and either a nighttime (79% of quarters) or passenger (21%) restriction during initial unsupervised driving.
[d] Mandatory learner permit holding period and restrictions on both nighttime driving and allowed passengers during initial unsupervised driving.

Quarters were coded as having a GDL program if novice 16-year-old drivers in the state were required to hold a learner permit for at least 3 months, followed by an unsupervised driving period with a nighttime driving restriction starting before 1 AM or a passenger restriction allowing no more than 1 passenger younger than 18 years. Graduated programs that included both of these restrictions were considered stronger than those that included only one. Licensing requirements were considered in effect during an entire quarter if they were in place for at least 2 months.

Data Analysis

Four age-specific Poisson regression models were used to estimate separate driver fatal crash involvement rate ratios for 16-, 17-, 18-, and 19-year-old drivers. These age-specific rate ratios compared quarters under each type of teen licensing system (Table 1) with quarters having none of the key GDL elements, adjusted for potential confounders. Because the outcome of interest was population-based rates of fatal crashes involving drivers, the natural logarithm of age-specific state population was used as an offset term in the models.[31]

Generalized estimating equations with a first-order autoregressive correlation matrix and robust (empirical) variance were used in the models to account for any correlation among the quarters attributable to repeated measurements of state age groups over time (geodemographic clustering).[32] In addition, a combined-age model was used to estimate a single net rate ratio for each type of licensing system combined across 16- to 19-year-old drivers. Model fit was assessed using the quasi-likelihood independence model criterion and plots of predicted vs actual crash rates.[33,34]

The regression models included parameters to adjust for confounding resulting from differences in state crash rates (state indicator variables), long-term crash trends (linear time for each state), crash seasonality (quarter indicator variables for each state), state macroeconomic factors (linear quarterly unemployment rate for each state),[35] and crude changes in driving exposure (a linear term to adjust for annual state-specific

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highway fuel use per capita).[36,37] Linear parameters were also included in the models to represent the separate contemporaneous fatal crash involvement rates of drivers aged 20 through 24, 25 through 39, 40 through 59, and 60 years or older for each state. This was done to control for other unmeasured factors (eg, changes in enforcement activity, weather, roadway conditions, and gasoline prices) that might influence teen crash rates.

In addition, indicator variables were included for changes made to the following traffic safety–related laws: (1) rural interstate speed limits (55, 65, 70, or ≥75 miles per hour)[19,38]; (2) primary- and secondary-enforcement seatbelt laws[19,38]; (3) laws making driving with a blood alcohol concentration of 0.10 or 0.08 g/dL per se illegal[39]; (4) a minimum legal age of 21 years for drinking alcohol[40]; (5) zero-tolerance laws making it illegal for persons younger than 21 years to drive with any detectable blood alcohol concentration[19,38]; and (6) immediate administrative license suspension for driving with a blood alcohol concentration that exceeds the legal limit.[41]

Analyses were conducted using SAS version 9.2 (SAS Institute Inc, Cary, North Carolina). Rate ratios were considered statistically no different from the null if their confidence interval included 1.0, a procedure equivalent to 2-sided hypothesis testing using an α level of .05. An analysis of statistical power for this study revealed that power was 88% or higher in all age groups for detecting a rate ratio of 0.95 or lower (ie, farther from the null).

To estimate the net population association of GDL programs with fatal crashes for teen drivers, GDL-attributable fatal crashes were calculated using population-attributable fractions (for rate ratios ≥1) or prevented fractions (for rate ratios <1) using the adjusted rate ratios from the models, without regard to their statistical reliability.[42,43] These were used to estimate the actual numbers of increased or decreased fatal crashes involving drivers, for each teen age group and 16- to 19-year-old drivers combined, associated with implementing GDL programs in the United States from 1996 through 2007.[42,43]

RESULTS

TABLE 2 reports age-specific and combined rates per 100 000 person-years of fatal crashes involving 16- to 19-year-old drivers under each teen licensing system as well as rate ratios comparing crash rates under these systems with rates during quarters having none of the key GDL elements. Fatal crash incidences for 16-, 17-, 18-, and 19-year-old drivers and for 16- to 19-year-old drivers combined were consistently lower when states had 3-stage GDL programs or some of the key GDL elements than when they had none of these elements. Fatal crash involvement increased from 28.2 per 100 000 person-years in 16-year-old drivers to 36.9 per 100 000 person-years in 17-year-olds before reaching a plateau of 46.2 per 100 000 person-years in 18-year-olds and 44.0 per 100 000 person-years in 19-year-olds.

The unadjusted rate of fatal crashes involving 16- to 19-year-old drivers combined was 29.7 per 100 000 person-years with stronger GDL programs, 36.8 per 100 000 person-years with weaker GDL programs, and 47.2 per 100 000 person-years in programs with none of the key GDL elements. However, in age-specific and adjusted models, GDL programs were not associated with lower incidences of fatal crashes involving drivers for all teen ages. Stronger GDL programs (relative to no GDL program) were statistically associated with lower fatal crash incidence only for 16-year-old drivers (rate ratio [RR], 0.74 [95% CI, 0.65-0.84]) (Table 2). For 18-year-old drivers, the rate of fatal crashes was statistically higher for stronger GDL programs than for programs having none of the key GDL elements (RR, 1.12 [95% CI, 1.01-1.23]) (Table 2). Rate ratios for 17-year-old drivers, 19-year-old drivers, and 16- to 19-year-old drivers combined were not statistically different from the null (Table 2).

The pattern of results was similar—though weaker—under GDL programs with only 1 restriction during initial unsupervised driving (Table 2). Stronger GDL programs appeared to be associated with a larger reduction in fatal crashes among 16-year-old drivers (RR, 0.74 [95% CI, 0.65-0.84]) than weaker GDL programs (RR, 0.84 [95% CI, 0.75-0.94]). However, the increase in fatal crashes involving 18-year-old drivers was similar under both types of GDL program (RR, 1.12 [95% CI, 1.01-1.23] for stronger programs; RR, 1.10 [95% CI, 1.03-1.18] for weaker programs).

Since enactment of the first program in 1996, GDL programs (weaker and stronger combined) are estimated to have been associated with 1348 fewer fatal crashes involving 16-year-old drivers but with 1086 more involving 18-year-old drivers.

COMMENT

Overall Findings

These findings suggest that implementing GDL in the United States from 1996-2007 was associated with substantially decreased incidence of fatal crashes involving 16-year-old drivers and somewhat increased incidence of those involving 18-year-old drivers, with the result that the net association for 16- to 19-year-old drivers combined was not statistically different from the null. We found that stronger GDL programs, which had restrictions on both nighttime driving and allowed passengers during initial unsupervised driving, appeared to be associated with a larger reduction in fatal crashes among 16-year-old drivers than weaker GDL programs but with a similar increase in fatal crashes involving 18-year-old drivers. This suggests that modifying weaker existing state GDL programs to include nighttime as well as passenger restrictions may result in additional crash savings among 16-year-olds as well as a larger net savings among teen drivers overall.

The analytic approach used here was selected to provide better control of extraneous factors than was achieved in previous multistate studies of aggregate GDL associations.[19-22] Pooling longitudinal data across states provides better control for long-term trends than simply comparing data points for each age group before and after GDL was implemented, with adjustments for relevant covariates. By using this approach, adjustments are made directly

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for trends in each age group separately within each state, rather than assuming that trends in crash rates among adult drivers are the same as those for all teenaged drivers.[44] The long period examined encompasses many years in which GDL programs were not in effect within each state (1986-1996 or longer) relative to the overall analysis period. This was done to minimize any effect of GDL programs on the state-specific trend estimates. Nonetheless, the age-specific point estimates from the present study are generally similar to those from a prior multistate study that used simple comparisons of data before and after GDL but that adjusted for some state-specific sources of confounding.[21] They are smaller (for younger teens) and larger (for older teens) than estimates from another study that used an approach similar to that used in the present study but that lacked adjustments for state- and age-specific trends and baseline differences in fatal crash rates.[22]

The results of the present study were robust to most variations in model specification. However, failure to adjust for baseline differences in state rates of fatal crashes involving drivers and state-specific trends and seasonality produced substantially different results. Adjusting for these factors accounted for the large differences between the crude and adjusted rate ratios. Adjusting for changes in non-GDL traffic safety laws, adult crash rate covariates, unemployment, and highway fuel use was largely inconsequential. A model with no adjustments except the adult crash rate covariates was found inadequate to control for all sources of confounding.

The net associations found in this study represent several possible crash-reducing influences of GDL, including less driving among younger teens; reduced exposure

Table 2. Fatal Crashes Involving Drivers, Driver Fatal Crash Rates, and Unadjusted and Adjusted Rate Ratios for Different Teen Driver Licensing Systems, United States, 1986-2007

Driver Licensing System Characteristics	GDL System[a]	No. of Fatal Crashes Involving Drivers	Person-Years	Unadjusted Fatal Crash Rate per 100 000 Person-Years	RR	
					Unadjusted	Adjusted (95% CI)[b]
16- to 19-year-olds (combined)						
All driver licensing systems		131 604	338 951 628	38.8		
No learner permit holding period or initial restrictions	No	52 952	112 195 675	47.2	1 [Reference]	1 [Reference]
Learner permit holding period but no initial restrictions	No	27 702	68 574 136	40.4	0.86	0.99 (0.94-1.03)
Initial restrictions but no learner permit holding period	No	15 680	51 599 192	30.4	0.64	1.01 (0.94-1.10)
GDL with 1 restriction during unsupervised driving	Weaker	18 711	50 909 631	36.8	0.78	0.99 (0.95-1.03)
GDL with 2 restrictions during unsupervised driving	Stronger	16 559	55 672 995	29.7	0.63	0.97 (0.92-1.03)
16-year-olds						
All driver licensing systems		23 677	84 030 933	28.2		
No learner permit holding period or initial restrictions	No	10 306	27 648 385	37.3	1 [Reference]	1 [Reference]
Learner permit holding period but no initial restrictions	No	5252	16 991 656	30.9	0.83	0.94 (0.83-1.07)
Initial restrictions but no learner permit holding period	No	2676	12 605 188	21.2	0.57	1.04 (0.86-1.27)
GDL with 1 restriction during unsupervised driving	Weaker	3082	12 791 304	24.1	0.65	0.84 (0.75-0.94)
GDL with 2 restrictions during unsupervised driving	Stronger	2361	13 994 400	16.9	0.45	0.74 (0.65-0.84)
17-year-olds						
All driver licensing systems		31 261	84 803 766	36.9		
No learner permit holding period or initial restrictions	No	12 749	28 081 827	45.4	1 [Reference]	1 [Reference]
Learner permit holding period but no initial restrictions	No	6476	17 211 198	37.6	0.83	0.93 (0.85-1.00)
Initial restrictions but no learner permit holding period	No	3828	12 840 368	29.8	0.66	0.95 (0.85-1.06)
GDL with 1 restriction during unsupervised driving	Weaker	4516	12 724 135	35.5	0.78	0.98 (0.92-1.04)
GDL with 2 restrictions during unsupervised driving	Stronger	3692	13 946 239	26.5	0.58	0.91 (0.83-1.01)
18-year-olds						
All driver licensing systems		38 631	83 683 087	46.2		
No learner permit holding period or initial restrictions	No	14 994	27 540 374	54.4	1 [Reference]	1 [Reference]
Learner permit holding period but no initial restrictions	No	8029	16 796 916	47.8	0.88	1.05 (0.98-1.13)
Initial restrictions but no learner permit holding period	No	4637	12 749 647	36.4	0.67	1.06 (0.92-1.21)
GDL with 1 restriction during unsupervised driving	Weaker	5607	12 703 182	44.1	0.81	1.10 (1.03-1.18)
GDL with 2 restrictions during unsupervised driving	Stronger	5364	13 892 969	38.6	0.71	1.12 (1.01-1.23)
19-year-olds						
All driver licensing systems		38 035	86 433 842	44.0		
No learner permit holding period or initial restrictions	No	14 903	28 925 089	51.5	1 [Reference]	1 [Reference]
Learner permit holding period but no initial restrictions	No	7945	17 574 366	45.2	0.88	1.02 (0.94-1.10)
Initial restrictions but no learner permit holding period	No	4539	13 403 989	33.9	0.66	1.01 (0.90-1.15)
GDL with 1 restriction during unsupervised driving	Weaker	5506	12 691 011	43.4	0.84	1.00 (0.92-1.08)
GDL with 2 restrictions during unsupervised driving	Stronger	5142	13 839 387	37.2	0.72	1.05 (0.98-1.13)

Abbreviations: CI, confidence interval; GDL, graduated driver licensing; RR, rate ratio.
[a] Systems include both a mandatory learner permit holding period and an unsupervised driving stage with 1 (weaker) or 2 (stronger) initial license restrictions.
[b] Adjusted for state, annual state highway fuel use per capita, changes in state traffic safety–related laws (eg, seat belt laws), quarterly state unemployment rate, state linear trend and seasonality, and state contemporaneous age 20 through 24, 25 through 39, 40 through 59, and 60 years or older driver fatal crash involvement rates.

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to high-risk conditions, resulting from more driving while supervised by an adult and less driving late at night or with multiple young passengers; and safer driving, resulting from improved learning. The net associations also capture possible increases as well as decreases in crash rates among older teen drivers. During the study period, GDL programs in the United States applied only to drivers younger than 18 years. Consequently, benefits among 18- and 19-year-old drivers could result only from improved learning during the lengthy licensing process, when they were younger. Negative effects may also have resulted for older teens if GDL limited their opportunity to learn from driving without adult assistance at younger ages or led some teens to delay licensure until they were 18 years or older. These possible negative effects on 18- and 19-year-olds may represent a form of "payback" in limited experience by age 18 years for the benefits of reduced exposure at younger ages.

The larger association of GDL among 16-year-old drivers than among 17-year-olds is likely because a greater proportion of 16-year-old drivers' person-time involves only low-risk supervised driving. Most GDL systems have a 6-month learner period and more teens begin driving at 16 years, so many 17-year-old drivers have progressed beyond this maximally protective stage and entered the far less protective intermediate period.[23]

The reasons why GDL programs appear to be associated with higher incidence of fatal crashes for 18-year-old drivers are not known. The amount learned during the GDL process may not be comparable to what was learned previously, when young drivers learned through experience alone. Mandatory periods of supervised driving clearly reduce risk while novices learn how to handle a vehicle, gain insights into the behaviors of other drivers, and develop understanding of the physical driving environment. Supervised driving, however, is co-driving, and some important lessons of experience, such as the need for self-regulation and what it means to be fully responsible for a vehicle, cannot be learned until teens begin driving alone. Under GDL this now occurs at least 6 months later, reducing the time that young drivers have to learn from driving on their own before they turn 18.

The estimates of association from multistate studies of GDL are consistently smaller than those typically reported in the single-state studies that have examined fatal crashes separately.[12,13,45] To further understand and reconcile these differences, methodologically rigorous time series analyses of individual state programs are needed that take into account the present findings suggesting that GDL may be associated with an increase in fatal crash involvement rates for some older teen drivers. Single-state studies of GDL can avoid some of the limitations of multistate studies by including less severe crashes, incorporating how teens actually progress through the GDL program, taking grandfathering and transition effects into account, and better controlling for state-specific factors.[46] Single-state studies also can focus more directly on the effects of higher-quality GDL systems. Although we and others have distinguished crudely between stronger and weaker GDL systems, the estimates reported in multistate studies represent aggregations of programs of wide-ranging quality. Consequently, they likely underestimate the potential benefit of model GDL programs. To fully estimate the effect of GDL on crashes involving teenaged drivers, single-state studies need to examine crashes for all ages from 16 through 19 years, not merely for 16- or 17-year-olds. Examining only crashes involving young teens exaggerates the protective value of GDL by focusing only on drivers who are sheltered during the learner and intermediate licensing stages, overlooking the potential negative effect of producing less experienced older teenaged drivers.

Study Limitations

The findings of this study are based only on fatal crashes involving drivers. Fatal crashes represent a small and atypical subset of all crashes. The etiology of fatal crashes differs from that of less serious crashes. High-risk behaviors such as alcohol use and excessive speeding are much more common among drivers involved in fatal crashes.[47] Graduated licensing was designed to improve learning among novice drivers and to protect them from the consequences of their inexperience as they learn. It is not a program to control the excessive behaviors often involved in fatal crashes. Consequently, GDL should influence crashes attributable to lack of understanding more than those attributable to misbehavior.[48] Unfortunately, there is no state-specific national database of nonfatal crashes for the United States that could be used for a national study of nonfatal crashes.

The estimates from the present analyses are based on coding the licensing programs under the assumption that all teens pursue unrestricted licensure as early and quickly as possible. This assumption is necessary in multistate studies. The data needed to incorporate the complexities of how different age cohorts proceed through different licensing systems in varying locations and periods are not available. Many teens begin licensing later than the earliest possible age, and some spend longer than the minimum required time in the learner and intermediate licensing stages. The effect of this assumption on the estimates is unknown.

The analyses do not directly take into account "grandfathering"—ie, allowing teens who applied for a license prior to GDL to avoid some or all program requirements—that sometimes occurred as GDL programs were implemented. Moreover, transitory increases and decreases in crash rates sometimes occur when GDL programs are implemented.[12] Neither these, nor the gradual increases in program effect as greater proportions of licensed teens became subject to all program components, were directly modeled. However, the inclusion of long periods before and after most GDL programs were implemented reduces the influence of these temporary effects on the parameter estimates.

In conclusion, GDL programs in the United States were associated in this study with substantial reductions in incidence of fatal crashes among drivers to whom the protective elements most apply—16-year-olds—but appear to be associated with somewhat higher fatal crash incidence among 18-year-old drivers, who are not directly subject to GDL programs. Sev-

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eral mechanisms are possible, some or all of which could account for the increase among 18-year-old drivers. Research is needed to determine what accounts for the increase among 18-year-old drivers and whether this increase occurs among nonfatal crashes as well. This may suggest whether, and how, changes to licensing policy might reduce this association.

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Study concept and design: Masten, Foss, Marshall.
Acquisition of data: Masten, Foss.
Analysis and interpretation of data: Masten, Foss, Marshall.
Drafting of the manuscript: Masten, Foss.
Critical revision of the manuscript for important intellectual content: Masten, Foss, Marshall.
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