HLDI
Highway Loss Data Institute

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Evaluation of changes in teenage driver exposure — an update

In 2013, the Highway Loss Data Institute (HLDI) evaluated changes in teenage driver exposure for calendar years 2006–12 (HLDI, 2013). The analysis indicated that by 2012, national teen and prime-age (35-54) driver exposure had declined compared with 2006 levels, with teenage driver exposure declining more than prime-age driver exposure. This was consistent with media reports and studies indicating that the number of teens getting licensed had declined. The cause of this decline, however, was unclear. Some felt this was due to a shift in culture, with teenagers prioritizing social media ahead of driving. Others believed that economic factors played a more important role.

Using the ratio of teen exposure to prime-age exposure as the primary metric, a state level analysis was performed investigating the relationship of the teen-to-prime-age exposure ratio with changes in graduated driver licensing laws, census population estimates, and unemployment rates. The study found that a state's teen-to-prime-age exposure ratio was highly correlated with intermediate driver licensing age requirements, the ratio of teen and prime-age census population estimates, and the spread between teen and prime-age unemployment rates. Changes in the unemployment spread were found to be associated with 79 percent of the overall decline in the teen-to-prime-age exposure ratio. This would indicate that economic factors have contributed to the decline in the level of insured teens.

This analysis updates the previous study to include calendar years 2013 and 2014. Nationally, teen exposure increased in both years while prime-age exposure continued to decline slightly, resulting in an increase of 6 percent to the teen-to-prime-age exposure ratio between 2012 and 2014. At the same time, the unemployment rate for both teenagers and prime-age adults declined, with the teen unemployment rate declining faster than that of prime-age adults. Consequently, as the unemployment rate spread between teen and prime-age drivers declined, the teen-to-prime-age exposure ratio rose. Changes in the unemployment spread were estimated to be associated with 67 percent of the overall increase in the teen-to-prime-age exposure ratio between 2012 and 2014. This is consistent with the hypothesis of the prior study that economic factors played an important role in the decline in teen exposure and indicates that teens' exposure will increase as their economic situation improves.

Introduction

Motor vehicle crashes are the leading cause of death for U.S. teens, with studies showing that teenage drivers have among the highest crash and insurance claim rates of any age group in the United States (Highway Loss Data Institute (HLDI), 2014; National Center for Injury Prevention and Control, 2013; Tefft, 2012). While graduated driver licensing (GDL) laws have been effective at reducing the number of teens involved in motor vehicle crashes (Baker et al. 2007; HLDI, 2009), how much teens are driving remains an area of importance for highway safety.

In recent years, a number of studies have shown that the number of teens getting licensed has been on the decline. Studies by Sivak and Schoettle (2011, 2012a) found that in 2010, only 28 percent of 16 year-olds had a driver's license, down from 31 percent in 2008 and 46 percent in 1983. Licensed 17 year-olds were down to 46 percent in 2010 from 50 percent in 2008 and 69 percent in 1983. Another study by Davis et al. (2012) obtained similar results that young people are driving fewer miles and fewer are getting licensed. Shults and Williams (2013) found that licensure rates for teenagers had declined and that fewer high school seniors were routinely driving. They found that much of the decline had occurred after 2006. A study by HLDI (2013) confirmed these results, finding that the level of insured teens had declined by 12 percent between 2006 and 2012 compared with only 4 percent for prime-age drivers (35-54).

The cause of this decline has been the subject of much debate. Some media reports have suggested that the rise of social media, smartphones, and the internet was the primary reason for the decline (Gorzelany, 2012). They claim that teens are less interested in driving, instead turning to Facebook or Twitter to interact with friends. Research by Sivak and Schoettle (2012b) found that a higher proportion of internet users were associated with a lower licensure rate in a regression analysis on young drivers in 15 countries.

However, in a later survey by Schoettle and Sivak (2013), only 3 percent of 18-19 year-olds chose "Able to communicate and/or conduct business online instead" as their main reason for not currently having a driver's license. The authors speculated that high internet usage may be a consequence, instead of a cause, of not having a driver's license and being readily able to drive. The top primary reason was "Too busy or not enough time to get a driver's license," with 38 percent of 18-19 year-olds choosing this response. Second on the list was "Owning and maintaining a vehicle is too expensive," chosen by 17 percent of respondents as the primary reason. Similar surveys done by the Allstate Foundation (Williams, 2011) and the AAA Foundation for Traffic Safety (Tefft et al., 2013) found that teens wait to get licensed primarily for practical or economic reasons.

Using the ratio of teen insurance exposure to prime-age insurance exposure as the primary metric, HLDI (2013) performed a state level analysis investigating the teen-to-prime-age exposure ratio's relationship with changes in GDL laws, census population estimates, and unemployment rates. The study found that a state's teen-to-prime-age exposure ratio was highly correlated with intermediate driver licensing age requirements, the ratio of teen and prime-age census population estimates, and the spread between teen and prime-age unemployment rates. Changes in the unemployment spread were found to be associated with 79 percent of the overall decline in the teen-to-prime-age exposure ratio. This supported the hypothesis that economic factors may have contributed to the decline in the level of insured or licensed teens.

More recently, Curry et al. (2015) found that licensing rates in New Jersey varied highly based on sociodemographic strata, providing further evidence that teens may be delaying licensure for economic reasons. Approximately 78 percent of residents living in New Jersey's highest income zip codes were licensed within 6 months of turning 17. Conversely, only 19 percent of residents in the lowest income areas were licensed by this time.

The purpose of this analysis is to update the prior HLDI study with data from 2013 and 2014 and evaluate whether the trend in teen exposure has changed in recent years and if the relationship between teen exposure and unemployment rates continues.

Methods

External data

Population counts by age and state for the years 2006-14 were obtained from the U.S. Census Bureau. Data for years 2006-09 and 2010-14 were projections based on the 2000 and 2010 censuses, respectively.

National and state unemployment data for ages 16-19, 35-44, and 45-54 were obtained from the U.S. Bureau of Labor Statistics. Unemployment data for people younger than 16 were unavailable. The unemployment rate for the 35-54 age group was calculated by combining the data for the 35-44 and 45-54 age groups and dividing the total number of unemployed by the combined civilian labor force.

Insurance data

Insurance covers damage to vehicles and property as well as injuries to people involved in crashes. Different insurance coverages pay for physical damage versus injuries. Also, different coverages may apply depending on who is at fault. In the present study, collision coverage was examined. Collision coverage insures against vehicle damage to an at-fault driver's vehicle sustained in a crash with an object or other vehicle; this coverage is common to all 50 states. This analysis was based on collision exposure for the 10 most recent model year passenger vehicles during calendar years 2006-14. Exposure is the amount of time an individual vehicle is insured. Forty-nine states and the District of Columbia were included. Massachusetts was excluded due to incomplete data. The combination of 50 jurisdictions and nine calendar years produced 450 observations. Calendar year 2006 was chosen as the start date for this study as it was the first year with sufficient data on rated driver ages. Only data from insurers that consistently reported rated driver ages for all of 2006-14 were included.

Rated drivers

Two rated driver age groups were used for this study: teenagers (14-19) and prime-age drivers (35-54). The rated driver is the one who typically is considered to represent the greatest loss potential for the insured vehicle. In a household with multiple vehicles and/or drivers, the assignment of drivers to vehicles can vary by insurance company and by state. Because only the year of birth is provided to HLDI, the exact age of the rated driver is unknown. A January 1 birth date was assumed, resulting in a 2 year range in the actual age for a given rated driver age. For example, the assigned age of 16 in this study can range from an actual age of 15 and 1 day to 16 and 364 days.

State GDL Laws

GDL laws are designed to delay full licensing while allowing beginning drivers to gain experience under lower risk conditions. Based on the results of the prior analysis, only the intermediate licensing age is examined in this study. There were no changes to intermediate licensing ages in 2013 or 2014. In some states, GDL requirements are relaxed or restrictions are lifted sooner for teenagers who have completed driver education. As with the prior HLDI report, in these states the GDL provisions applicable to those who completed driver education were coded. No distinction was made between GDL laws with primary enforcement and those with secondary enforcement.

A GDL law was assigned to a state-year if the law went into effect before October 1 of that year. Laws going into effect October 1 or later were assigned to the following year. A fourth quarter cutoff was used because laws going into effect late in the year would have little or no effect on that calendar year's results.

Analytical Methods

The primary metric used to evaluate changes in teen exposure was the ratio of teen exposure to prime-age exposure. The ratio was scaled by a factor of 100 in order to improve the readability of results. A ratio was chosen because it provided a control for changes in teen exposure due to other trends or laws not included in the analysis. Ages 35-54 were selected as the control because this range provided a large stable group that was sufficiently separated from youthful and senior rated drivers.

In order to assess the effect of the recession and the economy on the teen-to-prime-age exposure ratio, the difference between teen and prime-age unemployment rates was used. The unemployment rate is defined as the percentage of the total labor force that is unemployed but actively seeking employment and willing to work. As population levels are already controlled for, the spread between unemployment rates provides a measure of the excess percentage of teens, compared with the prime-age group, actively seeking but unable to find employment.

Linear regression was used to model the effects of GDL and the unemployment spread on the teen-to-prime-age exposure ratio. The ratio of the teen-to-prime-age census population estimates was used as a control for changes in the population distribution. All regression analysis was conducted at the state level. A traditional linear model assumes that all observations have uncorrelated errors. However, due to the repeated observations for each state, one for each year, significant correlation exists. In addition, there is large variation in the teen-to-prime-age exposure ratio between states. For example, in 2006 the District of Columbia had a ratio as low as 1.27, whereas Ohio had ratios as high as 5.62. There are many potential reasons for this variation including state laws not included in the analysis, availability of public transportation, population density, and incomplete data. For example, teens in the densely populated District of Columbia, which has an extensive rail and bus system, may be less likely to be insured than teens living in more rural states.

In order to address the correlation and variation among states, a linear mixed-effects model was used. A mixed-effects model incorporates random effects that can be thought of as unmeasured covariates. Inclusion of random effects at the state level in the model will account for correlated observations. Under this model, state is included as a random effect and it is assumed that each state has its own state-specific mean response. The overall mean response of the teen-to-prime-age exposure ratio is then modeled as a combination of characteristics that are assumed to be shared by all states (i.e., the effects of the unemployment rate spread, GDL laws, and census population ratio) and state-specific effects that are unique to that state. The former are referred to as fixed effects, while the latter are referred to as random effects. The term mixed is used to denote that the model contains both fixed and random effects.

Results

Figure 1 shows the national teen and prime-age exposures and the teen-to-prime-age exposure ratio (scaled by 100) from 2006 through 2014. Figure 2 shows the national teen and prime-age exposures indexed to 2006. Prime exposure was much higher than teen exposure, averaging approximately 24 million insured vehicle years during the period, compared with 972,000 insured vehicle years for teenagers. In 2008, prime exposure peaked, reaching 25,675,000 insured vehicle years, a 5 percent increase over 2006 values. Teen exposure peaked in 2007, reaching 1,046,000 insured vehicle years, or 3 percent higher than 2006 values. By 2012, prime exposure had fallen to 96 percent of its 2006 level, whereas teen exposure had decreased to 88 percent. In 2013 and 2014, prime exposure continued to decline to 93 percent of 2006 values. Teen exposure, however, increased in 2013 and 2014, climbing back to 91 percent of 2006 values. The teen-to-prime-age exposure ratio shows that from 2006 to 2010, the exposure of teens compared with prime-age drivers decreased from 4.2 to 3.8. Between 2010 and 2012, the ratio remained relatively constant before increasing back to 4.1 in 2014.

Figure 1: Comparison of national teen and prime-age exposures

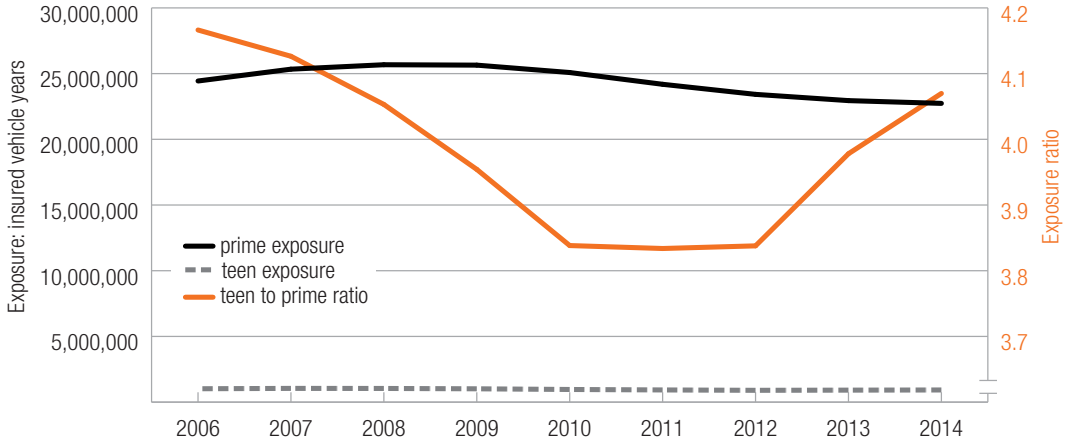

Figure 2: Comparison of national teen and prime-age exposures indexed to 2006

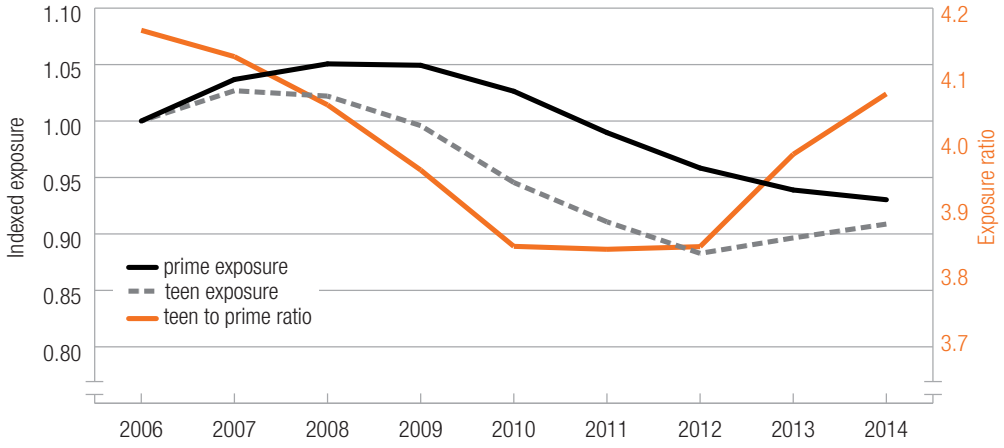

Figure 3 compares the national teen-to-prime-age exposure ratio with the teen-to-prime-age census population ratio. Both ratios have been scaled by 100 to improve readability. The national census population ratio remained fairly constant, decreasing from 30.2 to 30.1 between 2006 and 2012 before returning to 30.2 in 2014. Compared with the exposure ratio, the census population ratio was more than 7 times larger. This indicates that, relative to the prime-age group, the level of teens in the overall population is much higher than that of insured teens.

Figure 3: National teen-to-prime-age exposure and census population ratios

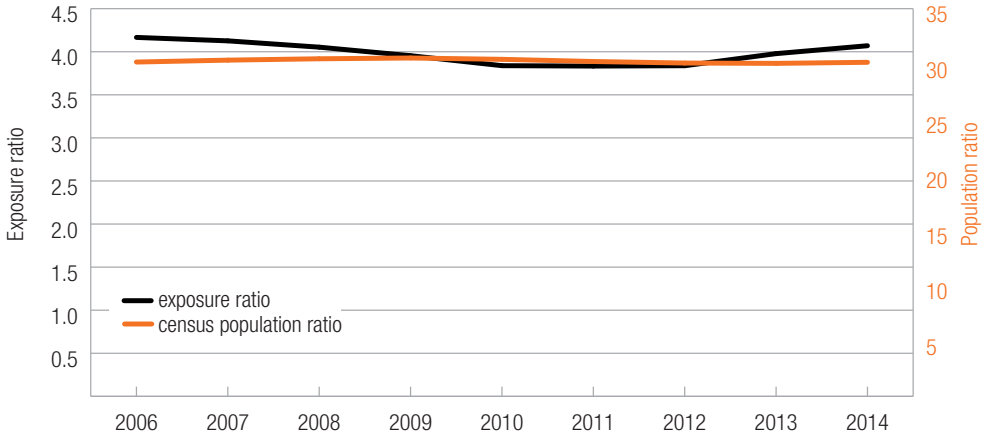

Figure 4 shows the national unemployment rates for the teen and prime-age groups, as well as the spread between them. The teen unemployment rate is much higher than the prime-age unemployment rate, reaching a maximum difference in the unemployment spread of 18 percent in 2010. In addition, while both age groups experienced increased unemployment between 2006 and 2010, teen unemployment rose more, as indicated by the unemployment spread. From 2006 to 2010, the teen unemployment rate rose from 15 to 26 percent, an increase of 11 percentage points, while the prime-age unemployment rate rose from 3 to 8 percent, an increase of 5 percentage points. From 2010 to 2014, unemployment rates for both teen and prime-age groups declined.

Figure 4: National teen vs. prime-age unemployment rates

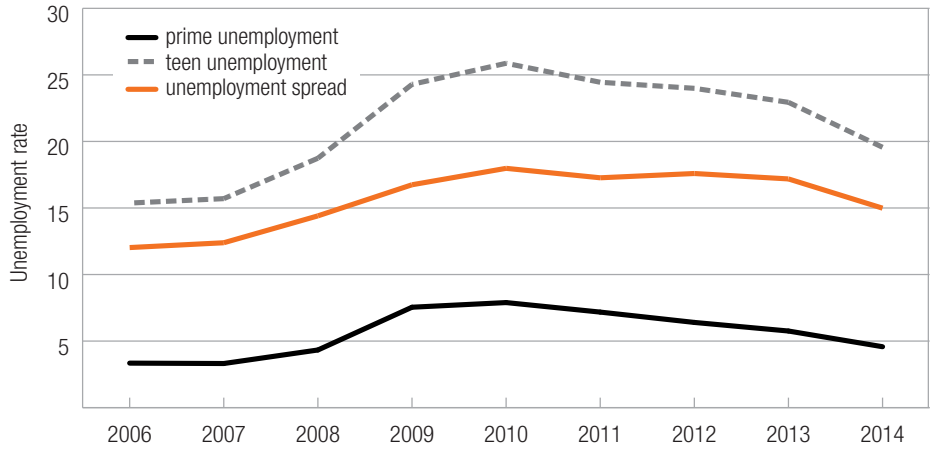

Figure 5 highlights the inverted relationship between the national teen-to-prime-age exposure ratio and the national unemployment spread. Note that the vertical axes on this figure have been truncated. From 2006 to 2010, as the unemployment spread increases, a higher percentage of teens compared with prime-age are unable to find employment. At the same time, fewer teenage drivers are being insured relative to prime-age drivers, and the teen-to-prime-age exposure ratio decreases. In 2011, the unemployment spread declines slightly before rising slightly in 2012, while the teen-to-prime-age exposure ratio remains relatively constant. In 2013 and 2014, the unemployment spread decreases while the teen-to-prime-age exposure ratio increases.

Figure 5: National teen-to-prime-age exposure ratio and unemployment spread

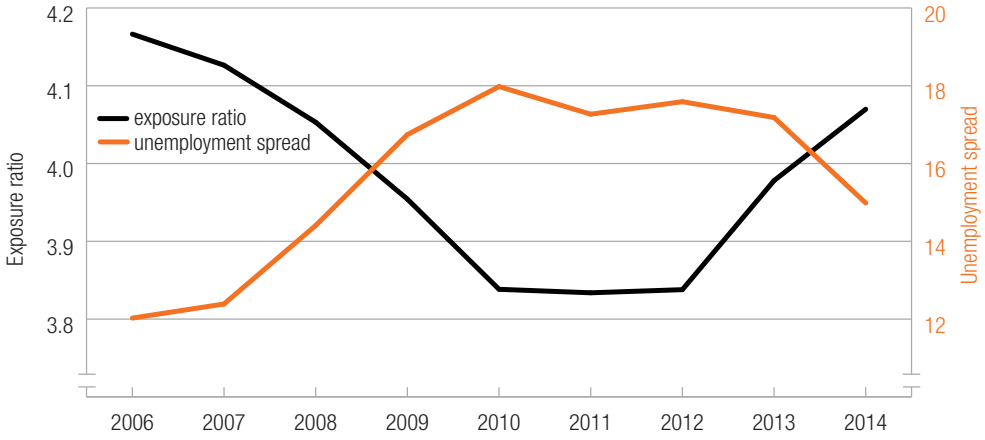

Table 1 summarizes the results of the mixed model regression where state is treated as a random effect, with unemployment spread, intermediate licensing age, and the census population ratio included as covariates. The results are consistent with the results of the prior study. The estimates for the unemployment spread and census population ratio are statistically significant at the 95 percent confidence level, with the intermediate licensing age being significant at the 90 percent confidence level. The model estimates that a 1 point increase in the unemployment spread (i.e., from 10 to 11 percent) will, on average, result in a 0.019 decline in the teen-to-prime-age exposure ratio. At the state level, the unemployment spread increased as much as 13.3 points between 2006 and 2012. According to the model, this would result in a decrease to the mean teen-to-prime-age exposure ratio in that state of 0.23. The effect of the census population ratio was positive; as the overall teen population increases relative to the prime-age population, the number of insured teen drivers relative to prime-age drivers increases as well. The effect of the intermediate licensing age was negative; an increase in a state's intermediate licensing age would result in fewer teens able to be licensed and therefore insured, resulting in a lower teen-to-prime-age exposure ratio.

Table 1: Summary of mixed model regression results

Parameter	Estimate	Standard error	P-Value
Intercept	6.5833	2.9539	0.0306
Unemployment spread	-0.0190	0.0044	<0.0001
Census population ratio	0.0845	0.0303	0.0056
Intermediate age	-0.3012	0.1664	0.0711

For each factor, the change in the teen-to-prime-age exposure ratio from 2012 to 2014 was predicted while holding all other factors constant at their 2012 levels. The overall changes predicted for each factor were then combined. Using this method, 77 percent of the increase predicted by the model between 2012 and 2014 was associated with changes in the unemployment spread with the remaining 23 percent associated with changes in the census population ratio. Intermediate licensing ages did not change between 2012 and 2014. Based on the conditional R^2 (Nakagawa and Schielzeth, 2013), the model accounts for 87 percent of the variance in the teen-to-prime-age exposure ratio. Thus approximately 67 percent (77 percent times 87 percent) of the overall decline in the teen-to-prime-age exposure ratio is estimated to be associated with changes in the unemployment spread.

Discussion

The level of insured teens increased in 2013 and 2014. Coinciding with this increase, unemployment rates declined, with teen unemployment declining more than prime-age unemployment. This inverse relationship between the teen-to-prime-age exposure ratio and the unemployment spread is consistent with the prior analysis and the hypothesis that economic factors play an important role in the level of insured teens. As teens find employment, driving may be necessary to provide transportation to and from their jobs. In addition, the income from working helps make driving-related expenses such as gas, maintenance, and insurance more affordable. With prime-age unemployment also declining, parents may be also be more willing or able to help subsidize the cost of a car and driving expenses for their teenagers.

If this trend of rising teen exposure continues, this could have a significant impact on highway safety. Although graduated driver licensing laws have helped mitigate teen crash risk, teen drivers continue to be a higher crash risk than the adult driving population (Thor and Gabler, 2010). If an increase in teen exposure translates into more teens on the road, this could result in more teen crashes and fatalities.

References

Baker, S.P.; Chen, L.; and Li, G. 2007. Nationwide review of graduated driver licensing. Washington, DC: AAA Foundation for Traffic Safety.

National Center for Injury Prevention and Control. 2013. Web-based Injury Statistics Query and Reporting System (WISQARS) [Online]. Atlanta, GA: Centers for Disease Control and Prevention (producer).

Curry, A.E.; Pfeiffer, M.R.; Durbin, D.R.; Elliott, M.R.; and Kim, K.H. 2015. Young driver licensing: examination of population-level rates using New Jersey's state licensing database. *Accident Analysis and Prevention* 76:49-56.

Davis, B.; Dutzik, T.; and Baxandall, P. 2012. Transportation and the new generation: Why young people are driving less and what it means for transportation policy. Santa Barbara, CA: Frontier Group.

Gorzelany, J. 2012. Social media trumps driving among today's teens. *Forbes*, January 23.

Highway Loss Data Institute. 2009. Graduated driver licensing laws and insurance collision claim frequencies of teenage drivers. *Insurance special report* A-79. Arlington, VA.

Highway Loss Data Institute. 2013. Evaluation of changes in teenage driver exposure. *Loss Bulletin* Vol. 30, No. 17. Arlington, VA.

Highway Loss Data Institute. 2014. Insurance losses by rated driver age and gender. *Loss Bulletin* Vol. 31, No. 6. Arlington, VA.

Nakagawa, S. and Schielzeth, H. 2013. A general and simple method for obtaining R^2 from generalized linear-mixed-effects models. *Methods in Ecology and Evolution* 4(2): 133-142.

Scholettle, B. and Sivak, M. 2013. The reasons for the recent decline in young driver licensing in the U.S. Report no. UMTRI-2013-22. Ann Arbor, MI: University of Michigan Transportation Research Institute.

Shults, R.A. and Williams, A.F. 2013. Trends in driver licensing status and driving among high school seniors in the United States, 1996-2010. *Journal of Safety Research* 46:167-70.

Sivak, M. and Schoettle, B. 2011. Recent changes in the age composition of U.S.drivers: Implications for the extent, safety, and environmental consequences of personal transportation. *Traffic Injury Prevention* 12:588-92.

Sivak, M. and Schoettle, B. 2012a. Update: Percentage of young persons with a driver's license continues to drop. *Traffic Injury Prevention* 13:341.

Sivak, M. and Schoettle, B. 2012b. Recent changes in the age composition of drivers in 15 countries. *Traffic Injury Prevention* 13:126-32.

Tefft, B.C. 2012. Motor vehicle crashes, injuries, and deaths in relation to driver age: United States, 1995-2010. Washington, DC: AAA Foundation for Traffic Safety.

Tefft, B.C.; Williams, A.F.; and Grabowski, J.G. 2013. Timing of driver's license acquisition and reasons for delay among young people in the United States. Washington, DC: AAA Foundation for Traffic Safety.

Thor, C.P. and Gabler H.C. 2010. Assessing the residual teen crash risk factors after graduated drivers license implementation. *Annals of Advances in Automotive Medicine*. 54:295-308.

Williams, A.F. 2011. Teenagers' licensing decisions and their views of licensing policies: a national survey. T*raffic Injury Prevention* 12:312-19.

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