GRADUATED DRIVER LICENSING

Review and Recommendations for Young Driver Licensing Practices in Massachusetts

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Based in part on preliminary research conducted for the Governor's Highway Safety Bureau
Young drivers pose a unique challenge to the traffic safety community. Their inexperience makes them less competent than other drivers in handling the tasks associated with safe driving; however, for them to gain necessary experience they must spend time behind the wheel putting themselves, and other road users, in potentially risky situations. This white paper will provide brief, general information on young driver safety in the United States, and then specifically in Massachusetts. In addition, this paper includes an overview of Massachusetts’s graduated licensing policy with identification of areas for improvement based on national guidelines for implementing effective graduated licensing at the state level.

**Young Driver Safety: A National Perspective**

Adolescent drivers have the highest crash rate of any age group (1,2). Nationally, the crash rate per mile driven among drivers 16 to 19 years old is four times higher than the rate for adult drivers (1). Teen drivers put more than just themselves at risk. Of fatal crashes in 2004 involving at least one 15-17 year old driver, the teen was fatally injured in only one third; 31.8 percent were passengers in the teen’s vehicle; 24.2 percent were occupants of other vehicles; and 7.5 percent were non motorists (3).

Crash rates for 16 year-old drivers are higher than for any other age, including other teenage drivers (4). In 2004, 14 percent of all drivers involved in fatal crashes were between the ages of 15 and 20; the number of young drivers involved in fatal crashes increased five percent from 1994 to 2004 (5). These figures indicate not only that young drivers are a hazardous population, but also their involvement in the most serious crashes (fatal crashes) has increased in the past 10 years.

These high crash rates have been tied to several factors: driver error, loss of control, and driver distraction (due to vehicle passengers). According to the Insurance Institute for Highway Safety (IIHS), 79 percent of fatal crashes involving a 16 year-old driver were associated with driver error; this number drops to 55 percent for adult drivers age 20 to 49 (6). Single vehicle crashes are often the result of a loss of vehicle control. Fatal crashes involving 16 year-old drivers were single vehicle crashes 52 percent of the time while only 39 percent of fatal crashes for drivers age 20 to 49 were single vehicle crashes. Twenty-nine percent of fatal crashes involving 16 year-old drivers involved vehicles with three or more occupants, frequently other teenagers; this figure is 18 percent for fatal crashes involving 20 to 49 year-old drivers (6).

While these three characteristics (driver error, loss of vehicle control, and distraction due to passengers) highlight some of the behaviors associated with young driver fatal crashes, it is interesting to note that only 13 percent of fatal crashes involving a 16 year-old driver had a driver killed with a BAC of 0.08 g/dl or higher (6). Forty-four percent of fatal crashes involving a driver age 20 to 49 years-old had a driver killed with a BAC of 0.08 g/dl or higher. While alcohol-related crashes are a problem for all age groups, alcohol-related fatalities are less frequently associated with 16 year-old drivers than for other age groups. Table 1 summarizes all of these driving behaviors for three age categories.
### Young Driver Safety in Massachusetts

In Massachusetts, drivers ages 16 to 19 have the highest crash rates per licensed driver, and the risk peaks at age 16. In 2004, the crash rate (per 100,000 licensed drivers) for 16 year old drivers was more than twice that among 17 to 19 year-olds. Massachusetts’s youngest drivers are overrepresented when considering both crashes and violations.

#### Crashes

Sixteen year old drivers in Massachusetts are notably overrepresented in crashes of all severities. Figure 1 shows the percent of all drivers that are 16 years old involved in all crashes, injury crashes, and fatal crashes. In addition, the dashed line shows the percentage of all licensed drivers in Massachusetts that are 16 years old. Crash involvement for 16 year old was six to seven times higher than the proportion of licensed drivers that 16 year olds accounted for. Seventeen year old drivers were also overrepresented in crashes at all severity levels, though not as significantly as 16 year olds.

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**TABLE 1 Percentage of Fatal Crashes by Characteristic, 2004 (6)**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Driver Age:</th>
<th>16</th>
<th>17-19</th>
<th>20-49</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver error</td>
<td></td>
<td>78%</td>
<td>69%</td>
<td>55%</td>
</tr>
<tr>
<td>Speeding</td>
<td></td>
<td>39%</td>
<td>33%</td>
<td>23%</td>
</tr>
<tr>
<td>Single vehicle</td>
<td></td>
<td>52%</td>
<td>45%</td>
<td>39%</td>
</tr>
<tr>
<td>3+ occupants</td>
<td></td>
<td>29%</td>
<td>24%</td>
<td>18%</td>
</tr>
<tr>
<td>Drivers killed with 0.08+ BAC</td>
<td></td>
<td>13%</td>
<td>25%</td>
<td>44%</td>
</tr>
</tbody>
</table>

Young driver safety is not only an important issue at the national level; young drivers in Massachusetts are also an area worth examining.

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![Figure 1 Sixteen year old driver crash involvement and license rates, 2002-2004 (7).](image-url)
Another way of examining the involvement of young drivers in crashes is to consider the rate of the number of drivers in crashes per 100,000 licensed drivers.

- This crash rate for 16 year old drivers involved in all crashes was six times higher than the same rate for all drivers (7).
- The crash rate for 16 year old drivers involved in a crash where someone was injured was five times higher than the same rate for all drivers (7).
- The crash rate for 16 year old drivers involved in a crash where someone was killed was five times higher than the same rate for all drivers (7).

Violations

Analyzing the issuance of violations to drivers is another avenue for examining highway safety. Again, when considering violations rather than crashes, 16 year olds were notably overrepresented. Figure 2 shows the percent of all drivers issued total, speeding, and driving while intoxicated (DWI) violations that were 16 years old. The proportion of violations issued to 16 year old drivers was two to five times higher than the proportion of licensed drivers that 16 year olds account for. Seventeen year olds were also overrepresented but at a lower rate than 16 year olds.

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Figure 2 Sixteen year old driver violation issuance and license rates, 2002-2003 (7).
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Another way of examining the issuance of violations to young drivers is to analyze the rate of violations issued per 100,000 licensed drivers.

- The violation rate for all violations issued to 16 year old drivers was four times higher than the same violation rate for all drivers (7).
- The violation rate for speeding violations issued to 16 year old drivers was four times higher than the same violation rate for all drivers (7).
- The violation rate for DWI (alcohol) violations issued to 16 year old drivers was two times higher than the same violation rate for all drivers (7).
The overrepresentation of 16 and 17 year old drivers in crashes and violations is one of the most compelling reasons for the implementation of programming and policy that focuses specifically on new teenage drivers.

**General Information on Graduated Drivers Licensing**

Inexperience, immaturity, distractions (especially when they have other teen passengers in the vehicle), sensation seeking, and risk taking appear to be among the main factors that contribute to high crash risk among adolescents (8, 9, 10, 11). Peer influence among teens is a major factor in risky behaviors. Some of this effect is direct; the risk of being involved in a crash is much higher for teen drivers when they are carrying other teens in the vehicle (12, 13, 14). The presence of teenage passengers has been associated with driver error often caused by distractions and induced risk taking (13).

One attempt to find a safe medium for young drivers to gain driving experience while limiting their exposure to risky situations has been the implementation of the graduated driver licensing (GDL) system. While the idea of gradually increasing a new driver’s exposure to risky driving environments may be beneficial to novice drivers of all ages, the idea is especially important for young drivers. GDL programs have been implemented for new drivers of all ages in other countries; in the United States, GDL programs target new teen drivers as they comprise the majority of new drivers (4). GDL is a proactive approach to limiting the harm done to teen drivers themselves as well as other road users.

The GDL system phases young drivers into full driving privileges as they age and gain experience. While some states have implemented a partial GDL system, the full GDL system should have three stages: supervised learner’s period, intermediate license, and full licensure (15). The supervised learner’s period occurs prior to passing the driver test and is associated with driving done under the supervision of a licensed adult. The intermediate license includes limiting unsupervised driving in high-risk situations such as late-night driving or driving with teenage passengers. Requiring a minimum number of supervised hours and mandating a minimum amount of time a driver must remain in each of the two learning phases strengthens the positive impact of the GDL system.

More detailed information, including the history of GDL, can be found in the *Graduated Driver Licensing Literature Review* completed by MassSAFE for the Governor’s Highway Safety Bureau in September, 2004.

**Review of the Effectiveness of Graduated Drivers Licensing in Massachusetts**

In Massachusetts, graduated licensing is carried out through the Junior Operator License (JOL) law [Chapter 220 of the Act of 1998]. The JOL law was implemented in Massachusetts in November 1998 placing restrictions and limitations on the driving privileges of young drivers. The law requires the acquisition of a full license through a series of stages: the learner’s permit, the Junior Operator’s License, and full licensure.
The learner’s permit entails the following requirements and restrictions:

- Minimum age of 16 years-old;
- Minimum holding time of six months;
- Thirty hours of classroom instruction;
- Six to eight hours of behind-the-wheel training;
- Four to six hours as an observer to another student driver; and
- Twelve hours of supervised driving experience.

The Junior Operator’s License entails the following requirements and restrictions:

- Minimum age of 16.5 years-old;
- No driving between the hours of midnight and 5:00 AM unless accompanied by a parent or guardian; and
- For the first six months, no passengers under the age of 18 unless they are supervised by a driver age 21 or older.

Following completion of these two stages, a driver may obtain a full, unrestricted license at the age of 18.

As of March 2006, IIHS has given Massachusetts’s young driver licensing system a rating of “good” – the highest possible rating (16). Of the six traffic safety categories rated for each state, Massachusetts received this rating only in GDL and motorcycle helmet use (the other four categories are DUI/DWI, safety belt use, child restraint use, and red light camera). To receive a rating of “good” for young driver licensing, a state has to have a minimum of six months for the learner’s phase. Once licensed, the driver has to be subject to nighttime driving restrictions. In addition, a passenger restriction limiting new drivers to having no more than one passenger when driving unsupervised is required. Unrestricted licensure begins no earlier than 17 years old (17).

An analysis of available data was conducted to determine the effectiveness of the JOL law in improving young driver safety in Massachusetts. Figure 3 shows the changes in the average annual rate of drivers in injury crashes per 100,000 licensed drivers before, during, and after JOL implementation. There was a 14 percent reduction in the rate of drivers in injury crashes from the before and during periods to the after period for crashes involving 16 year-old drivers. The differences were very small between the before and after periods for 17 and 18 year-old drivers as well as for the control group (drivers age 19 and older).
Similar to the rate of young drivers involved in injury crashes, the rate of young drivers involved in fatal crashes changed most noticeably for 16 year-old drivers; there was a 48 percent decrease in the rate from the before period to the after period. This decrease is not seen for 17 and 18 year-old drivers or for the control group (age 19 or older), as shown in Figure 4.

Figure 3  Rate of drivers involved in injury crashes per 100,000 licensed driver (7).

Figure 4  Rate of drivers involved in fatal crashes per 100,000 licensed driver (7).
While it appears that JOL legislation had a positive impact on driver safety for 16 year olds, there are changes to the JOL restrictions that could further increase the effectiveness of this law.

**Review of Massachusetts JOL Policy and Recommendations for Improving Effectiveness**

In August 2004, IIHS and the Traffic Injury Research Foundation (Ontario, Canada) released “Graduated Licensing: A Blueprint for North America” (18). This document outlines best practices for establishing and maintaining effective graduated licensing programs. Because the document covers both the United States and Canada, it addresses some of the issues associated with graduated licensing for drivers of all ages; in Canada a significant number of new drivers are not young. The results of this document are 13 recommendations for graduated licensing programs. The remainder of this white paper will focus on these recommendations and how they apply to Massachusetts. In some cases, current JOL policy adequately addresses the recommendation from the Blueprint document; those recommendations that are not currently adequately addressed in Massachusetts JOL policy have been marked with a star (★).

**Recommendation 1:** “Consider the age distribution of the beginning driver population in deciding whether to apply graduated licensing to all beginners or only young beginners, who are the primary targets.”

★Massachusetts should further examine licensed driver data to determine whether teen drivers are, indeed, the largest population of new drivers in Massachusetts.

In the United States, graduated licensing is generally applied only to teen new drivers as they are the largest group of new drivers and are associated with the highest crash rates and most risky behavior (18). When considering crash rates in Massachusetts, young drivers are overrepresented. If teens are the largest population of new drivers in Massachusetts, this would strengthen the basis for continuing a graduated licensing program that focuses specifically on this age. If teen drivers are not the largest population of new drivers in Massachusetts, there may be a case for expanding graduated licensing to apply to new drivers of all ages.

**Recommendation 2:** “Implement three-stage licensing systems.”

*Any efforts to improve the graduated licensing system in Massachusetts should maintain a three-stage system, similar to the one currently in place.*

Some states have elements of graduated licensing systems but have not fully implemented the recommended three-stage system. Currently Massachusetts’s graduated licensing is based on the three-stage licensing systems; it is this type of three-stage system that has proven to be most effective in improving young driver safety.

**Recommendation 3:** “Maintain the starting age at 16, or raise it to 16.”

*Massachusetts starting age is currently 16 years old; any revisions to graduated licensing policy in Massachusetts should include a starting age that is no less than 16.*
The starting age for driving varies among jurisdictions with most that have implemented a graduated licensing program ranging from 14 to 16 years-old. Some jurisdictions actually lowered the starting age when the graduated licensing program was implemented to allow for more time for supervised driving prior to obtaining an intermediate license. However, research has shown that lowering the age for supervised driving encourages unsupervised driving at young ages as well (18).

**Recommendation 4:** “Require adult supervision and restrict driving at the discretion of the supervisor. It is acceptable to phase in more difficult driving as in North Carolina.”

*Massachusetts should maintain the supervised driving portion of the learner’s permit phase.*

Massachusetts requires drivers operating under the learner’s permit (first stage) to complete 12 hours of supervised driving. In addition, the driver must complete six to eight hours of behind-the-wheel training. Some jurisdictions limit this type of driving, even when it is supervised driving (limiting nighttime driving, for example). Other jurisdictions require supervised driving in risky situations, such as night driving, as a way to gain experience. Some jurisdictions do a combination of both restricting driving in the earliest part of the supervised driving phase and gradually introducing it in the later part of the supervised driving phase. North Carolina, for example, has a 12-month learner’s permit stage allowing night driving only during the second six months (18).

**Recommendation 5:** “ Require 30 to 50 hours of certified driving, some of which should be allocated to nighttime driving.”

★★*Massachusetts should consider increasing the number of hours of supervised driving experience required before proceeding to the next phase of licensure from 12 hours to at least 30 hours with some of those hours being nighttime driving.*

Massachusetts currently requires only 12 hours of supervised driving experience, the least number of hours of supervised driving time required by any state that has implemented graduated licensing. Jurisdictions range in the required number of supervised driving hours from 12 to 50 hours. Some jurisdictions require 10 hours of supervised night driving.

**Recommendation 6:** “Establish a minimum 6-month learner’s phase.”

*Any efforts to improve Massachusetts’s graduated licensing should maintain the minimum six-month learner’s permit phase.*

Some jurisdictions have no minimum holding time for the learner’s permit. Among those that do, that minimum hold period ranges from 30 days to one year. Though there is no formal research on the ideal holding time, the general consensus is that a minimum of six months should be required (18). Massachusetts currently requires a new teen driver to drive for six months with a learner’s permit prior to acquiring a Junior Operator’s License.
Recommendation 7: “Do not permit any unsupervised driving before age 16, 6 months.”

Massachusetts should maintain a current minimum age of no less than 16.5 years-old for acquisition of the Junior Operator License which allows unsupervised driving with certain restrictions.

Because new drivers are at highest risk when they first begin unsupervised driving, it is important to limit the age at which that can happen and restrict certain types of high-hazard unsupervised driving (18). Massachusetts requires a driver to be at least 16.5 years-old before they can acquire the Junior Operator’s License which allows some unsupervised driving.

Recommendation 8: “Restrict unsupervised night driving by newly licensed drivers. Examine the pattern of nighttime crashes in the age group to which graduated licensing will apply to decide when this restriction should begin; optimal starting times are 9 or 10 PM. Exempt appropriate activities from the night driving restriction.”

★Massachusetts should consider expanding the restricted nighttime driving period which currently begins at midnight to begin at 9 or 10 PM.

Massachusetts currently limits night driving for inexperienced drivers. Drivers operating with a Junior Operator’s License (the intermediate stage of licensure) cannot drive between the hours of midnight and 5 AM unless they are accompanied by a parent or guardian. Expanding the nighttime restriction may improve young driver safety by further limiting nighttime driving. An analysis of data examining young driver crashes between 8 and 11 PM might provide further insight as to which time would be ideal for Massachusetts to begin the nighttime restriction.

Recommendation 9: “Limit teenage passengers to none or just one during some or all of the intermediate phase, absent adult supervision.”

★Massachusetts should continue the current passenger limitation which prohibits any passengers under the age of 18 for the first six months of unsupervised driving time unless there is adult supervision and might consider expanding that to include the entire duration of Junior Operator’s Licensure.

Research has shown that increasing the number of teenage passengers in a vehicle increases the crash risk for new drivers (18). Currently, 26 jurisdictions limit passengers; some only limit teenage passengers while others restrict passengers of any age. The number of passengers allowed and the exemption of family members also vary across jurisdictions. While more parents support this driving restriction than the nighttime driving restriction, more teen drivers are likely to violate this restriction than the nighttime restriction (18).

Recommendation 10: “Hold beginning drivers in the intermediate stage until at least age 18. Both inexperience and immaturity contribute to the high crash rate of young drivers and graduated systems can address both by delaying the age of full-privilege driving until 18.”
Massachusetts should continue to restrict driving for teenagers until they reach age 18 at which time they may obtain a full license, provided they have met all other requirements.

Forty-two licensing systems in the United States allow full licensure before age 18, with the other nine restricting it until age 18. Massachusetts is one of those nine and any efforts to improve the graduated licensing system should not change this.

**Recommendation 11:** “Consider an exit test to ensure competence prior to full-privilege licensure.”

★Massachusetts should consider requiring young drivers to pass a road test at age 18 prior to acquiring a full license.

Requiring drivers to pass a more difficult road test than the one passed to obtain the intermediate stage license might motivate young drivers to improve skills and gain necessary experience (18). Under the current JOL law, young drivers in Massachusetts graduate to full-licensure at age 18 with no road test provided they have completed the other JOL requirements. Currently no licensing system in the United States has implemented this requirement though it has been implemented in some Canadian jurisdictions.

**Recommendation 12:** “Graduated licensing works with or without driver education. In jurisdictions that do not already require driver education, the graduated system need not include any such provisions. In jurisdictions that do require driver education, the training should be integrated to complement graduated licensing. Ways should be explored to harmonize the delivery of driver education lessons with multistage graduated licensing requirements. However, there is no justification for time discounts.”

★Massachusetts may continue to require the driver education component specified in the learner’s permit stage for drivers in their first six months of licensure; however, further evaluation of the effectiveness of driver education and the role it plays in graduated licensing would be beneficial.

Although traditional driver education has not proven to reduce crash risk, it is a good way to learn basic driving skills. Integrating driver education with a graduated licensing system has been raised as a possible way to increase the value of driver education. In some jurisdictions, participating in driver education gives drivers a “time discount allowing them to move on to the next phase sooner; these time discounts have proven counterproductive (18). Massachusetts requires 30 hours of classroom training, six to eight hours of behind-the-wheel training and four to six hours of time as an observer to another student driver as part of the learner’s permit phase; this is the type of integration of driver education and graduated licensing mentioned earlier.

**Recommendation 13:** “Include penalty provisions that delay graduation for drivers with poor driving records.”

★Massachusetts should continue to penalize new teen drivers who have poor driving records during the learner’s permit or Junior Operator’s phases but should consider expanding the penalties beyond the current violations.
All jurisdictions penalize drivers who receive violations or are held responsible for a crash. In some jurisdictions, some violations can result in “starting the clock over.” Nova Scotia, for example, may require the driver to begin the two year intermediate stage from the beginning for some violations (18). In Massachusetts, a teen driver’s license will be suspended for a second offense of speeding or drag racing. An examination of violation data to determine other common teen violations, and their relation to future crash risk, may yield valuable information on other driving behaviors that are indicators of unsafe driving for this age group.

Summary of Massachusetts JOL Policy and Recommendations for Improvement

Table 2 is a summary of the recommendations, where Massachusetts stands in relation to each recommendation as well as suggestions for policy changes that would improve the graduated licensing system in Massachusetts to meet these recommended components.

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Current MA Policy</th>
<th>Suggested Improvements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recommendations where Massachusetts is already in compliance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Three-stage licensing</td>
<td>Massachusetts current graduated licensing stages are learner’s permit, Junior Operators License, full licensure.</td>
<td></td>
</tr>
<tr>
<td>Starting age of 16</td>
<td>Massachusetts minimum age for learner’s permit is 16.</td>
<td></td>
</tr>
<tr>
<td>Adult supervision</td>
<td>Massachusetts currently requires adult supervision in the learner’s permit stage.</td>
<td></td>
</tr>
<tr>
<td>Minimum 6 month learner’s phase</td>
<td>Massachusetts currently requires a new teen driver to hold the learner’s permit for six months.</td>
<td>None</td>
</tr>
<tr>
<td>No unsupervised driving before 16.5 years-old</td>
<td>Massachusetts minimum age for Junior Operator’s license which allows some unsupervised driving is 16.5 years-old.</td>
<td></td>
</tr>
<tr>
<td>No full licensure before age 18</td>
<td>Massachusetts currently requires a driver to remain a Junior Operator until age 18.</td>
<td></td>
</tr>
<tr>
<td>Integrate driver education</td>
<td>Massachusetts currently requires driver education as part of the learner’s permit phase.</td>
<td></td>
</tr>
</tbody>
</table>
Recommendations where Massachusetts is in partial compliance

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Massachusetts requirements</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supervised driving – 30 to 50 hours with some nighttime</td>
<td>Requires 12 hours of supervised driving experience</td>
<td>Increase supervised driving experience to at least 30 hours with some nighttime driving requirement.</td>
</tr>
<tr>
<td>Nighttime driving restriction – begin at 9 or 10 PM</td>
<td>Restricts nighttime driving beginning at midnight</td>
<td>Expand nighttime driving restriction from current hours of midnight to 5 AM to 9/10 PM to 5 AM.</td>
</tr>
<tr>
<td>None or one teenage passenger</td>
<td>Restricts teen passengers during the first six months of unsupervised driving</td>
<td>Consider expanding restriction to entire duration of Junior Operator License.</td>
</tr>
<tr>
<td>Penalties for poor driving record</td>
<td>Implements license revocation for second offense of speeding or drag racing</td>
<td>Expand penalties to include other common/high risk teen violations and consider other types of penalties (restarting JOL).</td>
</tr>
</tbody>
</table>

Recommendations where Massachusetts is not in compliance

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Massachusetts requirements</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examine whether GDL should apply to all new drivers</td>
<td>Graduated licensing currently applies only to new, teen drivers</td>
<td>Analyze licensed driver data to determine whether teens are largest population of new drivers.</td>
</tr>
<tr>
<td>Exit test prior to full licensure</td>
<td>Does not currently require an exit test prior to moving from Junior Operator’s License to full licensure</td>
<td>Require a 2nd, more difficult, road test prior to full licensure at age 18 to ensure appropriate experience has been gained and necessary skills learned.</td>
</tr>
</tbody>
</table>

Conclusions

Graduated licensing systems have proven to be effective ways for new drivers to gain experience while limiting the risk placed on themselves and other road users. While Massachusetts’s graduated licensing system – the Junior Operator Law – has been shown to reduce the crash risk associated with new teen drivers, the application of the recommendations found in *Graduated Licensing: A Blueprint for North America* could be an effective way to increase the benefits and reduce the dangers associated with these drivers. In addition, continued evaluation of related data including crash, violation, and licensed driver information could be valuable in developing an ongoing understanding of the impact of graduated licensing on Massachusetts traffic safety and methods for improving the benefits of this program.

Data Notes

It is unclear whether the number of licensed 16 year old drivers provided by the Registry of Motor Vehicles includes those drivers with a learner’s permit. All analyses are based on best available data and understanding of data quality issues at time of analysis. Improved understanding of data quality or other analysis-related issues may lead to slight variation in actual frequencies reported. Analyses were based on crash data collected by the Massachusetts Registry of Motor Vehicles and fatality data collected by the National Highway Traffic Safety Administration (NHTSA).


