# Characteristics of vehicles driven by teens and adults killed in crashes, 2013–2017

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## CONTENTS

## ABSTRACT

*Introduction:* Teen drivers experience higher crash risk than their experienced adult counterparts. Legislative and community outreach methods have attempted to reduce this risk; results have been mixed. The increasing presence of vehicle safety features across the fleet has driven fatality numbers down in the past decades, but the disparity between young drivers and others remains.

*Method:* We merged Fatality Analysis Reporting System (FARS) data on fatal crashes with vehicle characteristic data from the Highway Loss Data Institute (HLDI). The analysis compared the vehicle type, size, age, and the presence of select safety features in vehicles driven by teens (ages 15–17 years) and adult drivers (ages 35–50 years) who were killed in crashes from 2013 to 2017. Results were compared with a similar analysis conducted on data from 2007 to 2012.

*Results:* Teen drivers were more likely than their adult counterparts to be killed while driving older, smaller vehicles that were less likely to have the option to be equipped with side airbags.

*Discussion:* Teenage drivers remain more likely to be killed while driving older, smaller vehicles than adult drivers. Parents and guardians are mainly responsible for teen vehicle choice, and should keep vehicle size, weight, and safety features in mind when placing their teen in a vehicle.



**Keywords:** Vehicle characteristics, fatality statistics, teen drivers

## INTRODUCTION

Despite driving less than almost every other age group, teen drivers are associated with a fatal crash rate per miles driven that is about 3 times that for drivers ages 20 years old and older (Insurance Institute for Highway Safety, 2019). Legislative efforts targeted at new teen drivers have corresponded with a drop in teen crashes and deaths over the past 20 years, as have improvements in vehicle design and safety (McCartt, Teoh, Fields, Braitman, & Hellinga, 2010; Farmer & Lund, 2015). However, past research has found that vehicles driven by fatally injured teens were older and smaller compared with those driven by fatally injured adults (McCartt & Teoh, 2015). Thus, although innovations in design and technology have resulted in increasingly safer motor vehicles year after year, teen drivers lag behind adult drivers in their adoption of these technologies.

Vehicle safety technologies that were once new are now standard or at least very common among the fleet on the road today. Frontal airbags became standard on new passenger vehicles by 1999, electronic stability control (ESC) became standard on all passenger vehicles and light trucks beginning with 2012 models, rearview cameras became standard on all new U.S. vehicles in May 2018, and side airbags continue to be offered as standard equipment on more new models, although they are not required to be so. One analysis estimates that most or all reductions in crash fatalities from the mid-90s through about 2007 were due to the increased safety of the vehicles on roadways (Farmer & Lund, 2015). Continuing design advances also reduce vehicle incompatibility, or the energy mismanagement that occurs during a crash that results in an uneven distribution of injury risk. Although incompatibility remains high between vehicles of very different weights, reductions in incompatibility between vehicles of the same class have contributed to reduced crash risk among newer vehicles (Monfort & Nolan, 2019). Advancements in safety technology notwithstanding, vehicle technology takes longer to reach the teen driver population. Parents tend to put their teens in smaller, older, and less expensive vehicles (Eichelberger, Teoh, & McCartt, 2015). Teens driving relatively older cars combined with their tendency to engage in riskier driving behaviors (Oviedo-Trespalacios & Scott-Parker, 2018) places them at a greater risk of collision and injury. The persistent disparity between teen and adult crash outcomes necessitates ongoing research on the various sources of risk for teen drivers. The current analysis was therefore conducted to update an analysis published in 2015 comparing the characteristics of the vehicles driven in fatal crashes by teen drivers with those driven by adult drivers (McCartt & Teoh, 2015). An up-to-date understanding of the vehicles driven by fatally injured teens can help guide efforts to improve vehicle safety for teenage drivers.

## METHOD

The current study analyzed Fatality Analysis Reporting System (FARS) data from 2008 through 2017 merged with vehicle information and features data from the Highway Loss Data Institute (HLDI). These data were used to examine vehicle characteristics—like the availability of front and side airbags, ESC, curb weight, and vehicle age—in vehicles driven by fatally injured drivers. We focused on the differences in vehicle characteristics for driver deaths in two age groups: 15 to 17- and 35 to 50-year-olds. The data were also split into two 5-year time periods to make an explicit comparison with the time period studied by McCartt & Teoh (2015), i.e., to determine if teen driver vehicle characteristics have changed over time. Rate ratios (relative proportion, computed as the percent of driver deaths in 2013–2017 / the percent of driver deaths in 2008–2012) were used to make comparisons across age groups and time periods. Confidence intervals for the rate ratios (RR) were computed using a normal distribution approximation given by the following:

$$95\%\ CI = e^{\ln(RR) \pm 1.96\sqrt{\frac{1}{a} - \frac{1}{a+b} + \frac{1}{c} - \frac{1}{c+d}}}$$

Where *a*, *b*, *c*, and *d* are the frequencies in a 2 by 2 contingency table (Morris & Gardner, 1988).

## RESULTS

### Vehicle type and size

The 2013–2017 crash data showed that the majority of teenage drivers killed in crashes were in a car (63%); the remainder were split between pickups (18%) and SUVs (17%), with a small number in minivans (2%). By comparison, fewer fatally injured adult drivers were in cars (50%), but the remainder were again split between pickups (23%) and SUVs (23%), with a small number in minivans (4%).

Fatally injured teenage drivers tended to drive smaller vehicles compared with their adult counterparts. In particular, teenage drivers were significantly more likely to be killed in a micro, mini, or small car (28% vs. 19%) or in a midsize car (25% vs. 20%) compared with adult drivers (Figure 1). Teen drivers were significantly less likely to have been killed in pickups and in SUVs. Consistent with these differences, the vehicles in which teenage drivers were killed were 250 pounds lighter on average than those in which adult drivers were killed (overall: 3,460 lbs. vs.  3,710 lbs.).

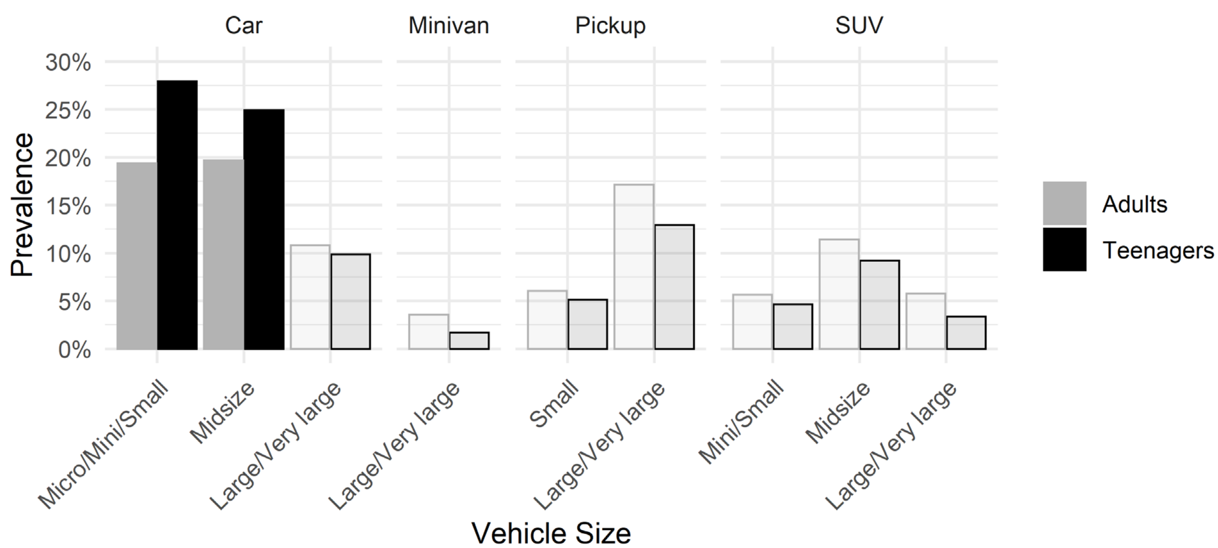


**Figure 1.** Comparison between fatally injured adult and teenage drivers in 2013–2017 by vehicle type and size; statistically significant differences between age groups are denoted by opaque bars.

The tendency for teenage drivers to be killed in smaller vehicles than adults is consistent with the effects observed in the 2008–2012 crash data (Table 1). In both 2008–2012 and 2013–2017, teenagers were more likely to have been killed in midsize or smaller cars, while adults were more likely to be killed in pickups and SUVs. The prevalence of teenage drivers killed in large or very large pickup trucks significantly increased in the latest dataset, however (10.4% to 12.9%), while the prevalence of adult drivers in these vehicles remained the same (17.0% to 17.2%).

**Table 1.** Distribution (percent) of the type and size of vehicles driven by fatally injured passenger vehicle drivers ages 15–17 and 35–50 years, comparison between 2008–2012 and 2013–2017.

| | Teenagers | | | | Adults | | | |
|---|---|---|---|---|---|---|---|---|
| Vehicle type and size | 2008–12 (N=2,394) | 2013–17 (N=1,911) | Rate ratio [95% CI] | | 2008–12 (N=18,273) | 2013–17 (N=17,253) | Rate ratio [95% CI] | |
| **Car** | **64.2** | **63.0** | **0.98 [0.94, 1.03]** | | **48.3** | **50.2** | **1.04 [1.02, 1.06]** | * |
| Micro/mini/small | 28.8 | 28.0 | 0.97 [0.88, 1.07] | | 20.2 | 19.4 | 0.96 [0.92, 1.00] | |
| Midsize | 23.6 | 24.9 | 1.06 [0.95, 1.17] | | 16.8 | 19.7 | 1.17 [1.12, 1.22] | * |
| Large/very large | 11.8 | 9.9 | 0.84 [0.70, 1.00] | * | 11.0 | 10.9 | 0.99 [0.93, 1.05] | |
| **Minivan** | **1.9** | **1.7** | **0.89 [0.57, 1.39]** | | **4.6** | **3.6** | **0.77 [0.70, 0.86]** | * |
| **Pickup** | **17.1** | **18.1** | **1.06 [0.93, 1.21]** | | **25.7** | **23.4** | **0.91 [0.88, 0.94]** | * |
| Small | 6.6 | 5.1 | 0.77 [0.60, 0.98] | * | 8.4 | 6.1 | 0.72 [0.67, 0.77] | * |
| Large/very large | 10.4 | 12.9 | 1.25 [1.06, 1.47] | * | 17.0 | 17.2 | 1.01 [0.96, 1.05] | |
| **SUV** | **16.8** | **17.2** | **1.02 [0.90, 1.21]** | | **21.5** | **22.9** | **1.07 [1.03, 1.11]** | * |
| Mini/Small | 4.7 | 4.6 | 0.99 [0.76, 1.30] | | 5.4 | 5.6 | 1.04 [0.96, 1.14] | |
| Midsize | 9.3 | 9.2 | 1.00 [0.83, 1.20] | | 11.2 | 11.5 | 1.02 [0.96, 1.08] | |
| Large/very large | 2.9 | 3.3 | 1.16 [0.83, 1.62] | | 4.8 | 5.8 | 1.20 [1.13, 1.27] | * |

*Note.* Percentages may not add up to the overall category value due to vehicles of unknown size; * = difference between study periods statistically significant at $\alpha=0.05$.

## Vehicle age and type

From 2013–2017, teenage drivers killed in a crash were significantly less likely to be driving a new vehicle (<3 years old) compared with adult drivers (3.7% vs. 8.6%). Conversely, fatally injured teenage drivers were significantly more likely to be driving an older vehicle (11–15 years old) compared with adult drivers (38.0% vs. 31.6%). The differences between other vehicle age groups were not statistically significant by driver age group (Figure 2), but these differences were consistent with teenagers driving older vehicles, on average, than adults.

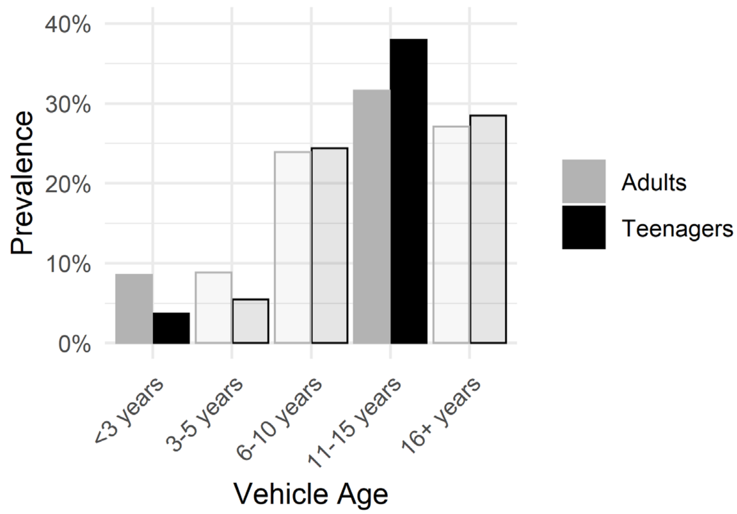


**Figure 2.** Comparison between fatally injured adult and teenage drivers in 2013–2017 by vehicle age; statistically significant differences between teenagers and adults are denoted by opaque bars.

The fact that fatally injured teenagers tended to drive older vehicles than fatally injured adults in 2013–2017 is broadly consistent with the trends observed in 2008–2012 (Table 2). However, the latest crash data show that all drivers (i.e., both teenagers and adults) have moved toward older vehicles—overall vehicle age increased from 10.4 years to 12.0 years between the two study periods. Compared with 2008–2012, significantly fewer teenagers and adults crashed in vehicles that were 3–5 years old and significantly more crashed in vehicles older than 5 years old. The only exception to this pattern occurred among new vehicles (<3 years old). The proportion of adults driving new vehicles in 2013–2017 was unchanged since 2008–2012 (8.3% to 8.6%).

In sum, teenagers remain disproportionately likely to be fatally injured in older vehicles. Although the average vehicle age increased for both driver age groups between 2008–2012 and 2013–2017, this increase was somewhat larger for teenage drivers.

**Table 2.** Distribution (percent) of age of vehicles driven by fatally injured passenger vehicle drivers ages 15–17 and 35–50 years, comparison between 2008–2012 and 2013–2017.

| | Teenagers | | | | Adults | | | |
|---|---|---|---|---|---|---|---|---|
| Vehicle age | 2008–12 (N=2,394) | 2013–17 (N=1,911) | Rate ratio [95% CI] | | 2008–12 (N=18,273) | 2013–17 (N=17,253) | Rate ratio [95% CI] | |
| <3 years | 6.1 | 3.7 | 0.60 [0.46, 0.80] | * | 8.3 | 8.6 | 1.03 [0.96, 1.10] | |
| 3–5 years | 12.1 | 5.5 | 0.45 [0.37, 0.56] | * | 14.2 | 8.8 | 0.62 [0.59, 0.66] | * |
| 6–10 years | 34.3 | 24.4 | 0.71 [0.65, 0.78] | * | 31.6 | 23.9 | 0.76 [0.73, 0.78] | * |
| 11–15 years | 30.8 | 38.0 | 1.23 [1.14, 1.34] | * | 26.8 | 31.6 | 1.18 [1.14, 1.22] | * |
| 16+ years | 16.7 | 28.5 | 1.70 [1.52, 1.91] | * | 19.1 | 27.1 | 1.42 [1.36, 1.47] | * |

*Note.* * = difference between study periods statistically significant at α=0.05.

Compared with fatally injured teenagers in 2008–2012, teenagers in 2013–2017 were less likely to drive cars, pickups, and SUVs that were under 11 years old and more likely to drive cars, pickups, and SUVs that were at least 11 years old (Table 3). Of these vehicles, the highest increase was observed for SUVs that were 16+ years old (an increase of 156%, compared with an increase of 62% for cars and 63% for pickups). A similar pattern was observed for adults.

**Table 3.** Distribution (percent) of the type and age of vehicles driven by fatally injured passenger vehicle drivers ages 15–17 and 35–50 years, comparison between 2008–2012 and 2013–2017.

| | Teenagers | | | | Adults | | | |
|---|---|---|---|---|---|---|---|---|
| Vehicle type/age | 2008–12 (N=2,394) | 2013–17 (N=1,911) | Rate ratio [95% CI] | | 2008–12 (N=18,273) | 2013–17 (N=17,253) | Rate ratio [95% CI] | |
| **Car** | | | | | | | | |
| <3 years | 4.8 | 2.7 | 0.56 [0.40, 0.77] | * | 4.9 | 5.4 | 1.11 [1.01, 1.21] | * |
| 3–5 years | 7.8 | 3.7 | 0.47 [0.36, 0.62] | * | 6.9 | 5.5 | 0.79 [0.72, 0.85] | * |
| 6–10 years | 21.3 | 17.2 | 0.81 [0.71, 0.91] | * | 13.7 | 12.6 | 0.92 [0.87, 0.97] | * |
| 11–15 years | 20.2 | 23.0 | 1.14 [1.02, 1.28] | * | 12.8 | 13.9 | 1.09 [1.03, 1.15] | * |
| 16+ years | 10.1 | 16.4 | 1.62 [1.39, 1.90] | * | 9.9 | 12.8 | 1.29 [1.21, 1.37] | * |
| **Minivan** | | | | | | | | |
| <3 years | 0.0 | 0.1 | 2.50 [0.23, 27.6] | | 0.2 | 0.1 | 0.88 [0.52, 1.50] | |
| 3–5 years | 0.1 | 0.2 | 1.25 [0.25, 6.19] | | 0.7 | 0.2 | 0.33 [0.23, 0.47] | * |
| 6–10 years | 0.8 | 0.5 | 0.69 [0.32, 1.50] | | 1.6 | 0.9 | 0.56 [0.46, 0.68] | * |
| 11–15 years | 0.6 | 0.7 | 1.08 [0.52, 2.27] | | 1.5 | 1.6 | 1.01 [0.86, 1.20] | |
| 16+ years | 0.3 | 0.2 | 0.63 [0.19, 2.07] | | 0.7 | 0.8 | 1.13 [0.88, 1.44] | |
| **Pickup** | | | | | | | | |
| <3 years | 0.8 | 0.1 | 0.14 [0.03, 0.60] | * | 1.9 | 1.4 | 0.74 [0.63, 0.87] | * |
| 3–5 years | 2.0 | 0.5 | 0.23 [0.12, 0.48] | * | 3.8 | 1.3 | 0.36 [0.31, 0.41] | * |
| 6–10 years | 5.4 | 3.6 | 0.67 [0.50, 0.89] | * | 7.8 | 5.4 | 0.39 [0.64, 0.75] | * |
| 11–15 years | 4.4 | 6.6 | 1.49 [1.16, 1.91] | * | 6.2 | 7.2 | 1.16 [1.08, 1.26] | * |
| 16+ years | 4.5 | 7.4 | 1.63 [1.28, 2.08] | * | 6.0 | 8.0 | 1.33 [1.23, 1.44] | * |
| **SUV** | | | | | | | | |
| <3 years | 0.5 | 0.8 | 1.71 [0.79, 3.70] | | 1.4 | 1.6 | 1.16 [0.98, 1.37] | |
| 3–5 years | 2.2 | 1.1 | 0.53 [0.32, 0.87] | * | 2.8 | 1.8 | 0.65 [0.57, 0.75] | * |
| 6–10 years | 6.9 | 3.1 | 0.45 [0.34, 0.60] | * | 8.5 | 5.1 | 0.59 [0.55, 0.64] | * |
| 11–15 years | 5.5 | 7.7 | 1.39 [1.11, 1.75] | * | 6.3 | 8.9 | 1.42 [1.32, 1.53] | * |
| 16+ years | 1.8 | 4.5 | 2.56 [1.78, 3.69] | * | 2.5 | 5.5 | 2.23 [1.99, 2.48] | * |

*Note.* * = difference between study periods statistically significant at α=0.05.

## Safety features

In addition to driving older vehicles, fatally injured teenage drivers tended to drive vehicles with fewer advanced safety features than their adult counterparts. Teenage drivers in the current sample were significantly less likely than adults to have vehicles equipped with side airbags (both for the head and for the chest) and ESC as standard equipment. Conversely, teenage drivers were significantly more likely to be driving vehicles where head-protecting side airbags and ESC were not available, or in the case of chest-protecting side airbags, merely optional (Figure 3).

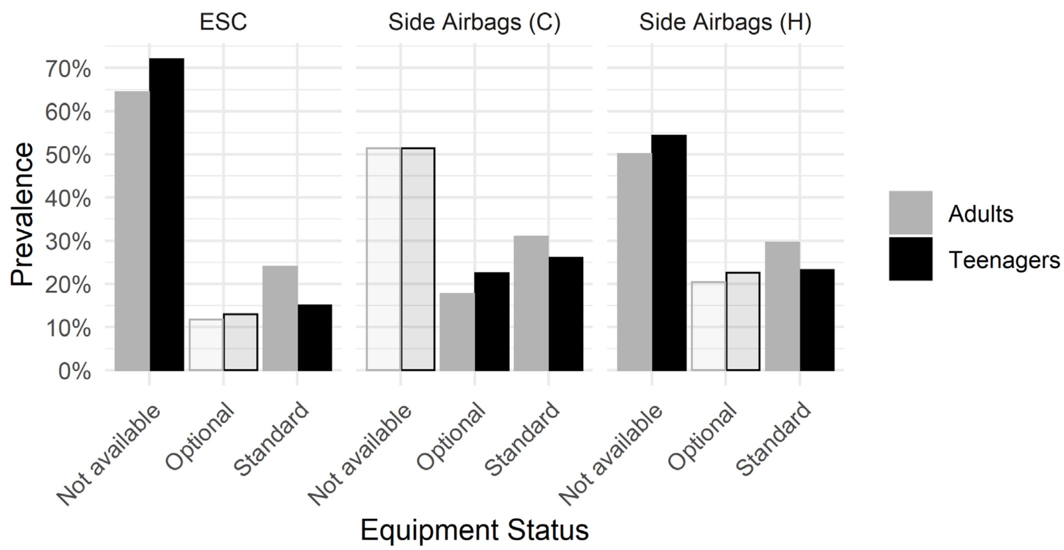


**Figure 3.** Comparison between fatally injured adult and teenage drivers in 2013–2017 by vehicle safety equipment status; significant differences between teenagers and adults are denoted by opaque bars. C = chest; H=head.

Although the latest fatal crash data show that teenage drivers remain disadvantaged with respect to the presence of standard safety systems, the degree to which they were disadvantaged has decreased since 2008–2012 (Table 4). In 2008–2012, fatally injured adult drivers were nearly twice as likely than fatally injured teen drivers to have been killed in a vehicle equipped standard with ESC (6.5% vs. 3.3%; 2.0 times as likely). In 2013–2017, this discrepancy was somewhat smaller (24.0% vs. 15.0%; 1.6 times as likely).

**Table 4.** Distribution (percent) of vehicle safety features for fatally injured passenger vehicle drivers ages 15–17 and 35–50 years, comparison between 2008–2012 and 2013–2017.

| | Teenagers | | | | Adults | | | |
|---|---|---|---|---|---|---|---|---|
| Vehicle safety feature | 2008–12 (N=2,394) | 2013–17 (N=1,911) | Rate ratio [95% CI] | | 2008–12 (N=18,273) | 2013–17 (N=17,253) | Rate ratio [95% CI] | |
| **Side airbags (chest)** | | | | | | | | |
| Not available | 70.3 | 51.4 | 0.73 [0.70, 0.77] | * | 70.9 | 51.4 | 0.73 [0.71, 0.74] | * |
| Optional | 18.7 | 22.5 | 1.20 [1.07, 1.35] | * | 16.2 | 17.6 | 1.09 [1.04, 1.14] | * |
| Standard | 11.0 | 26.1 | 2.37 [2.07, 2.72] | * | 13.0 | 30.9 | 2.39 [2.28, 2.49] | * |
| **Side airbags (head)** | | | | | | | | |
| Not available | 72.5 | 54.3 | 0.75 [0.71, 0.79] | * | 70.2 | 50.0 | 0.71 [0.70, 0.73] | * |
| Optional | 18.9 | 22.6 | 1.19 [1.06, 1.34] | * | 18.7 | 20.4 | 1.09 [1.05, 1.14] | * |
| Standard | 8.6 | 23.2 | 2.68 [2.30, 3.13] | * | 11.1 | 29.5 | 2.66 [2.53, 2.78] | * |
| **ESC** | | | | | | | | |
| Not available | 88.1 | 72.0 | 0.82 [0.79, 0.84] | * | 84.6 | 64.3 | 0.76 [0.75, 0.77] | * |
| Optional | 8.5 | 13.0 | 1.52 [1.28, 1.81] | * | 8.9 | 11.7 | 1.32 [1.24, 1.40] | * |
| Standard | 3.3 | 15.0 | 4.49 [3.53, 5.72] | * | 6.5 | 24.0 | 3.67 [3.51, 3.83] | * |

*Note.* * = difference between study periods statistically significant at α=0.05.

## CONCLUSION

Teenage drivers remain more likely to be killed while driving older, smaller vehicles than adult drivers. Compared with adults, teenagers were more likely to be killed driving micro, mini, small, and midsize cars, and were less likely to be killed driving pickups and SUVs.

This pattern is largely consistent with the differences observed in 2008–2012 with a few notable exceptions. Teenage drivers killed in crashes in 2013–2017 were driving even older vehicles than teenage drivers killed in 2008–2012. Even so, adult drivers were also driving older vehicles in 2013–2017 than they were in the 2008–2012 interval. While this shift to older vehicles has had a bigger impact on teen drivers, it could be the result of broader market trends towards vehicles remaining on the roads longer. However, a 5-year-old vehicle in 2017 likely was more advanced than a 5-year-old vehicle in 2012, with improvements in crashworthiness and safety technology (Highway Loss Data Institute, 2019).

The availability of advanced safety systems—particularly ESC—has increased for all drivers since 2008–2012. However, fatally injured teen drivers are still less likely to have been driving vehicles equipped with ESC and side airbags than their adult counterparts. Regulations and improving technology have had a delayed impact on teen driving safety, relative to that of adult drivers.

Graduated driver licensing laws (GDL) have targeted teen driving risk, and laws have been implemented and strengthened across the country since the national effort began in 1996. Several studies have found that some components of GDL (passenger and nighttime restrictions, and minimum licensing age) have had a greater impact on teen driving safety than others (the number of required supervised practice driving hours), but overall the presence of GDL provisions has significantly reduced crash risk among teen drivers (McCartt, Teoh, Fields, Braitman, & Hellinga, 2010; Williams, 2017). Unfortunately, no state has implemented all of the strongest provisions available, and efforts to pass new GDL legislation have essentially stopped in the past 5 years. Public health communication efforts targeted at teen drivers have had minimal positive impact on teen drivers to date, and evaluations of driver education programs show minimal or neutral effects of such programs on teen driving safety (Curry, Peek-Asa, Hamann, & Mirman, 2015; Mayhew et. al., 2017). A key to improving teen driving safety lies in increased vehicle safety.

The choices that parents make when placing their teen in a vehicle can have a great impact on the safety of their teen as well as the safety of other road users. The current analysis suggests that trends in vehicle choices for teens and adults have held relatively consistent over the past 10 years, and that greater efforts to shift how parents think about and choose the vehicle they let their teen drive will be necessary moving forward.

As time passes and improved vehicle technology continues to spread throughout the fleet, safety features like ESC and side airbags will become standard, while more advanced driver assistance features, such as automatic emergency braking, will become increasingly common. As a result, we expect that vehicles and roadways will become safer for both teenage and adult drivers in the future. However, it is disappointing that, 5 years after the problem was recognized by McCartt & Teoh (2015), teenage drivers still are driving the least safe vehicles. Changing this trend for the riskiest driving population requires more informed decision-making by parents and the acceleration of vehicle technology by automakers. Parents need to be educated on the safety benefits of placing their teen driver in the newest vehicle with the most advanced safety features. At the same time, automakers need to more rapidly expand vehicle safety features across their fleets to ensure that teens are driving vehicles with the latest technology.


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