



# Passenger Vehicle Occupant Injury Severity in Police-Reported Crashes by Vehicle Age and Model Year

## Summary

This study is a descriptive assessment of the relationship between a vehicle's age and model year to its occupant's injury severity in all police-reported crashes, using the most recent data from NHTSA's General Estimates System (GES) 2012-2015 and Crash Report Sampling System (CRSS) 2016. The analysis shows that among all passenger vehicle (passenger cars, SUVs, pickup trucks, or vans) occupants involved in police-reported crashes, the proportion who were seriously injured (including fatalities) was higher among occupants of older model year vehicles as compared to the occupants of newer model year vehicles. Also, the proportion of occupants who were seriously injured increases with vehicle age, i.e., the proportion was higher among occupants of older vehicles as compared to the occupants of newer vehicles.

## Introduction

Previous studies, either through descriptive analysis or by statistical modeling that takes into consideration other vehicle, driver, and environment characteristics, have shown that the proportion of occupants who were fatally injured (percentage killed) increases with increasing vehicle age. This trend was also observed in vehicles of older model years, i.e., the proportion of fatally injured occupants (percentage killed) of newer vehicles is lower than that of occupants of older model year (MY) vehicles.<sup>1 2 3 4</sup> These findings were supported by studies focused either on fatal crashes (e.g., FARS dataset) or on all injury severity level crashes (e.g., NASS-CDS dataset).

This Research Note expands the scope of analysis and conducts a descriptive examination of the passenger vehicle occupant injury severity by vehicle age and model year in all police-reported crashes. The most recent police-reported crash data reported in GES from 2012 to 2015 and CRSS 2016 was used to show the similar patterns to those shown in fatal crashes: the proportion of occupants who were fatally, seriously, and severity unknown injured (percentage injured) increased as vehicle age increased and in earlier model year vehicles.

## Data and Methodology

Police-reported crash data from GES/CRSS for calendar years 2012 to 2016 was used for this analysis. GES (2015 and before) and CRSS (2016 and after) are obtained from a nationally representative probability sample selected from all police-reported crashes. To be eligible for the NASS GES/CRSS sample, a police accident report (PAR) must be completed for the crash, and the crash must involve at least one motor vehicle traveling on a trafficway and must result in property damage, injury, or death. The variable examined in this study is the injury severity of the passenger vehicle occupant. Descriptive statistics of the *percentage injured* [i.e., [(fatally, seriously, and severity unknown injured occupants) / (total occupants)] × 100%] are presented. The age of a vehicle is measured by subtracting the vehicle MY from the calendar year at the time of the crash (vehicle whose age was calculated to be negative one was recoded to be age zero). In the study, the MY is categorized in 5-year increments as 2013–2017, 2008–2012, 2003–2007, 1998–2002, 1993–1997, 1985–1992, and 1984 and earlier. The vehicle age is grouped as 0–3 years, 4–7 years, 8–11 years, 12–14 years, 15–17 years, and 18+ years.

## Results

The relationship between a vehicle's age and MY to an occupant's injury severity in police-reported crashes is illustrated in Figure 1 (weighted case). Figure 1(a) shows that the percentage of occupants who were injured was higher among occupants of older model year vehicles than those of newer model year vehicles: from 3.5 percent for MY 1984 and earlier vehicles to 1.0 percent for MY 2013-2017 vehicles in the weighted cases. The complex survey design adjusted Rao-Scott chi-square test of association between occupant injury severity and vehicle model year shows that the percentages of injuries between model year groups are significantly different at the 99 percent confidence level [ $\chi^2 (d.f.=6) = 212.39, p\text{-value} < .0001$ ].

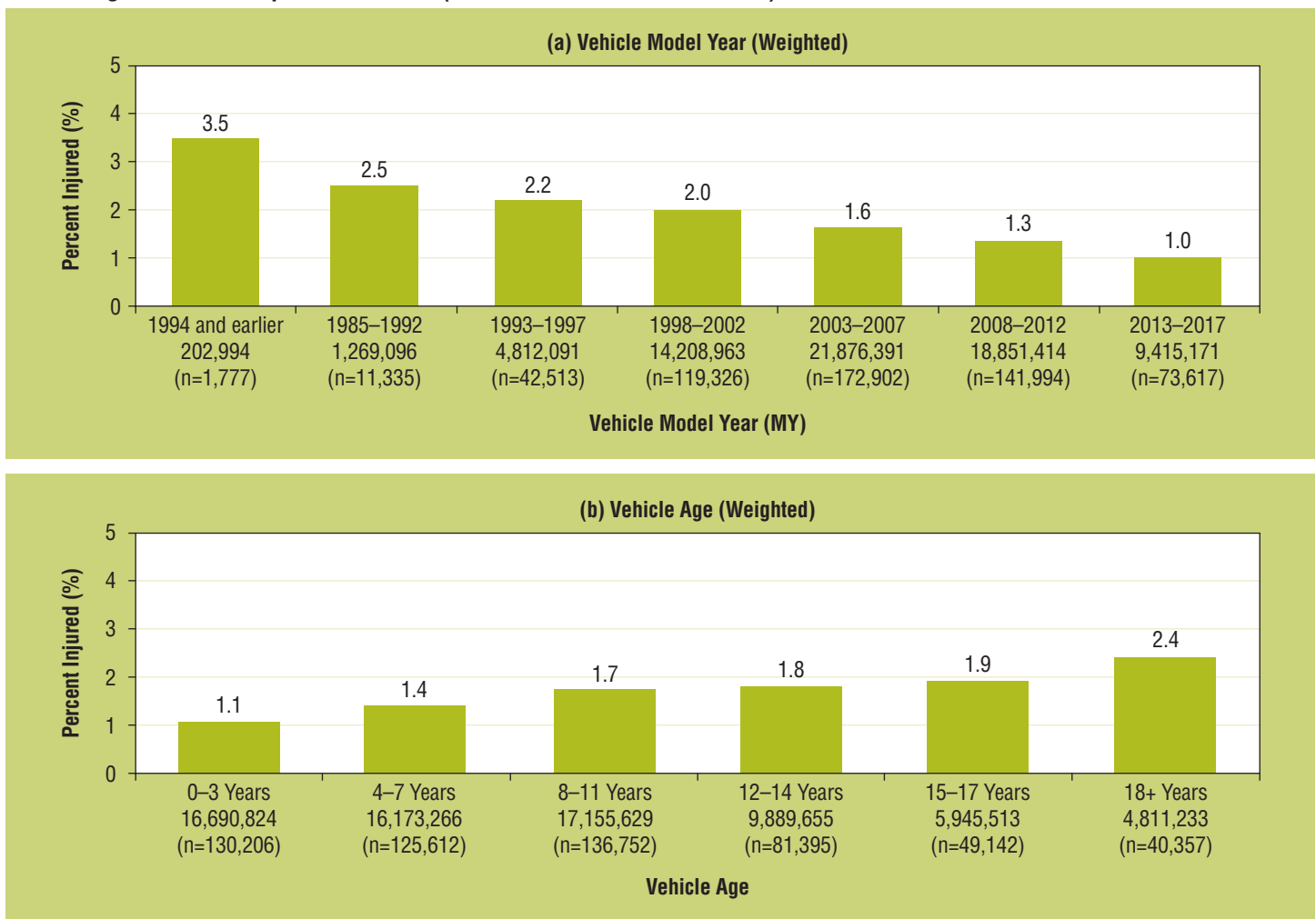
The data in Figure 1(b) shows that the percentage of occupants who were injured increased as the vehicle age increased: from 1.1 percent for the 0-3 age group to 2.4 percent for the

18+ age group in the weighted cases. The complex survey design adjusted Rao-Scott chi-square test of association between occupant injury severity and vehicle age shows that the percentages of injuries between vehicle age groups are significantly different at the 99 percent confidence level [ $\chi^2 (d.f.=5) = 193.65, p\text{-value} < .0001$ ].

Further analysis examines the occupant injury severity within each age group. Figure 1(c) shows that the percentage of occupants injured was higher among occupants of older model year vehicles than those of newer model year vehicles in every age group examined. Note that each of the six categories of vehicle age are stratified into seven categories of model year. Bars in certain categories are not displayed because no vehicles of those types existed in the data. The bars consistently get lower from left to right within each of the six vehicle age categories, which indicates the percentage injured is highest among older MY vehicles and lowest among newer MY vehicles.

Figure 1

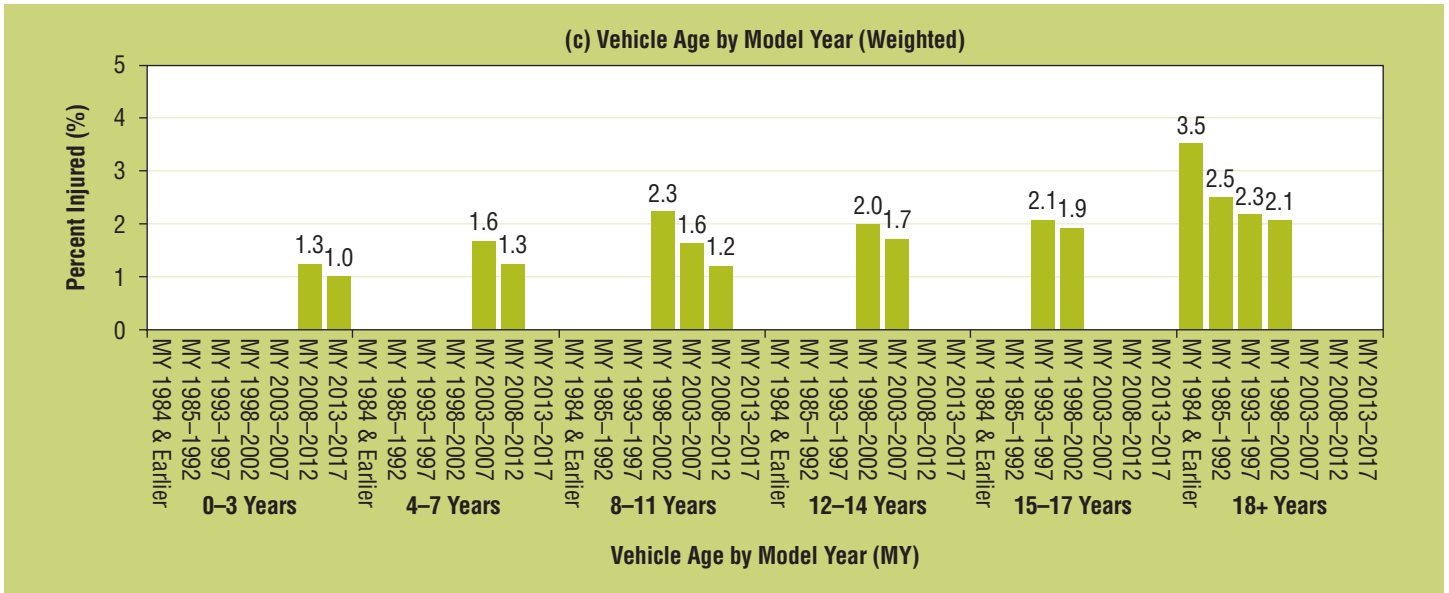
**Total Occupants (Shown in Label Text; n Is the Unweighted Sample Size) and Percentage Injured by Model Year and Vehicle Age in Police-Reported Crashes (GES 2012–2015 & CRSS 2016)**



## Conclusions

Using the most recent police-reported crash data, this analysis finds a similar pattern like the one shown for fatal crashes that a higher proportion of the occupants of older MY vehicle suffered a fatal, serious, and severity unknown injury. In addition, the proportion of vehicle occupants who were fatally, seriously, and severity unknown injured increases with the age of the vehicle.

This study is only a descriptive assessment of the relationship between occupant injury severity and the vehicle's age and MY. Statistical model analysis of the relationship between the injury risk and vehicle age/MY that control<sup>14</sup> for other factors (e.g., delta-V, seat belt use, age, sex) could be an interesting part of future analysis.



## References

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