

Final Report

Young Driver Crash Rates and Iowa's Passenger Restriction Waiver

Principal Investigator:	Michelle L. Reyes National Advanced Driving Simulator The University of Iowa
Co-investigators:	Sang Hee (Nina) Kim Cher Carney
Sponsors:	Iowa Department of Transportation Federal Highway Administration
Iowa DOT Technical Office Representative:	Steve Gent Director, Office of Traffic & Safety Iowa Department of Transportation
Iowa DOT Project Number:	17-SPR0-009

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. 17-SPR0-009	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Young Driver Crash Rates and Iowa's Passenger Restriction Waiver		5. Report Date December 2018
		6. Performing Organization Code:
7. Author(s) Michelle L. Reyes Sang Hee (Nina) Kim Cher Carney		8. Performing Organization Report No.
9. Performing Organization Name and Address University of Iowa National Advanced Driving Simulator 2401 Oakdale Blvd Iowa City, Iowa 52242		10. Work Unit No.
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address Iowa Department of Transportation Research and Analytics Bureau 800 Lincoln Way Ames, IA 50010 Federal Highway Administration U.S. Department of Transportation 1200 New Jersey Avenue SE Washington, DC 20590		13. Type of Report and Period
		14. Sponsoring Agency Code 17-SPR0-009
15. Supplementary Notes		
<p>16. Abstract</p> <p>Iowa is the only state in the US that gives parents the option to implement or waive a passenger restriction that limits the number of unrelated minor passengers to one for the first six months of licensure. The restriction does not apply to a driver's sibling, step-sibling, or a child who resides at the same household as the driver. The Iowa DOT indicated that approximately 90% of parents choose to waive the restriction during 2014, the first year the policy was in effect.</p> <p>This study analyzed crash rates for young drivers who were and were not subject to the passenger restriction in the first six months of intermediate licensure. Rates for the subsequent six months (i.e., after the passenger restriction has ended) were also analyzed. In addition, this study quantified the number of newly-licensed drivers who were subject to the passenger restriction and their characteristics. Because many young drivers in Iowa obtain the optional minor school license (MSL), which allows teens as young as 14.5 years to drive to and from school and school-related activities without a supervisor before obtaining his or her intermediate license, MSL and non-MSL drivers were considered separately.</p> <p>While most parents waived the passenger restriction, the observed acceptance rate of 23% was higher than previously indicated. Even though the passenger restriction was associated with higher rather than lower crash rates among drivers who previously held a minor school license, the limitations associated with studying an optional policy do not permit conclusions to be drawn about the policy's impact on the safety of young drivers and their passengers. Perhaps parents who perceived that their young driver was at higher risk of being involved in a crash were more likely to opt for the passenger restriction. It is conceivable that the crash rates would have been higher without the passenger restriction in place for those drivers. There is some evidence that parents who supported early driving for their teen drivers (i.e., with a MSL and/or licensure at age 16.0) were less likely to opt for the passenger restriction. However, on the whole, these data offer very little insight into the parents' decision making process for opting or waiving the passenger restriction.</p>		

<p>Before any modification to the current policy is considered, steps should be taken to learn what factors parents consider when making their decision about the passenger restriction. What safety statistics, goals and objectives, traits of the teen driver, family needs, and aspects of the parent-teen relationship are being weighed when parents decide whether to opt for or waive the restriction? Conducting a survey of parents would provide important data about how Iowa's GDL passenger restriction is being applied and to inform any potential policy change or educational effort.</p>			
<p>17. Key Words Driver licenses – Teenage drivers – Crash data – Front seat occupants – Rear seat occupants – Passengers – Policy, legislation and regulation</p>		<p>18. Distribution Statement No restrictions.</p>	
<p>19. Security Classification of Report Unclassified</p>	<p>20. Security Classification of Page Unclassified</p>	<p>21. No. of Pages 21</p>	<p>22. Price</p>

The opinions, findings, and conclusions expressed in this publication are those of the author and not necessarily those of the Iowa Department of Transportation or the United States Department of Transportation, Federal Highway Administration.

Federal and state laws prohibit employment and/or public accommodation discrimination on the basis of age, color, creed, disability, gender identity, national origin, pregnancy, race, religion, sex, sexual orientation or veteran's status. If you believe you have been discriminated against, please contact the Iowa Civil Rights Commission at 800-457-4416 or Iowa Department of Transportation's affirmative action officer. If you need accommodations because of a disability to access the Iowa Department of Transportation's services, contact the agency's affirmative action officer at 800-262-0003.

Executive Summary

Introduction

It has been well documented that teen drivers with multiple teen passengers have increased risk of being involved in a crash. Restricting the number of passengers a teen driver can transport is a key component of the graduated driver's licensing (GDL) laws in 45 states and the District of Columbia (IIHS, 2017). Most studies show positive safety effects associated with GDL restrictions on passengers.

Iowa is the only state in the US that gives parents the option to implement or waive a passenger restriction that limits the number of unrelated minor passengers to one for the first six months of licensure. The restriction does not apply to a driver's sibling, step-sibling, or a child who resides at the same household as the driver. The Iowa DOT indicated that approximately 90% of parents choose to waive the restriction during 2014 (Lucey, 2015), the first year the policy was in effect.

This study analyzed crash rates for young drivers who were and were not subject to the passenger restriction in the first six months of intermediate licensure. Rates for the subsequent six months (i.e., after the passenger restriction has ended) were also analyzed. In addition, this study quantified the number of newly-licensed drivers who were subject to the passenger restriction and their characteristics. Because many young drivers in Iowa obtain the optional minor school license (MSL), which allows teens as young as 14.5 years to drive to and from school and school-related activities without a supervisor before obtaining his or her intermediate license, MSL and non-MSL drivers were considered separately.

This analysis considered young drivers during the first 12 months of intermediate licensure over a period of three years, from January 2015 through December 2017. Crash rates were calculated as the number of reported crashes per 1,000 drivers per month (or, per 1,000 driver-months) according to duration of licensure, specifically the first month, the first three months, the first six months, and the next six months of licensure. Two-way frequency tables were used to examine a variety of characteristics for crashes occurring in the first six months of licensure, including severity of injuries sustained in the crash, crash type (e.g., single vehicle, head-on, rear-end), time of day and day of week, rurality, and alcohol involvement. Additionally, the number and ages of occupants in the vehicle were tabulated. Characteristics of the young drivers that might be associated with a parent's decision to opt for or waive the passenger restriction were examined, including the young driver's age at the time they obtained their intermediate license, the duration the young driver held a MSL (for the MSL subgroups) or an instruction permit (for the No MSL subgroups), their gender, and previous crashes or convictions.

Findings

More than sixty-one thousand intermediate licenses were issued from January 2015 through December 2017. About 23% of parents opted for a passenger restriction for their intermediate driver. This is considerably higher than the 10% previously reported (Lucey, Des Moines Register, 15 Mar 2015). More than half the young drivers (54%) held a MSL before obtaining an intermediate license, and among these, only 15% had the passenger restriction. Among drivers who never held a MSL, 33% had the passenger restriction on their intermediate license.

Young drivers holding intermediate licenses for less than 12 months were involved in 8,502 crashes. The overall crash rate in the first six months of driving was 9.2 crashes per thousand driver-months. In the second six months, the rate was 6.7, a decrease of 27%.

The crash rates for young drivers who did not previously have minor school licenses were similar regardless of passenger restriction status. During the first six months of driving, non-MSL drivers with the restriction had a rate of 10.8 and those without it had a rate of 10.2. During the subsequent six months, the rates fell to 7.3 and 7.4, respectively. Among intermediate drivers who previously held a MSL, those whose parents opted for the restriction had the highest crash rates of any subgroup in the first month of driving (11.5), but after three months of driving the rate was 14% lower at 9.9. Overall this subgroup's rates were similar to those for the non-MSL groups, with a rate of 9.6 during the first six months and 6.7 during the subsequent six months. The MSL drivers without the passenger restriction had the lowest crash rates, with a crash rate of 7.9 during the first 6 months and 5.9 during the second half-year. Within all driver subgroups, the crash rates in the second half-year of driving were 25-32% lower than in the first six months.

Two of the crash characteristics that were examined—the manner of crash/collision and vehicle occupancy—revealed slight differences between the driver subgroups. Young drivers who previously had a MSL (regardless of passenger restriction status) were involved in proportionally 8% more rear-end crashes than non-MSL drivers. Second, the drivers without a previous MSL who had the passenger restriction had about 4% more single vehicle crashes compared to the overall average. Crash-involved young drivers without the passenger restriction were carrying two or more passengers in their vehicle in proportionally 5% more crashes than those with the passenger restriction.

Teens who previously held a MSL were more likely to obtain their intermediate license at age 16 yr 0 mo. About 85% of those who previously had a MSL got their intermediate licenses at age 16 compared to 48% of those who never held a MSL. Fewer parents of young drivers who were licensed at age 16 opted for the passenger restriction than those licensed later. Fourteen percent of MSL drivers licensed at age 16 had the passenger restriction compared to 20% of MSL drivers licensed at ages 16 yr 1 mo through 16 yr 11 mo. Among drivers who never had MSLs, 28% of those licensed at age 16 had the restriction compared to 37% of those licensed at ages 16 yr 1 mo through 16 yr 11 mo.

Parents of intermediate drivers who previously held a MSL were slightly more likely to opt for the passenger restriction if their teen had held the MSL for a shorter period of time. The difference in the median duration of minor school licensure between those without and with the passenger restriction was about three months.

The young drivers' records were examined to see if being involved in a crash or having a driving-related conviction on their record prior to obtaining an intermediate license seemed to be a factor when parents were deciding whether to opt for or waive the passenger restriction. About 5% of the drivers obtaining their intermediate license for the first time had a previous conviction or crash. Among these drivers, only 15% had the passenger restriction on their intermediate license, compared to 23% of the young drivers with no record of convictions or accidents.

Conclusions

While most parents waived the passenger restriction, the observed acceptance rate of 23% was higher than previously indicated. Even though the passenger restriction was associated with higher rather than lower crash rates among drivers who previously held a minor school license, the limitations associated with studying an optional policy do not permit conclusions to be drawn about the policy's impact on the safety of young drivers and their passengers. Perhaps parents who perceived that their young driver was at higher risk of being involved in a crash were more likely to opt for the passenger restriction. It is conceivable that the crash rates would have been higher without the passenger restriction in place for those drivers. There is some evidence that parents who supported early driving for their teen drivers (i.e., with a MSL and/or licensure at age 16.0) were less likely to opt for the passenger restriction. However, on the whole, these data offer very little insight into the parents' decision making process for opting or waiving the passenger restriction.

Recommendations

Before any modification to the current policy is considered, steps should be taken to learn what factors parents consider when making their decision about the passenger restriction. What safety statistics, goals and objectives, traits of the teen driver, family needs, and aspects of the parent-teen relationship are being weighed when parents decide whether to opt for or waive the restriction? Conducting a survey of parents would provide important data about how Iowa's GDL passenger restriction is being applied and to inform any potential policy change or educational effort.

Background

It has been well documented that teen drivers with multiple teen passengers have increased risk of being involved in a crash (e.g., Chen et al., 2000; Doherty et al., 1998; Regan and Mitsopoulos, 2001; Williams, Ferguson & McCartt, 2007; Padlo et al., 2005 Ouimet et al., 2015). Restricting the number of passengers a teen driver can transport is a key component of the graduated driver's licensing (GDL) laws in 45 states and the District of Columbia (IIHS, 2017). Most studies show positive safety effects associated with GDL restrictions on passengers. Data from 1993 to 2003 shows that restricting the number of passengers 16-year-old drivers were allowed to carry has reduced the proportion of fatal crashes involving teen passengers from 53% to 44% (Williams et al., 2005). McCartt et al. (2010) examined fatal crashes among 15-, 16-, and 17-year-olds using FARS data from 1996-2007. They found that states that did not allow teen passengers had a 21% lower fatal crash rate and states that allowed only one teen passenger had a 7% lower fatal crash rate compared to states with no passenger restriction. More recently a meta-analysis of fourteen studies published between 2001 and 2011 found that for 16-year olds, passenger restrictions were associated with a 6% reduction in total passenger crashes and a 16% reduction in fatal passenger crashes (Masten et al., 2015).

Passenger distractions are one of the most frequent distractions for teen drivers involved in crashes. Teen drivers who were transporting passengers when they crashed were more likely to be distracted compared to teens driving alone (Curry et al., 2012). An examination of on-board video recorded during nearly 1700 teen driver crashes found that 58% of the drivers were engaged in potentially distracting behaviors in the six seconds preceding a crash. Attending to a passenger was the most frequently observed driver behavior and occurred in nearly 15% of crashes (Carney et al., 2015).

Many young drivers are aware that passengers can lead to driver distraction. A study of young, adolescent drivers found that 38% reported being distracted by their passenger. While the majority of distractions were just conversations, almost 8% were deliberate, such as tickling, hitting, and messing with vehicle controls (Heck and Carlos, 2008). In an online survey conducted by Allstate Insurance Company (2015), 40% of teens reported that having passengers in the vehicle was extremely/very distracting and 44% reported that they were safer drivers when their friends were not in the car. Focus groups conducted by NHTSA (2006) found that while teens recognized that their peer passengers could create risky/unsafe situations, teen drivers had a hard time finding the confidence to set rules or limits in their vehicles and felt they lacked the ability to keep their passengers under control.

The results of several observational studies indicate that peer passengers, and particularly male passengers, increase the rate of risky driving. Faster speeds and shorter headways were seen when young drivers were in the presence of a young male passenger (Baxter et al., 1990; Simons-Morton et al., 2005). The crash data also indicated an increase in risky behavior leading up to crashes. Aldridge et al. (1999) found that when teen drivers were involved in a crash in which peers were present, 31% of the crashes involved excessive speed, compared to only 24% of crashes when they were driving alone. More recently, a nationally representative study of 677 teen drivers involved in crashes found that compared to males driving alone, males with passengers were nearly six times more likely to perform an illegal maneuver and more than twice as likely to engage in aggressive driving before a crash (Curry et al., 2012). However, perhaps most telling is that teens themselves have reported that they were more likely to take risks when passengers are present (Regan and Mitsopoulos, 2001; Allstate Insurance Company, 2015).

As is the case in many other states, young drivers in Iowa must be at least 16 years old in order to obtain an intermediate license. However, our state has a few policies that differ greatly from national norms. First, Iowa is the only state in the US that gives parents the option to implement or waive a passenger restriction that limits the number of unrelated minor passengers to one for the first six months of licensure. The restriction does not apply to a driver's sibling, step-sibling, or a child who resides at the same household as the driver. The Iowa DOT indicated that approximately 90% of parents choose to waive the restriction during 2014 (Lucey, 2015), the first year the policy was in effect. Second, Iowa also offers a minor school license (MSL) that allows teens as young as 14.5 years to drive to and from school and school-related activities without a supervisor before obtaining his or her intermediate license. Due to this policy, many teens already have independent driving experience prior to obtaining their intermediate licenses.

This study analyzed crash rates for young drivers who were and were not subject to the passenger restriction in the first six months of intermediate licensure. Rates for the subsequent six months were also analyzed in order to see if rates change after the restriction has ended. In addition, this study quantified the number of newly-licensed drivers who were subject to the passenger restriction and their characteristics.

Approach

This analysis considered young drivers during the first 12 months of intermediate licensure over a period of three years, from January 2015 through December 2017. Crash rates were calculated as the number of reported crashes per 1,000 drivers per month (or, per 1,000 driver-months) according to duration of licensure.

We requested and obtained from the Iowa DOT Office of Driver and Identification Services (ODIS) records for all licenses issued to young drivers in Iowa from 2008 through 2017. The data for each type of license (i.e., instruction permit, minor school license, intermediate license, and full license) were provided in a separate data file. Each unique driver was identified by a customer number. The four data tables were merged and sorted by customer number and date and time of each licensing record. Duplicate records were eliminated, as were records for licenses issued at age 21 or older. Each driver's licensing history was examined to assign him or her to one of four driver subgroups depending on whether or not they previously held a minor school license (MSL or No MSL) and whether or not their parent opted or waived the passenger restriction (PR or No PR) when they obtained an intermediate license. If a young driver held an intermediate license and then held another type of license before being reissued an intermediate license, only the first licensure was considered. Datasets with information about accidents and traffic-related convictions on the drivers' records were also obtained.

The number of drivers holding an intermediate license on the 15th of each month during the study period was tabulated according to duration of licensure for each subgroup. These data formed the denominator for the crash rate calculations.

Crash system datasets were requested through the University of Iowa Injury Prevention Research Center, which has an agreement with the Iowa DOT to administer access to the data for research purposes. We obtained the crash-, vehicle-, and individual-level datasets for crashes from 2015-2017. In

addition, we obtained the driver's license number (DLN) and zip code from the driver-level dataset (also known as the private dataset because it contains the drivers' identifying information). The full set of crashes was reduced to only include drivers of a passenger vehicle under the age of 21. Initially we planned to link drivers involved in crashes with their driver licensing data using their DLNs. However, the DLNs were missing from the crash dataset with enough frequency that a different strategy was employed. The driver information from the Crash file was cross-referenced with the Accident records (i.e., crashes that have been reported on the drivers' records). In 97% of the crashes, the driver's date of birth and the date of the crash were unique in both the Crash and Accident (i.e., licensing) datasets. When date pairs did not uniquely link drivers and crashes, the multiple matches were reconciled using gender, zip code, and (when present) DLN. After linking each crash to the driver's licensing history, the type of the last license issued prior to the crash and the duration of licensure at the time of the crash were determined. Crashes associated with drivers holding their first intermediate license for less than 12 months were tabulated for each month of study period according to duration of licensure for each driver subgroup.

For each month of the study period, within each driver subgroup, the number of crashes for each duration of licensure was divided by the number of young drivers (in thousands) holding a license for the same duration. To aggregate crash rates across duration of licensure, the total number of crashes was divided by the total number of driver-months (in thousands). Crash rates were calculated for the first month, the first three months, the first six months, and the next six months of licensure. Two-way frequency tables were used to examine a variety of characteristics for crashes occurring in the first six months of licensure. This method was also used to study how driver licensing history characteristics were associated with opting or waiving the passenger restriction.

Findings

More than sixty-one thousand intermediate licenses were issued from January 2015 through December 2017. Table 1 shows the number of drivers in each of the subgroups. Regardless of whether or not the drivers had previously held a MSL, many more parents waived the passenger restriction than opted for it. Overall, the passenger restriction was implemented for 23% of intermediate licenses. Intermediate drivers holding their licenses for less than one year were involved in about 8500 crashes during the study period (see Table 2).

Table 1. Driver subgroups for drivers receiving intermediate licenses from January 2015 through December 2017.

Driver subgroup	Minor school license prior to intermediate license?	Passenger restriction on intermediate license?	N (%)
No MSL – No PR	No	No	19215 (31%)
No MSL – PR	No	Yes	9189 (15%)
MSL – No PR	Yes	No	27954 (46%)
MSL – PR	Yes	Yes	4828 (8%)
Total			61186

Table 2. Number of crashes occurring from January 2015 through December 2017 involving intermediate drivers licensed for less than six months and licensed for six up to twelve months.

Driver subgroup	Crashes with drivers licensed < 6 months	Crashes with drivers licensed 6 to < 12 months	Total
No MSL – No PR	1791 (36%)	1278 (36%)	3069
No MSL – PR	887 (18%)	586 (17%)	1473
MSL – No PR	1917 (38%)	1389 (40%)	3306
MSL – PR	392 (8%)	262 (7%)	654
Overall	4987	3515	8502

Crash rates

The overall crash rate in the first six months of driving was 9.2 crashes per thousand driver-months. In the second six months, the rate was 6.7, a decrease of 27%. Figure 1 shows the crash rates for each of the subgroups. About thirty percent of the intermediate drivers never held a minor school license and did not have the passenger restriction. In the first month of driving, they were involved in 11.2 crashes per thousand driver-months and the rate for the first three months of driving was about the same. The rate for the first six months of driving was slightly lower at 10.2 and the rate over months 6 up to 12 decreased 27% to 7.4. The intermediate drivers who had not held a MSL and had the passenger restriction on their intermediate licenses represented 15% of the drivers. Their crash rate for the first month of driving was the same as the first six months of driving—about 10.8 crashes per thousand driver-months—and was the only subgroup to not show improvement in the first 6 months relative to the first month. It was also the only subgroup to show an increase over time, with a rate of 11.1 over the first three months. In the second six months of driving, when the drivers were no longer subject to the passenger restriction, the rate was about 32% lower at 7.3. On the whole, the crash rates for the two subgroups of drivers who never held MSLs were very similar regardless of passenger restriction status.

Among the intermediate drivers who previously held a MSL, there were large differences in crash rates based on passenger restriction, particularly for the first six months of driving. The MSL – No PR subgroup was the largest and consisted of almost half the study population. This group had the lowest crash rates at each time point examined. The crash rate for the first month of intermediate licensure was 8.7, at least 20% lower than the other three subgroups. The rate was 7.9 over the first 6 months and decreased 25% to a rate of 5.9 in the second half of the first year of licensure. Finally, the young drivers who previously had a MSL and had a passenger restriction accounted for only 8% of the study population and had the highest crash rate for the first month of licensure, 11.5 crashes per thousand driver-months. However this subgroup was the only one to show a meaningful decrease early after licensure, as the rate over the first three months of driving was 14% lower than the rate for the first month alone. After 6 months, the crash rate was 9.2, and in the second 6 months of driving, the crash rate was 30% lower at 6.7. This subgroup's rates for the first three, the first six, and the second six months of driving were all lower than the corresponding rates for both the No MSL subgroups.

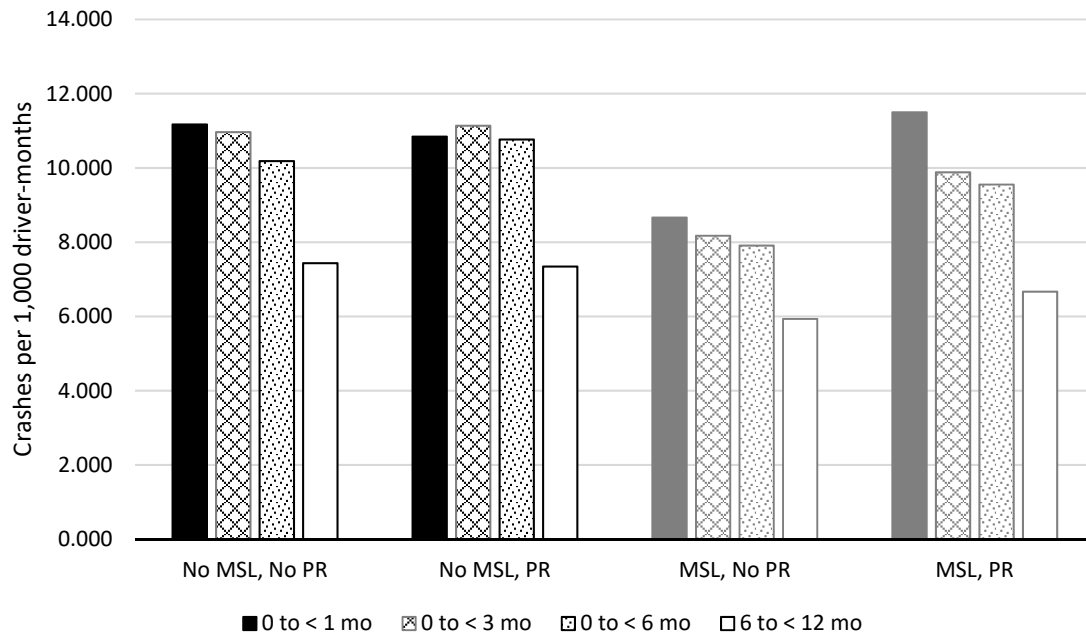


Figure 1. Crash rates for the first month, first three months, first six months, and second six months of intermediate licensure for young drivers with and without previous minor school licenses (MSL) and with and without passenger restrictions (PR), 2015-17.

Crash characteristics

From 2015 to 2017, there were nearly five thousand crashes involving intermediate drivers licensed for less than six months. The information available for these crashes was examined in a number of aspects, including severity of injuries sustained in the crash, crash type (e.g., single vehicle, head-on, rear-end), time of day and day of week, rurality, and alcohol involvement. Additionally, the number and ages of occupants in the vehicle were tabulated.

The vast majority of the crashes (71%) did not result in injuries. About 28% crashes were classified as at least one occupant sustaining a possible, minor, or unknown injury. Just 1.4% of crashes resulted in at least one major injury. A total of 13 crashes, representing one quarter of one percent of all the crashes, resulted in a fatality. No substantial differences were seen between the four driver subgroups with respect to the proportion of crashes in each of these categories.

The “manner of crash or collision” variable was examined for differences in crash type between the driver subgroups. Just over 30% of the crashes were rear-end crashes, 23% were broadside (i.e., front of one vehicle hit the side of another), and 22% were single vehicle (i.e., road departure or collision with another fixed or non-fixed object that was not a vehicle). Two between-group differences were observed. First, intermediate drivers who previously had a minor school license (regardless of passenger restriction status) were involved in proportionally 8% more rear-end crashes than those drivers who had not held a MSL before getting their intermediate license. Second, the No MSL – PR subgroup had about 4% more single vehicle crashes compared to the overall average.

The four subgroups of young drivers did not show any meaningful differences in day of week and time of day for crashes. Friday was the day of the week when the most crashes occurred (about 18%). About 15% of the crashes occurred each day Monday through Thursday. Thirteen percent occurred on Saturdays and nine percent on Sundays. The time of day when the crashes occurred was assessed using thirty-minute time bins. These were examined separately for weekdays Monday through Friday and weekend days Saturday and Sunday (see Figure 2). During the weekdays, the most crashes occurred in the afternoon from 3:00 to 3:30 and from 3:30 to 4:00, respectively 8% and 10% of the crashes. About 5% of crashes occurred in each of the half-hours from 4:00 to 5:30 pm. Overall, 38% of weekday crashes occurred between 3:00 and 6:00 pm. Another 7% of the weekday crashes occurred between 7:30 and 8:00 am. The peak time for weekday morning crashes was much shorter in duration, with 14% of crashes occurring between 7:00 and 8:30 am. On the weekend days, the crash times were more evenly distributed. The proportion of crashes rises steadily from around 7:00 am before peaking around 5:00 pm and then gradually decreasing through the evening and late night hours. A total of 76 crashes (1.5%) occurred between 12:30-5:00 am, the hours when intermediate drivers are restricted from driving without a supervisor.

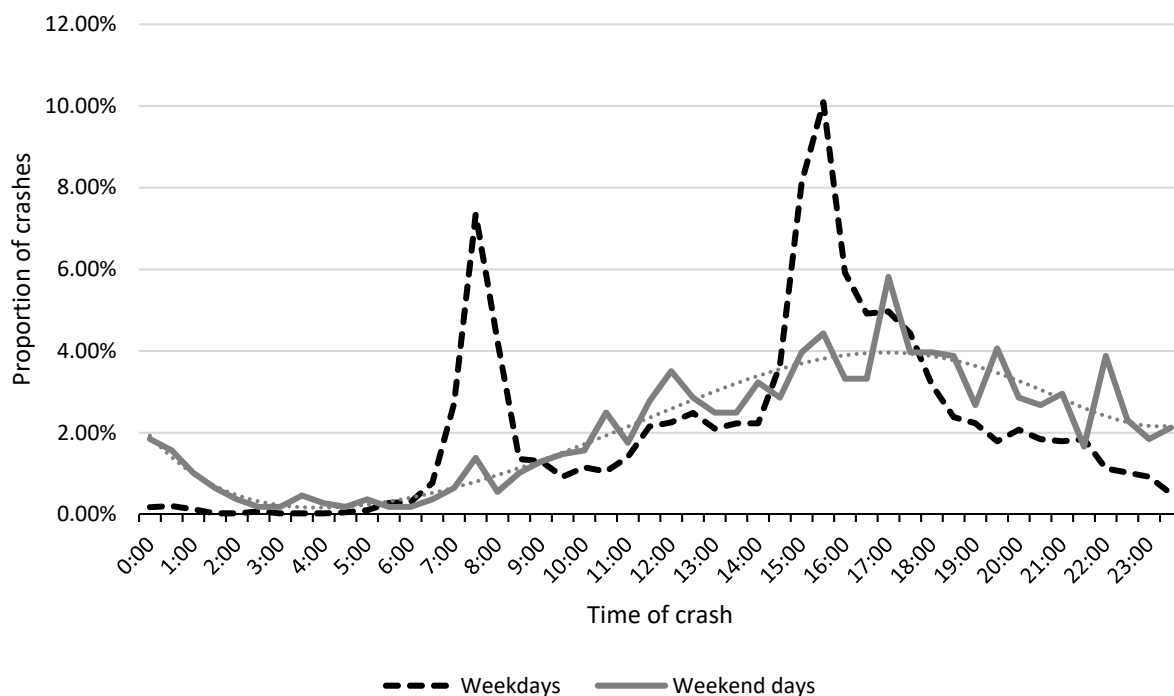


Figure 2. Proportion of crashes involving intermediate drivers licensed for less than six months from 2015-2017 with crash times occurring in each half-hour of the day, for both weekdays (i.e., Monday through Friday) and weekend days (i.e., Saturday and Sunday), along with a polynomial trend line for the latter.

The crash dataset contains a derived variable named “rural/urban” related to whether or not the crash occurred within the boundary of an incorporated area. According to this definition, one quarter of the young driver crashes were rural and this proportion was consistent across the subgroups (range of 22-

27%). Finally, only 28 crashes reported an alcohol test result. Of these, thirteen young drivers had a non-zero result.

Crash-involved passenger characteristics

In a majority of crashes, 63% overall, the young driver was the only occupant in the vehicle (see Table 3). The young drivers were transporting one other occupant in about one out of every four crashes. The proportion of young drivers carrying more than one passenger was higher for drivers who did not have the passenger restriction. These drivers had 2 or more passengers on board during 12% of their crashes compared to 7% for drivers with the passenger restriction. It is important to note that the drivers with the restriction who were carrying more than one passenger were not necessarily violating the restriction because the restriction only limits the number of unrelated passengers in the vehicle. The young drivers can carry as many related passengers as their vehicle has seatbelts. It is impossible to determine from the data available whether or not the other occupants of the vehicle were or were not unrelated minors and whether the young driver was in compliance with the restriction.

Among the crashes where the young drivers were transporting passengers, no information about the passengers was recorded for 84% of the vehicles. When occupant information was recorded, 79% were between 14 and 20 years old (see Table 4). Passengers under the age of 14 accounted for 11% while adults represented only 4% of the known passengers.

Table 3. Vehicle occupancy for crashes occurring in 2015-2017 involving young drivers with an intermediate license in the first six months of licensure

Driver subgroup	Total crashes	Driver only	One passenger	Two or more passengers
No MSL – No restriction	1791	1057 (59%)	499 (28%)	235 (13%)
No MSL – Restriction	887	580 (65%)	242 (27%)	65 (7%)
MSL – No restriction	1917	1228 (64%)	470 (25%)	219 (11%)
MSL – Restriction	392	273 (70%)	95 (24%)	24 (6%)
Overall	4987	3138 (63%)	1306 (26%)	543 (11%)

Table 4. Age for reported passengers in vehicles driven by young drivers with an intermediate license in the first six months of licensure involved in crashes, 2015-2017

Passenger age (years)	N (%)
< 14	39 (11%)
≥ 14 to < 21	280 (79%)
≥ 21 to < 30	8 (2%)
≥ 30	15 (4%)
Unknown	13 (4%)
All reported passengers	355

Passenger restriction licensing trends

Among the intermediate licenses issued from 2015 to 2017, 23% included the passenger restriction. These rates varied drastically by history of holding a minor school license (refer to Table 1). Almost one third of parents whose teens who never held a minor school license opted for the passenger restriction compared to 14.5% of the teens who had been issued a minor school license.

The licensing data were examined to see if the proportion of parents opting for the restriction was increasing or decreasing over study period. The linear trend of the proportion of drivers within the No MSL subgroups who obtained an intermediate license with passenger restriction was slightly rising at a rate of about 1.2% per year. The linear trend for the proportion within the MSL subgroups was very slightly increasing, about 0.5% per year.

The licensing data were also examined for any evidence of seasonality when it comes to opting for the passenger restriction. Among drivers who did not have a MSL, issuance of intermediate driver's licenses in the summer months was about double that as in the winter months while issuance of intermediate licenses among MSL holders remained relatively steady year-round. Since drivers who did not have MSL accounted for a greater proportion of the intermediate licenses issued with the passenger restriction, the overall proportion of licenses issued with the restriction also increased in the summer. However, within drivers who previously had a MSL and within drivers who never held a MSL, the proportion opting for the restriction stayed relatively consistent year-round.

Young driver characteristics with respect to passenger restriction

Characteristics of the young drivers that might be associated with a parent's decision to opt for or waive the passenger restriction were examined, including the young driver's age at the time they obtained their intermediate license, the duration the young driver held a MSL (for the MSL subgroups) or an instruction permit (for the No MSL subgroups), their gender, and previous crashes or convictions.

Intermediate license age The ages at which drivers obtained their intermediate licenses were examined for the four subgroups. Overall, 68% of the young drivers were licensed at age 16 yr 0 mo. However, this age varied widely according to minor school license status. Figure 3. Cumulative percent of age at which young drivers were issued an intermediate license 2015-2017, by driver subgroup. The proportion of drivers who received their intermediate licenses within one month of their sixteenth birthdays was much higher for the two MSL subgroups. About 85% of those who previously had a MSL got their intermediate licenses at age 16 compared to 48% of those who never held a MSL. Figure 3 shows the cumulative percent of drivers who obtained their licenses at or below the age indicated on the horizontal axis.

With respect to the passenger restriction, the proportion of drivers with the restriction was relatively stable over intermediate license age with one exception: fewer drivers licensed at age 16 yr 0 mo had the passenger restriction (see Figure 4). The proportion of young drivers licensed at this age with the passenger restriction was 14% for MSL drivers and 28% for No MSL drivers. The proportion increased notably to 22% and 35%, respectively, at age 16 yr 1 mo. For intermediate licenses issued after age 16 and before age 17, 20% of the No MSL and 37% of the MSL drivers had the passenger restriction.

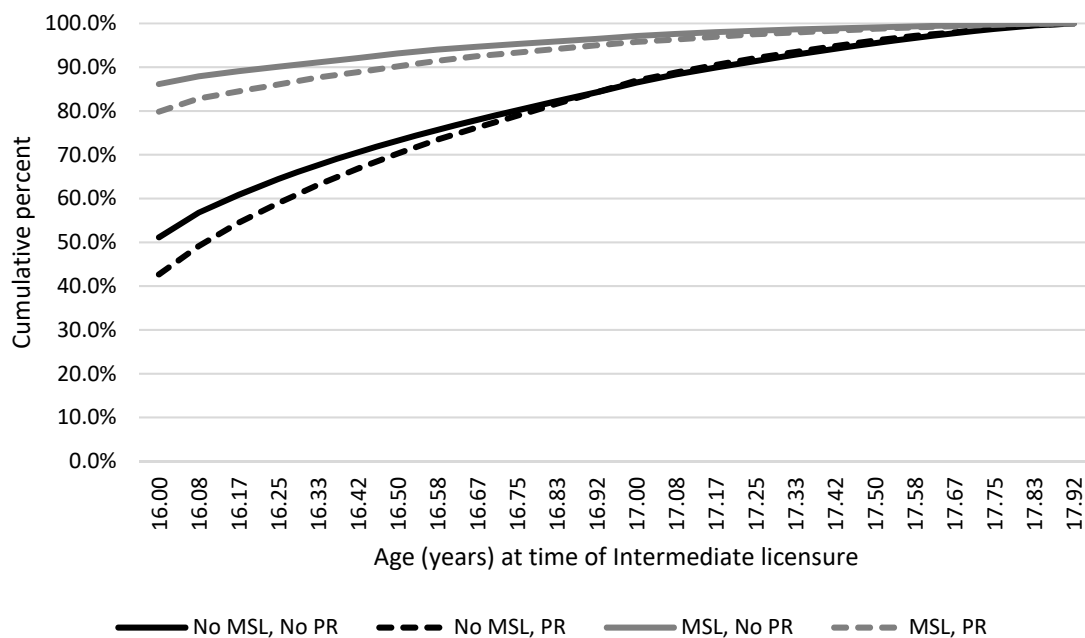


Figure 3. Cumulative percent of age at which young drivers were issued an intermediate license 2015-2017, by driver subgroup.

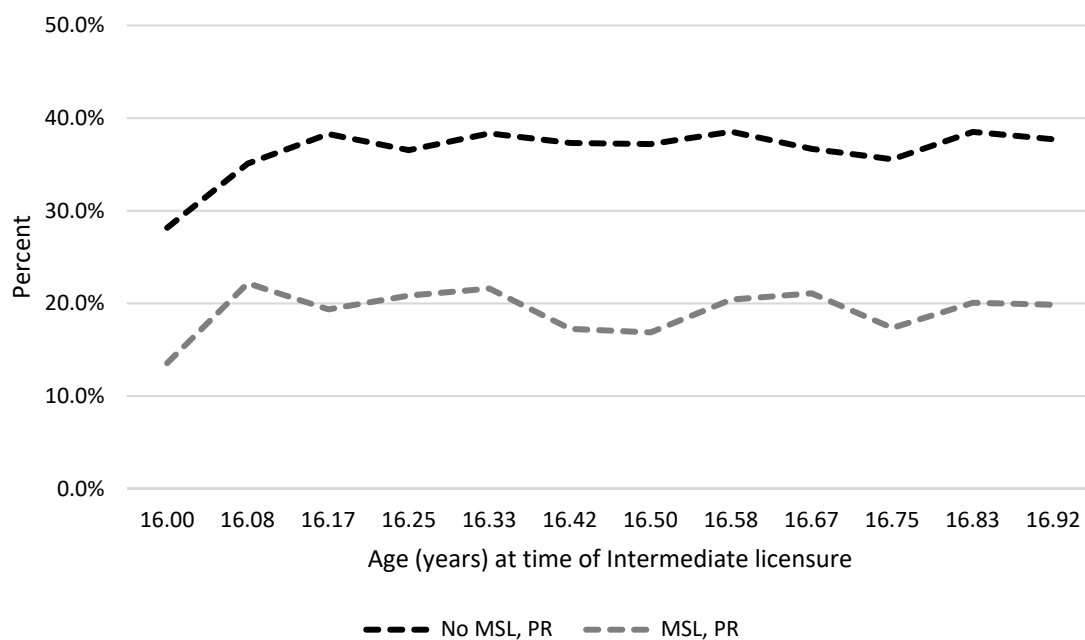


Figure 4. Proportion of drivers with a passenger restriction by minor school license status and age at intermediate licensure.

Duration of minor school license Within the MSL subgroups, the length of time the drivers held their minor school licenses was calculated and compared across passenger restriction status. Parents of intermediate drivers who previously held a MSL were slightly more likely to opt for the passenger restriction if their teen had held the MSL for a shorter period of time. The difference in the median duration of minor school licensure between those without and with the passenger restriction was about three months. Among young drivers who held the minor school license for 6 months or less, 20% had the passenger restriction compared to about 10% for those who held the MSL longer than 16 months.

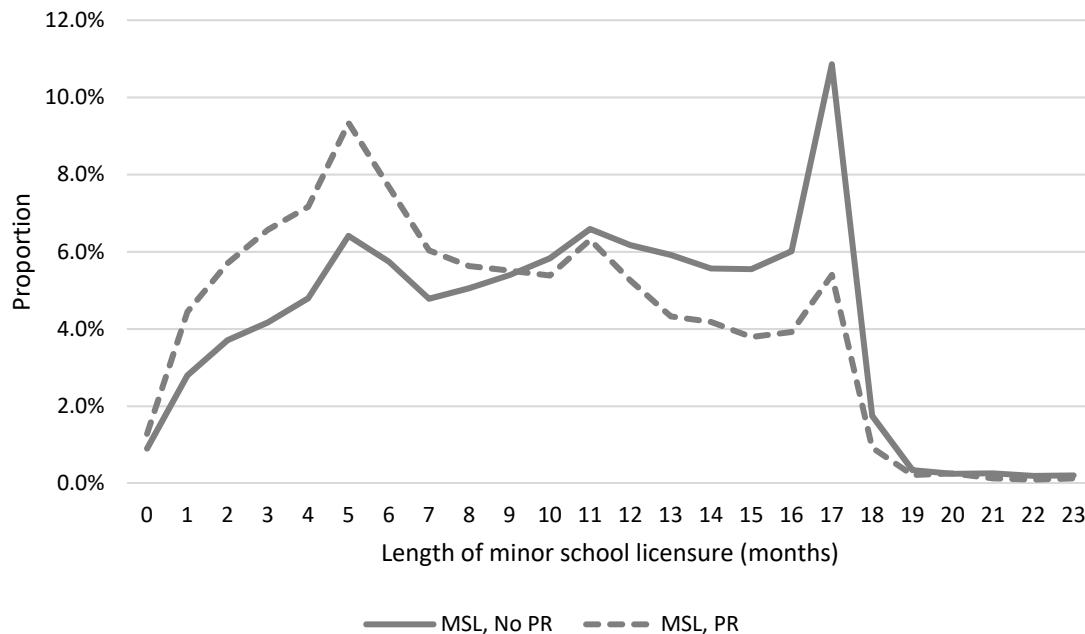


Figure 5. Length of minor school licensure for drivers with and without a passenger restriction (PR) on their intermediate driver's license.

Duration of instruction permit No clear pattern was observed for duration of instruction permit and passenger restriction among the No MSL drivers. Parents were least likely to opt for the passenger restriction when the teens had held their instruction permit for 23 months, with three out of four waiving the restriction. However, 87% of these teens were also licensed at age 16 yr 0 mo, so in all likelihood this observation is due to the effect of intermediate license age discussed above.

Gender Male young drivers were slightly over represented in the PR subgroups, accounting for 54% of the MSL-PR subgroup and 52% of the No MSL-PR subgroup.

Prior crash or conviction Finally, the young drivers' records were examined to see if being involved in a crash or having a driving-related conviction on their record prior to obtaining an intermediate license seemed to be a factor when parents were deciding whether to opt for or waive the passenger restriction. About 5% of the drivers obtaining their intermediate license for the first time had a previous

conviction or crash. Among these drivers, only 15% had the passenger restriction on their intermediate license, compared to 23% of the young drivers with no record of convictions or accidents.

Discussion

This project aimed to calculate crash rates during the first year of driving for young drivers holding intermediate licenses and to compare the rates for drivers with and without a passenger restriction that limited the number of unrelated minor passengers in the vehicle during the first six months of licensure. About 23% of parents opted for a passenger restriction for their intermediate driver. This was considerably more parents than the 10% previously reported (Lucey, 2015).

The crash rates for young drivers who did not previously have minor school licenses were similar regardless of passenger restriction status. However, the rates for these drivers with the passenger restriction did not decrease over the first six months, whereas a decrease was observed between the first month and the first six months for all the other subgroups. Among intermediate drivers who previously held a minor school license, those whose parents did not opt for the restriction had markedly lower crash rates—approximately 2.5 crashes per thousand driver-months during the first six months of driving—compared to all the other driver subgroups. The MSL drivers with the passenger restriction had the highest crash rates of any subgroup in the first month of driving, but after three months of driving their rate was lower than the rates for the No MSL intermediate drivers. The overall pattern for this subgroup's rates were similar to those for the No MSL groups. Within all driver subgroups, the crash rates in the second half-year of driving were 25-32% lower than in the first six months.

When considering the findings of this analysis, there is some evidence that parents of young drivers who previously held a minor school license may have recognized that their teens were at higher risk of crash when deciding to opt for a passenger restriction. However, the same pattern was not seen for parents of young drivers who did not have a minor school license. In addition, parents of young drivers who were involved in a crash or were convicted for a traffic offense before obtaining their intermediate license, a situation that would seem to indicate increased crash risk in the future, were actually more likely to waive the passenger restriction.

Another potential explanation is that parents considered the amount of time their young drivers had to gain driving experience when deciding whether to opt for or waive the passenger restriction. Within the minor school license group, the subgroup with the passenger restriction tended to have their school license for about three months less than the MSL drivers without the restriction, and the longer the MSLs were held, the more likely the parents were to waive it. However, for the drivers without minor school licenses, there was no clear relationship of duration of instruction permit and likelihood of opting for the passenger waiver.

The evidence seems more supportive of the theory that parents who authorize their teen to drive early, either with a minor school license or by obtaining their intermediate license at the earliest possible age, are more likely to waive the passenger restriction. Young drivers who did not have a minor school license previously were twice as likely to have a passenger restriction on their intermediate license. Within the MSL drivers, only 7% of those who obtained their MSL at age 14 yr 6 mo had the restriction on their intermediate license compared to about 20% of those who obtained their MSL at age 15 yr 6

mo or older. Regardless of minor school license status, parents were less likely to opt for the passenger restriction when their teen was obtaining their license at the age of 16.0.

The limited scope of this analysis is important to note. It is impossible to determine whether or not the passenger restriction has a safety benefit because what the crash rates would have been without the implementation of the parent-optional passenger restriction is unknowable. It is conceivable that the crash rates would have been higher without the passenger restriction in place, or that parents tended to opt for the passenger restriction for drivers at increased risk of a crash. The optional nature of the policy also makes it useless to compare the crash rates before and after the implementation. In addition, the simultaneous introduction of another policy that required young drivers to hold an instruction permit for 12 months (previously 6 months) also hinders a pre/post analytical approach.

Quantifying the crash rates is just one piece of the puzzle. Understanding parents' reasoning at the time of licensure is critical. The only way to ascertain what information, objectives, traits of the teen driver, family needs, and aspects of the parent-teen relationship are being considered when parents decide whether to opt for or waive the restriction is to ask them. It is also possible that some parents decide to restrict the number of passengers their teen driver can carry without opting for the official restriction on the license.

This study also could not assess compliance with the passenger restriction. First of all, it cannot be assumed that the vehicle occupancy observed during crashes is representative of normal driving. Second, information about the young drivers' passengers was not recorded for 84% of the crashes. Finally, even when passenger data was available, it cannot discriminate between related and unrelated minor passengers.

In conclusion, even though the passenger restriction was associated with higher rather than lower crash rates among drivers who previously held a minor school license, the limitations associated with studying an optional policy do not permit us to draw conclusions about the policy's impact on the safety of young drivers and their passengers. Before any change in policy is suggested, steps should be taken to learn what factors parents consider when making their decision about the passenger restriction. The vast majority of parents waived the passenger restriction and some of the findings of this analysis suggest that parents who supported early driving for their teen drivers were less likely to opt for the passenger restriction.

References

- Advocates for Highway and Auto Safety (2016). 2016 Roadmap of state and highway safety laws. <http://saferoads.org/wp-content/uploads/2016/01/2016-Roadmap-Report-FINAL.pdf> (accessed 7/1/2016).
- Aldridge, B., Himmler, M., Aultman-Hall, L., & Stamatiadis, N. (1999). Impact of passengers on young driver safety. *Transportation Research Record: Journal of the Transportation Research Board*, (1693), 25-30.
- Allstate Foundation (2015). Driving Change: Our journey to safer teen driving. <https://www.allstate.com/resources/allstate/attachments/pdf/2015-chronic-quant-summary.pdf> (accessed 7/1/2016).
- Baxter, J. S., Manstead, A. S., Stradling, S. G., Campbell, K. A., Reason, J. T., & Parker, D. (1990). Social facilitation and driver behaviour. *British Journal of Psychology*, 81(3), 351-360.
- Carney, C., McGehee, D.V., Harland, K. Weiss, M. & Raby, M. (2015). Using Naturalistic Driving Data to Assess the Prevalence of Environmental Factors and Driver Behaviors in Teen Driver Crashes. AAA Foundation for Traffic Safety, Washington, DC.
- Chen, L. H., Baker, S. P., Braver, E. R., & Li, G. (2000). Carrying passengers as a risk factor for crashes fatal to 16-and 17-year-old drivers. *JAMA*, 283(12), 1578-1582.
- Curry, A. E., Mirman, J. H., Kallan, M. J., Winston, F. K., & Durbin, D. R. (2012). Peer passengers: how do they affect teen crashes?. *Journal of Adolescent Health*, 50(6), 588-594.
- Doherty, S. T., Andrey, J. C., & MacGregor, C. (1998). The situational risks of young drivers: The influence of passengers, time of day and day of week on accident rates. *Accident Analysis & Prevention*, 30(1), 45-52.
- Heck, K. E., & Carlos, R. M. (2008). Passenger distractions among adolescent drivers. *Journal of safety research*, 39(4), 437-443.
- Insurance Institute for Highway Safety. (2017). Teenagers: Graduated driver licensing requirements by state. <http://www.iihs.org/iihs/topics/laws/graduatedlicenseintro?topicName=teenagers>
- Lucey, Catherine. Majority of Iowa parents waive teen driving restriction. *Des Moines Register*. March 15, 2015. Available: <https://www.desmoinesregister.com/story/news/politics/2015/03/15/parents-waive-teen-driving-restriction/24814733/>
- Masten, S. V., Thomas, F. D., Korbela, K. T., Peck, R. C., & Blomberg, R. D. (2015, November). Meta-analysis of graduated driver licensing laws. (Report No. DOT HS 812 211). Washington, DC: National Highway Traffic Safety Administration.
- McCartt, A. T., Teoh, E. R., Fields, M., Braitman, K. A., & Hellinga, L. A. (2010). Graduated licensing laws and fatal crashes of teenage drivers: a national study. *Traffic Injury Prevention*, 11(3), 240-248.
- National Highway Traffic Safety Administration. (2006). Teen Unsafe Driving Behaviors: Focus Group, Traffic Safety Facts- Traffic Tech.

<http://www.adtsea.org/Resources%20PDF's/NHTSA%20Teen%20Unsafe%20Driving%20Behaviors%20Focus%20Group%20Final%20Report.pdf> (accessed 7/1/2016).

Ouimet, M. C., Pradhan, A. K., Brooks-Russell, A., Ehsani, J. P., Berbiche, D., & Simons-Morton, B. G. (2015). Young Drivers and Their Passengers: A Systematic Review of Epidemiological Studies on Crash Risk. *Journal of Adolescent Health, 57*, S24-S35.

Padlo, P., Aultman-Hall, L., & Stamatiadis, N. (2005). Passengers and other factors affecting the safety of young and older drivers. *Transportation Research Record: Journal of the Transportation Research Board, (1937)*, 7-13.

Regan, M. A., & Mitsopoulos, E. (2001). Understanding passenger influences on driver behaviour: Implications for road safety and recommendations for countermeasure development (No. 180).

Simons-Morton, B., Lerner, N., & Singer, J. (2005). The observed effects of teenage passengers on the risky driving behavior of teenage drivers. *Accident Analysis & Prevention, 37*(6), 973-982.

Williams, A. F., Ferguson, S. A., & McCartt, A. T. (2007). Passenger effects on teenage driving and opportunities for reducing the risks of such travel. *Journal of Safety Research, 38*(4), 381-390.

Williams, A. F., Ferguson, S. A., & Wells, J. K. (2005). Sixteen-year-old drivers in fatal crashes, United States, 2003. *Traffic Injury Prevention, 6*(3), 202-206.