Continued trends in older driver crash involvement rates in the United States: data through 2017–2018

October 2020

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Abstract

Objective: Fatal crash involvements per vehicle miles traveled begin to increase among drivers at age 70 years and continue to increase with age. With the aging baby-boom cohort (born between 1946 and 1964) and subsequent increases in the proportion of older adults in the U.S. population, there had been concern that the growth in the older population would equate to higher fatal motor vehicle crashes. Yet, previous trend analyses showed this to be untrue. The purpose of this study was to examine current trends to determine if previous declines have persisted or risen with the recent increase in fatal crashes nationwide.

Methods: Trends among drivers ages 70 and older were compared with drivers ages 35–54 for U.S. passenger vehicle fatal crash involvements per 100,000 licensed drivers from 1997–2018, for U.S. passenger vehicle fatal and all police-reported crash involvements per vehicle miles traveled using the 1995, 2001, 2009, and 2017 National Household Travel Surveys, and driver deaths per 1,000 crashes.

Results: Over the entire study period, trends continued to show an overall decline in fatal crash involvements per licensed driver, with substantially greater declines for drivers ages 70 and older than for middle-aged drivers (43 vs. 21%). Fatal crash involvement rates per 100,000 licensed drivers and police-reported crash involvement rates per mile traveled for drivers ages 70–79 are now less than those for drivers ages 35–54, but their fatal crash involvement rates per mile traveled and risk of dying in a crash remain higher as they continue to drive fewer miles. As the economy improved over the past decade, fatal crash involvement rates increased substantially for middle-aged drivers but decreased or remained stable among older driver age groups.

Conclusions: The number of fatal crash involvements for adults ages 70 and older has increased in recent years, but they remain down from the peak that occurred in 1997, even as the number of licensed older drivers and the miles they drive have vastly increased. Improvements in health likely contributed to long-term reductions in fatal crash involvement rates. As older drivers adopt vehicles with improved crashworthiness and safety features, crash survivability will improve.

Keywords: older drivers; fatal crash involvements; crash trends
1. Introduction

Over the last several decades, the United States has seen an increase in life expectancy at birth, from 76.5 years in 1997 to 78.6 years in 2017 (National Center for Health Statistics [NCHS], 1999; NCHS, 2019). Life expectancy at age 65 was an additional 17.7 years for males and 20.3 years for females in 2010, an improvement of 4.7 and 3.5 %, respectively, since 1970 (Crimmins et al., 2016). Americans are not only living longer but are enjoying more years of disability-free life. Using estimates derived from questions about performing various activities of daily living and instrumental activities of daily living from the National Health Interview Survey and National Long Term Care Survey, Americans at age 65 have seen increases in estimates of active life expectancy, or years free of severe disability, that have outpaced those in remaining life expectancy with a disability (Crimmins et al., 2016; Freedman & Spillman, 2016).

This increase in life expectancy and the delay in the onset of severe morbidities can be attributed to advances in medical treatments that have allowed for the reduction of many acute diseases, enhanced screening for and management of chronic conditions, and a general decline in adverse health behaviors (Cichy et al., 2017; Wolf et al., 2005). The gains in overall life expectancy and disease-free life expectancy, combined with the aging of the American baby-boom cohort (born between 1946 and 1964) will result in an estimated 53 million people over age 70 in the United States by 2030 (United States Census Bureau, 2017). This demographic shift, coined the “gray tsunami”, will result in roughly 10,000 people reaching age 65 per day between the years 2010 and 2030 (United States Census Bureau, 2019). This equates to an increase in the percentage of the population that is 65 years old or older from 13 % to 20 % during that timeframe (Ortman et al., 2014).

Historical trends have shown that fatal and police-reported crash involvements per mile traveled begin to increase with age beginning at age 70 (Cicchino & McCartt, 2014). This higher crash risk can be credited to age-related declines in cognitive, visual, and physical function (Anstey et al., 2005; Owsley et al., 1991). With increases in age-related declines come increases in frailty, which is an increased vulnerability to sudden, drastic health status changes that are brought on by relatively minor events.
(Clegg et al., 2013). Higher fatal crash involvement may be related to the prevalence of frailty that increases with age, and an estimated 3% increase in risk of death when involved in a crash for each year of aging (Clegg et al., 2013; Kahane, 2013).

Higher crash risk and the projected increase in the older population due to the aging baby-boom cohort led to concern in the past that an increase in fatal crashes among older adults would follow (Lyman et al., 2002), yet previous research showed a decline from the mid-1990s through 2012 (Cicchino & McCartt, 2014). With the continued increase in older adult population size and longevity, profound implications remain for the safe and independent mobility of older adults. Given the recent increase in motor vehicle fatalities in the United States over the last decade, reassessing trends among older drivers is warranted.

The purpose of this study was to explore current trends in fatal and police-reported crash involvement for drivers ages 70 and older, specifically to evaluate if the crash rates for older drivers continued to decline despite the recent increase in fatal motor vehicle crashes in the United States. This study serves as a third installment to Cicchino and McCartt (2014) and Cheung and McCartt (2011) to include the most recent data available. Continuing with prior studies of this series, trend analyses began in the mid-1990s, as 1997 was the year in which older driver fatal crash involvements peaked in the United States.

2. Methods

This study compared trends of rates of involvement in fatal crashes per licensed driver for older drivers with rates for middle-aged drivers, ages 35–54 years, beginning in 1997. We also examined involvements in fatal and police-reported crashes of varying severity per vehicle mile traveled (VMT) and driver deaths per crash involvement for drivers ages 70 and older, relative to drivers ages 35–54, beginning in 1995.
2.1 Data sources

Data on fatal crash counts were derived from the National Highway Traffic Safety Administration’s (NHTSA) Fatality Analysis Reporting System (FARS). FARS is a census of all vehicle occupant or other road user deaths due to and occurring within 30 days of a motor vehicle crash on United States public roads. FARS data were used in conjunction with data on licensed drivers, vehicle miles traveled, and estimates of police-reported crashes to calculate fatal crash involvement rates and risk of driver death.

Additional data procured from NHTSA were U.S. police-reported crashes of all severities from the National Automotive Sampling System General Estimates System (NASS GES) and its successor, the Crash Report Sampling System (CRSS). NASS GES and CRSS are nationally representative probability samples that can be weighted to produce annual national estimates. Imputed data were utilized when available to account for missing data. NASS GES and CRSS data were used to calculate rates of police-reported crashes per VMT and the risk of a driver dying in a crash.

Yearly counts of U.S. licensed drivers by state and age in 1997–2018 were acquired from the Federal Highway Administration (FHWA). Data for drivers under age 70 are based on data submitted directly by the states, while data for older drivers (older than age 70) are estimates based on U.S. Census Bureau population figures for each state and age group (Federal Highway Administration, 2019).

Data on vehicle miles traveled were obtained from the National Household Travel Surveys (NHTSs) conducted by FHWA. The current study used data from the Nationwide Personal Transportation Survey (NPTS) conducted during 1995–1996 and the NHTSs administered during 2001–2002, 2008–2009, and 2016–2017. These surveys will be referred to as the 1995, 2001, 2009, and 2017 surveys from this point on.

Inclusion criteria of this study remained consistent with the Cicchino and McCartt (2014) study and consisted of passenger vehicle (car, van, SUV, and pickup) driver crash involvements. Miles driven calculations were also restricted to passenger vehicles. Police vehicles were excluded from analyses to align with participants of the NPTS and NHTSs used to derive VMT estimates. Older drivers remained
defined as those age 70 years and older and were further stratified by the age groups 70–74, 75–79, and 80 years and older. Middle-aged drivers were defined as ages 35–54 years. Middle-aged drivers were selected as the comparison group due to the lower prevalence of cognitive or physical age-related impairments experienced by older adults, coupled with a lower likelihood of engaging in risky driving behaviors that are associated with increased crash involvement among drivers under age 30.

2.2 Analyses

Analysis of covariance (ANCOVA) was used to explore linear trends in annual passenger vehicle fatal crash involvement rates per 100,000 licensed drivers of ages 70–74, 75–79, and 80 years and older, relative to the comparison group of drivers aged 35–54 years. Parameter estimates from the ANCOVA models are reported as estimates of annual changes in crash rates for each age group and differences between groups (changes for each older driver group relative to middle-aged drivers). Trends in fatal crash involvement per licensed driver were examined from 1997 to 2018 and 2010 to 2018. The year 2010 was chosen as the start of the second analysis, as that was the year fatalities among people ages 70 and older first increased following the long period of decline.

In addition to trends of crash involvement per licensed driver, this study explored fatal crash involvements per 100 million vehicle miles traveled (VMT) using data from the 1995 NPTS and the 2001, 2009, and 2017 NHTSs. Crash data from April–March of 1995–1996, 2001–2002, 2008–2009, and 2016–2017 were used to approximately align with the data collection periods of the NHTSs. Fatally injured driver counts were derived for the same periods from FARS. For each of the four survey periods and age groups, fatal crash involvements per 100 million VMT were calculated. Rate ratio calculations were performed to examine trends within each age group over time, comparing fatal crash involvements per VMT rates from 2017 to 1995 and 2017 to 2009. Ratios of the rate ratios comparing each older driver group with the middle-aged group were then computed for the time periods of interest. This served to examine the magnitude of difference in change over time between groups.
Rates of all police-reported crash involvements per 1 million VMT were also examined, again using the same four NHTS periods as the source for estimates of VMT. Finally, counts of fatal and nationally weighted estimates of police-reported crash involvements were used to calculate the risk of a driver dying in a crash per 1,000 crash involvements. The same methods described to calculate rate ratios and ratios of rate ratios for fatal crash involvements per 100 million VMT were extended to all police-reported crash involvements per 1 million VMT and driver deaths per 1,000 crash involvements.

Confidence intervals of rate ratios and ratios of the rate ratios were derived to assess if the changes over time were statistically significant using the method described by Ulmer et al. (2000). Point estimates with confidence intervals less than 1 indicate significant declines over the specified period for drivers in that age group (rate ratios) or relative to middle-aged drivers (ratios of the rate ratios), whereas point estimates with confidence intervals greater than 1 indicate significant increases.

3. Results

3.1 Trends in licensure and fatal crash involvement for drivers ages 70 and older

Table 1 displays trends in licensed drivers and passenger vehicle fatal crash involvements among people ages 70 and older from 1997 to 2018. During the entire study period, the number of older licensed drivers consistently increased each year and were up by 65% in 2018 from 1997. Increases in older licensed drivers have been more rapid in recent years. The number of older licensed adults increased twice as much during the last 11 years of the study than during the first 11 years, with a 36% increase from 2008 to 2018 vs. an 18% increase from 1997 to 2007. Passenger vehicle fatal crash involvement of drivers ages 70 and older declined from 1997 until about 2009. In the following years, fatal crash involvement trends reversed course and increased through 2018, with a total of 4,506 fatal crash involvements that year. The increase in fatal crash involvement in recent years resulted in a net decrease of 6.6% since 1997.
3.2 Trends in fatal crash involvement per licensed driver

Figure 1 depicts trends in fatal crash involvement per number of driver licenses for each age group, 35–54, 70–74, 75–79, and 80 and older for 1997 through 2018. For drivers ages 35–54, fatal crash involvements per licensed driver decreased 21 %, whereas drivers ages 70 and older experienced greater declines; a 39 % decrease for drivers ages 70–74, a 44 % decrease for drivers ages 75–79, and a 49 % decrease for drivers 80 and older. Beginning in 2015, rates in the middle-aged group exceeded the rate for those aged 70–79. Fatal crash involvements per licensed driver for all drivers ages 70 and older declined 43 % from 1997 to 2018.

Table 2 displays results of the ANCOVA model that examined linear trends in fatal crashes per 100,000 licensed drivers by age group. During the period of 1997–2018, there were significant average annual declines in the fatal crash involvement rates in every age group. These declines became larger with increasing age; −0.29 annually for drivers 35–54, −0.46 for those 70–74, −0.61 among 75- to 79-year-olds, and −0.88 for those aged 80 and older. The difference in average annual change in fatal crash involvement rate between drivers ages 70–74 and 35–54 was significant at $a = 0.10$ ($p = 0.0503$), with significant differences at $a = 0.05$ in average annual changes in fatal crash involvements for drivers 75–79 and 80 and older relative to the change for drivers 35–54.

From 2010 to 2018, changes in fatal crash involvement rates per licensed driver were stagnant and nonsignificant for each older driver group. There was a significant increase in the rate for middle-aged drivers, at 0.35 annually on average. The lack of change across the older driver groups compared with the increase in crash rates per licensed driver produced negative average annual differences in fatal crash involvement rates for all older drivers relative to those middle-aged, all of which were significant.

3.3 Trends in driving exposure

Table 3 displays estimates of annual passenger vehicle miles traveled per driver for each of the four travel survey periods: 1995, 2001, 2009, and 2017. Older drivers drove fewer miles in each survey period than the middle-age drivers, but experienced greater increases in miles driven since 1995. Drivers
75–79 years of age had the largest increase and nearly doubled the annual miles driven over the full period. Middle-aged drivers increased miles driven the least over the entire period, up a total of 37%. All age groups increased miles driven from 2009 to 2017.

3.4 Trends in crash involvement rates per mile driven and death risk

Figure 2 depicts fatal crash involvements of U.S. passenger vehicle drivers per 100 million miles traveled, for all age groups for each period the NHTS was conducted. Fatal crash involvement rates were highest among the younger and older drivers, with teenagers and the oldest adults having similar rates since 2001. Drivers ages 80 and older have seen the most dramatic decreases since the 1995 NHTS. Rates of fatal crash involvements per VMT improved over the four study periods across the older driver age groups, but the historical pattern of fatal crash involvement rates per VMT that begin to rise at age 70 and continue to increase with age persisted through 2017; rates in 2017 were 25% higher among drivers ages 70–74, 57% higher among drivers ages 75–79, and about 4 times as high among drivers 80 and older compared with middle-aged drivers. The rates among the older driver groups followed a general downward trajectory over time, except for drivers 80 and older from 2009 to 2017 where there was no real change.

Changes in rates of fatal crash involvements per VMT between 2017 and 1995 and 2017 and 2009 for middle-aged and older driver groups are displayed in Table 4. Fatal crash involvement rates declined among each age group over the full study period, with the largest reductions experienced by drivers ages 75 and older (35–54, −15%; 70–74, −46%; 75–79, −60%; 80+, −55%). However, during 2009 to 2017, fatal crash involvements per VMT among middle-aged drivers significantly increased by 19%. Since 2009, rates declined approximately 20% among drivers ages 70–79 and did not change among drivers 80 and older.

All crash involvements per VMT follow a similar U-shaped curve to fatal crash involvement rates in which they are highest for the youngest and the oldest drivers (Figure 3). However, police-reported crash involvements per 1 million miles is highest among the youngest drivers, unlike the nearly identical
rates between the oldest and youngest driver age groups seen with fatal crash involvements. Where rates of fatal crashes per VMT were higher among all older drivers groups than middle-aged drivers, police-reported crash involvements per VMT rates were lower for drivers ages 70–79 than ages 35–54 for the first time in 2017, with rates 16 % lower for drivers ages 70–74 and 4 % lower for ages drivers 75–79 than 35- to 54-year-old drivers. Police-reported crash rates for drivers 80 and older were 50 % higher than for middle-aged drivers in 2017.

As with fatal crash involvement rates, police-reported crash involvements per 1 million VMT decreased among drivers in all age groups since 1995, but middle-aged drivers experienced a significant rise of 26 % since 2009 (Table 4). There was a significant reduction of 6 % among the 70- to 74-year-old and 80 and older driver age groups during the most recent period, and drivers ages 75–79 experienced a minor, nonsignificant increase of 1 % since 2009. Over the entire study period of 2017 vs. 1995, larger declines in all police-reported crash involvements per mile traveled occurred with increasing age.

Figure 4 displays driver deaths per 1,000 crashes, or the risk of dying in a crash, for each NHTS period among all ages. A stable pattern is evident in which death risk increases with age. Compared with middle-aged drivers, death risk in 2017 was twice as high for drivers ages 70–74, 2.5 times as high for drivers ages 75–79, and climbed to nearly 5 times as high for the oldest drivers ages 80 and older.

Rate ratios of driver deaths per 1,000 police-reported crash involvements are similar between 2017 to 1995 and 2017 to 2009 for each age group (Table 4), indicating most of the declines seen since 1995 occurred in more recent years. Middle-aged drivers and drivers ages 70–79 experienced significant declines over both periods, with the most substantial declines seen among drivers 75–79 (~26% both from 2009 to 2017 and over the entire study period). The risk of dying in a crash for drivers 80 and older was relatively unchanged with both comparisons.

Table 5 displays the rate ratios of fatal crash and police-reported crash involvements per VMT and driver deaths per 1,000 police-reported crashes for each older driver group relative to those of middle-aged drivers, for periods 2017 vs. 1995 and 2017 vs. 2009. Fatal crash involvements per VMT declined significantly for all older driver age groups relative to middle-aged drivers for both 2017
compared with 1995 and 2017 compared with 2009. The same holds for police-reported crash involvements per VMT. Driver deaths per 1,000 police-reported crashes declined significantly relative to middle-aged drivers for drivers ages 70–74 from 1995 to 2017 and drivers ages 75–79 in both comparisons. Risk of dying in a crash among drivers 80 and older increased relative to middle-aged drivers during both time periods, both significant.

4. Discussion

This study builds upon Cicchino and McCartt (2014) by including the most recent data available to further examine trends in older driver crash involvements. The number of older driver fatal crash involvements have remained below their peak since reaching it in 1997, even with vast increases in the number of older drivers and the miles they drive. However, a reversal began in 2010 where fatal crash involvements among older drivers increased. This parallels the rise in the number of motor vehicle fatalities in the United States (Insurance Institute for Highway Safety [IIHS], 2019). Fatal crash involvement rates per mile traveled and per licensed driver have remained relatively stable in recent years among older drivers, but this is a marked contrast to what has been seen with middle-aged drivers, whose fatal and total crash involvement rates have spiked. Middle-aged driver fatal crash involvement rates per licensed driver and police-reported crash involvement rates per VMT now surpass those for drivers ages 70–79. Drivers 80 and older have the greatest declines in both fatal crash involvements per licensed driver and all police-reported crash involvements per VMT since the mid-1990s.

There has been a long-held agreement that traffic fatalities decline during recessions and increase with a strong economy (Evans and Graham, 1988; Ruhm, 1995). As the economy has largely rebounded from the economic recession that began in 2008, and miles driven and traffic-related fatalities are in direct relationship to the strength of the economy, it is expected that the number of fatalities and miles driven would increase given the lower unemployment level of 4 % in December 2018 vs. 10 % in December 2010 (United States Bureau of Labor Statistics [BLS], 2011; 2019). Fatal crash involvements per miles traveled among middle-aged adults increased in the past decade, yet it is surprising that these rates
declined among drivers ages 70–79 and remained stable among drivers 80 and older despite economic improvement.

It has been hypothesized that riskier forms of driving, such as alcohol-impaired driving and speeding, decrease most during a recession (Cotti & Tefft, 2011; He, 2016; Ruhm, 1995) and thus would be expected to rebound during economic recovery. Older people participate less in these types of risky driving (Rakotonirainy et al., 2012; Schroeder et al., 2013), which could explain the lack of a recent increase in their fatal crash involvement rates. Another contributing factor to differing fatal crash involvement rates over the past decade could be rising speed limits on limited-access roads, where older drivers more often restrict their travel (Naumann et al., 2011). Twenty states raised their maximum speed limits between 2011 and 2012, and such increases have been associated with an 8% rise in fatality rates on interstates and other freeways (Farmer, 2017).

A possible, partial explanation for the continued decline in older driver fatal crash involvement rates relative to middle-aged drivers since the mid-1990s is the evidence that shows Americans are living longer, healthier lives (Crimmins et al., 2016). Medical advancements associated with longer life expectancy and active life expectancy may be responsible for a delayed onset or improved management of severe age-related declines in cognitive, visual, and physical function that are associated with increased risk of crash involvement. These healthier older adults are more often staying in the workforce (BLS, 2008; Cichy et al., 2017), which is consistent with the increases seen in both the number of drivers ages 70 and older and the miles they drive.

Drivers 70 and older are overrepresented in intersection-related crashes and are more likely to be involved in multiple-vehicle crashes (Lombardi et al., 2017; Mayhew et al., 2006). Infrastructure adaptations that target the aging population by aiming to address the age-related declines that contribute to higher crash risk have been implemented since the FHWA first published the Older Driver Highway Design Handbook in 1998, with updates and expansions in 2001 and 2014 (Brewer et al., 2014). Its guidance includes recommendations to improve intersection design and traffic sign visibility, and calls for converting traditional intersections to roundabouts, which can eliminate the right-angle crashes in which
older drivers are over-involved. As state and local engineering professionals have gradually implemented these treatments, it is likely that these and other infrastructure enhancements which have been proposed with the aging population in mind have contributed to the declines in crash risk among adults 70 and older since the mid-1990s.

Increases in crash survivability relative to middle-aged drivers also contributed to lower relative fatal crash involvement rates among drivers ages 70–79. This could be the result of better health and the adoption of vehicle safety improvements, such as side airbags, that have been more beneficial for older adults than younger adults (Kahane, 2013). The crashworthiness of the United States passenger vehicle fleet is continually improving, with the proportion of registered vehicles earning good ratings in Insurance Institute for Highway Safety crash tests increasing each year (Highway Loss Data Institute [HLDI], 2019a). This is likely why death risk decreased among all but the oldest drivers during the full study period and more recently. However, it can take three decades before 95% of vehicles on the road have a given safety feature once introduced (HLDI, 2019b). Older adults tend to hold onto their vehicles longer than younger drivers, therefore these advancements in crashworthiness and safety features are slower to reach and benefit them, as the proportion of newer model year vehicles driven or crashed by older drivers decreases with increasing age (Braitman & McCartt, 2008; Fausto & Tefft, 2018). Further improvements in crash survivability can be expected, as more adults are driving today’s new vehicles.

Some limitations of this study should be noted. Police-reported crash sampling methods changed when NHTSA converted from NASS GES to CRSS, which may have affected the comparability of the 2017 data on all crash involvements with earlier years. We chose to compare the 2017 CRSS data with the older data derived from NASS GES because there is not another source of national police-reported crash estimates, and there is no reason to believe that potential bias varied by driver age. Additionally, driver license information was obtained through counts from states for younger drivers but derived from population estimates for drivers ages 70 and older. Estimates of VMT by age from household travel surveys for the older age groups are based on fewer respondents than the middle-aged group, and
therefore may be less reliable. Despite the different shortcomings of license counts and miles traveled, it is promising that results were consistent when using both measures of exposure.

Results of this study demonstrate that fatal crash involvements among older adults remain lower than the peak levels seen in the mid-1990s. Although a slowing of declining trends can be seen, there is no evidence to suggest an increase in fatal crash rates among older adults, as had been hypothesized when considering the increasing proportion of older adults in the United States population and their elevated crash risk.

5. Acknowledgement

This work was supported by the Insurance Institute for Highway Safety.

6. References


7. Tables

Table 1
National counts of licensed drivers and passenger vehicle driver fatal crash involvements for people ages 70 and older, 1997–2018

<table>
<thead>
<tr>
<th>Year</th>
<th>Older licensed drivers (in thousands)</th>
<th>Older driver passenger vehicle fatal crash involvements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>17,727</td>
<td>4,823</td>
</tr>
<tr>
<td>1998</td>
<td>17,911</td>
<td>4,808</td>
</tr>
<tr>
<td>1999</td>
<td>18,466</td>
<td>4,806</td>
</tr>
<tr>
<td>2000</td>
<td>18,940</td>
<td>4,574</td>
</tr>
<tr>
<td>2001</td>
<td>19,137</td>
<td>4,649</td>
</tr>
<tr>
<td>2002</td>
<td>19,877</td>
<td>4,543</td>
</tr>
<tr>
<td>2003</td>
<td>19,827</td>
<td>4,644</td>
</tr>
<tr>
<td>2004</td>
<td>19,966</td>
<td>4,355</td>
</tr>
<tr>
<td>2005</td>
<td>20,120</td>
<td>4,237</td>
</tr>
<tr>
<td>2006</td>
<td>20,589</td>
<td>4,064</td>
</tr>
<tr>
<td>2007</td>
<td>20,968</td>
<td>4,004</td>
</tr>
<tr>
<td>2008</td>
<td>21,567</td>
<td>3,739</td>
</tr>
<tr>
<td>2009</td>
<td>21,847</td>
<td>3,565</td>
</tr>
<tr>
<td>2010</td>
<td>22,264</td>
<td>3,630</td>
</tr>
<tr>
<td>2011</td>
<td>22,592</td>
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</tr>
<tr>
<td>2012</td>
<td>23,117</td>
<td>3,651</td>
</tr>
<tr>
<td>2013</td>
<td>23,603</td>
<td>3,565</td>
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<tr>
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<td>24,435</td>
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<td>25,304</td>
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<td>2016</td>
<td>26,358</td>
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</tr>
<tr>
<td>2017</td>
<td>27,989</td>
<td>4,528</td>
</tr>
<tr>
<td>2018</td>
<td>29,307</td>
<td>4,506</td>
</tr>
</tbody>
</table>

Percent change, 2018 vs. 1997

|                  | 65 | –6.6 |


### Table 2

Average annual change in passenger vehicle driver fatal crash involvement rates per 100,000 licensed drivers by driver age group, 1997–2018 and 2010–2018: summary of ANCOVA models

<table>
<thead>
<tr>
<th>Driver age group and period</th>
<th>Annual change in fatal crash involvement rate</th>
<th>Difference in annual change in fatal crash involvement rate relative to change for drivers ages 35–54</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997–2018</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35–54</td>
<td>−0.29*</td>
<td>—</td>
</tr>
<tr>
<td>70–74</td>
<td>−0.46*</td>
<td>−0.17±</td>
</tr>
<tr>
<td>75–79</td>
<td>−0.61*</td>
<td>−0.32*</td>
</tr>
<tr>
<td>80+</td>
<td>−0.88*</td>
<td>−0.59*</td>
</tr>
<tr>
<td>70+</td>
<td>−0.62*</td>
<td>−0.33*</td>
</tr>
<tr>
<td>2010–2018</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35–54</td>
<td>0.35*</td>
<td>—</td>
</tr>
<tr>
<td>70–74</td>
<td>0.00</td>
<td>−0.34*</td>
</tr>
<tr>
<td>75–79</td>
<td>0.01</td>
<td>−0.34*</td>
</tr>
<tr>
<td>80+</td>
<td>0.05</td>
<td>−0.31*</td>
</tr>
<tr>
<td>70+</td>
<td>−0.02</td>
<td>−0.37*</td>
</tr>
</tbody>
</table>

±p <0.10.  
*p <0.05.

### Table 3


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<tbody>
<tr>
<td>35–54</td>
<td>12,673</td>
<td>16,983</td>
<td>15,379</td>
<td>17,364</td>
<td>37</td>
</tr>
<tr>
<td>70–74</td>
<td>6,848</td>
<td>10,375</td>
<td>9,512</td>
<td>10,667</td>
<td>56</td>
</tr>
<tr>
<td>75–79</td>
<td>5,571</td>
<td>8,786</td>
<td>8,936</td>
<td>10,755</td>
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</tr>
<tr>
<td>80+</td>
<td>4,285</td>
<td>6,805</td>
<td>6,487</td>
<td>7,259</td>
<td>69</td>
</tr>
<tr>
<td>70+</td>
<td>5,948</td>
<td>9,000</td>
<td>8,446</td>
<td>9,830</td>
<td>65</td>
</tr>
</tbody>
</table>
### Table 4

Rate ratios (RR) and 95% confidence intervals of fatal crash involvement rates per VMT, police-reported crashes per VMT, and driver deaths per police-reported crashes of 2017 relative to those of 1995, and rates from 2017 relative to those of 2009 by age

<table>
<thead>
<tr>
<th>Driver age group</th>
<th>Fatal crash involvements per 100 million VMT</th>
<th>Crash involvements per 1 million VMT</th>
<th>Driver deaths per 1,000 police-reported crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>35–54</td>
<td>0.845 (0.824, 0.866) *</td>
<td>1.189 (1.159, 1.219) *</td>
<td>0.871 (0.865, 0.876) *</td>
</tr>
<tr>
<td>70–74</td>
<td>0.540 (0.503, 0.580) *</td>
<td>0.806 (0.746, 0.870) *</td>
<td>0.647 (0.633, 0.660) *</td>
</tr>
<tr>
<td>75–79</td>
<td>0.402 (0.371, 0.435) *</td>
<td>0.791 (0.727, 0.861) *</td>
<td>0.505 (0.494, 0.518) *</td>
</tr>
<tr>
<td>80+</td>
<td>0.450 (0.420, 0.482) *</td>
<td>1.014 (0.946, 1.087)</td>
<td>0.451 (0.440, 0.461) *</td>
</tr>
<tr>
<td>70+</td>
<td>0.501 (0.481, 0.523) *</td>
<td>0.833 (0.798, 0.871) *</td>
<td>0.567 (0.560, 0.575) *</td>
</tr>
</tbody>
</table>

*denotes statistical significance, $a = 0.05$

### Table 5

Ratio of the rate ratio (RR) and 95% confidence intervals of driver fatal crash involvements per VMT, police-reported crashes per VMT, and driver deaths per police-reported crashes of older drivers compared with middle-aged drivers during 2017 relative to that during 1995, and 2017 relative to that during 2009

<table>
<thead>
<tr>
<th>Driver age group</th>
<th>Fatal crash involvements per 100 million VMT</th>
<th>Crash involvements per 1 million VMT</th>
<th>Driver deaths per 1,000 police-reported crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>70–74</td>
<td>0.639 (0.593, 0.689) *</td>
<td>0.678 (0.625, 0.735) *</td>
<td>0.742 (0.727, 0.758) *</td>
</tr>
<tr>
<td>75–79</td>
<td>0.476 (0.438, 0.517) *</td>
<td>0.666 (0.609, 0.727) *</td>
<td>0.580 (0.567, 0.594) *</td>
</tr>
<tr>
<td>80+</td>
<td>0.533 (0.495, 0.573) *</td>
<td>0.853 (0.793, 0.919) *</td>
<td>0.517 (0.505, 0.530) *</td>
</tr>
<tr>
<td>70+</td>
<td>0.594 (0.566, 0.623) *</td>
<td>0.701 (0.667, 0.738) *</td>
<td>0.651 (0.643, 0.660) *</td>
</tr>
</tbody>
</table>

*denotes statistical significance, $a = 0.05$
8. Figures

Figure 1
Fatal crash involvements of U.S. passenger vehicle drivers per 100,000 licensed drivers by age group, 1997–2018

Figure 2
Figure 3

Figure 4
Driver deaths per 1,000 crashes by age group: 1995, 2001, 2009, and 2017