Everyone's at Risk 2018
Assessing Fatality Rates in Crash Involvement for Motorists and Non-Motorists in Teen Driver Crashes by Risk Factor

From 2007 to 2016, fatalities of young drivers (15-20 years old) have declined by nearly 40% (NCSA, 2018). Despite that large reduction, overall, young drivers are still overrepresented in motor vehicle crashes. While these crashes are devastating for the teen drivers and their families, it is also important to understand the impact that these crashes have on other individuals. A previous AAA Foundation for Traffic Safety report examined the proportion of other people who died in crashes in 2013 involving a teen driver (ages 15 to 19) including passengers, occupants of other vehicles and nonmotorists (i.e., pedestrians and cyclists) (Tefft, 2015). That study's findings revealed that teen drivers accounted for 34% of all fatalities related to teen crashes, while passengers accounted for 27%, occupants of other vehicles 29% and nonmotorists 10%. This underscores the important impact that these crashes have on individuals other than the teen drivers themselves.

The present study uses 2016 data to update and expand on these findings by assessing the rate of fatalities for different individuals involved in a teen driver crash. Overall results show that there were roughly 1,053,000 crashes of all levels of severity involving a teen driver. These crashes involved approximately 2,864,000 individuals. Of these crashes, there were 3,270 deaths, yielding an overall fatality rate of 11.4 fatal injuries per 10,000 individuals involved.

Nonmotorists including pedestrians and cyclists showed the most dramatic likelihood of dying when involved in a teen crash, with nearly 4 deaths per 100 nonmotorists involved. When stratifying the rates of fatality by various risk factors, speeding resulted in about 35 deaths per 10,000 individuals involved in a teen driver crash, while nighttime driving resulted in 32 deaths per 10,000 individuals involved. Further, nearly 3 in 10 nonmotorists involved in a speeding-related teen driver crash died in 2016 and nearly 1 in 10 nonmotorists died in a teen driver-related crash that occurred at night.

METHODS

Data
Data used in this brief came from the 2016 National Highway Traffic Safety Administration (NHTSA), Fatality Analysis Reporting System (FARS), and the Crash Report Sampling System (CRSS). The FARS database includes all motor vehicle crashes on public roadways that result in a fatality within 30 days of the crash. The CRSS database is a nationally representative probability sample of all police-reported crashes in the United States.

Measures
The total number of crashes in 2016 involving drivers age 16 to 19 in passenger vehicles (i.e., cars, trucks, vans, minivans and SUVs) were estimated from the CRSS database. Fatalities from crashes involving teen drivers in passenger vehicles were identified from the

FARS database and were tabulated for teen drivers, passengers of teen drivers, occupants of other vehicles, and pedestrians and cyclists (i.e., nonmotorists).

In addition to tabulating the number of fatalities, fatality rates were calculated to explore differences across types of individuals involved in the crashes as well as the impact of different risk factors. Fatality rates were calculated according to the following equation:

$$\text{Fatality Rate}_{ij} = \frac{\text{Total Fatalities}_{ij}}{\text{Total Individuals}_{ij}} \times 10{,}000$$

where i represents the type of individual involved in the crash (i.e., all individuals, teen driver, passenger(s) of the teen driver, occupants of other vehicles and nonmotorists

including pedestrians and cyclists) and *j* represents the specific type of crash, described below. It follows that the total number of fatalities (derived from FARS) and the total number of individuals involved (derived from CRSS) varied by *i* and *j*. For example, the overall fatality rate (*i* = all individuals; *j* = all crashes involving teen drivers) was determined using the overall number of fatalities and individuals involved. In contrast, the fatality rate for passengers of teen drivers (*i* = passengers) was determined using the number of fatally injured passengers of teen drivers (*Total Fatalities*$_{Pass}$) and the total number of passengers of teen drivers (*Total Individuals*$_{Pass}$).

Certain risk factors, such as age of the driver (teens age 16-17 vs age 18-19), carrying only teen passengers, speeding, nighttime driving and driving during the summer months were analyzed and tabulated. For these analyses, the number of fatalities and the fatality rate for teen driver crashes where these factors (j) were present or absent were determined. In determining the fatality rates in this manner, the impact of these factors on fatalities in teen driver crashes is better explained.

Results

Overall Fatality and Fatality Rates in Teen Driver Crashes

In 2016, teen drivers were involved in an estimated 1,053,000 crashes involving nearly 2,864,000 individuals. In these crashes, there were 3,270 fatalities (Table 1). Therefore, in 2016, for every 10,000 individual involved in

a crash with a teen driver, 11.4 were fatally injured. Table 1 also shows how these fatalities were distributed among the different types of individuals. Of the 3,270 fatalities, 35.7% (1,169) were teen drivers, 22.6% (739) were passengers of teen drivers, 29.6% (969) were occupants of other vehicles and 11.6% (379) were nonmotorists (i.e., pedestrians and cyclists). The proportion of fatal injury is relatively similar to the results of a study conducted by the AAA Foundation in 2015 on crashes involving drivers ages 15 to 19 (Tefft, 2015). Of those killed in these crashes in 2013, 34% (988) were the teen drivers, 27% (783) were the passengers, 29% (847) were occupants of other vehicles and 10% (309) were nonmotorists.

The fatality rates also varied based on the type of individual involved in the crash (i.e., drivers, passengers, occupants of other vehicles, and nonmotorists; see Table 1). Results show that for every 10,000 teen drivers involved in a crash, roughly 10.5 were fatally injured. For the passengers of teen drivers, the rate is higher, with 15.5 deaths per 10,000 passengers involved in these crashes. Occupants of other vehicles (not driven by a teen driver) had a fatality rate of 7.7 deaths per 10,000. Nonmotorists, including pedestrians and cyclists, who were involved in a teen driver-related crash had the highest fatality rate: 443.6 deaths per 10,000 nonmotorists involved. This highlights the vulnerability of nonmotorists when involved in a car crash.

Table 1: Number, proportion and rate of fatalities (per 10,000 people involved) by road user type, 2016

	Teen Drivers	Passengers of Teen Drivers	Occupants of Other Vehicles	Other[a]	Pedestrians and Cyclists	Total
Number of Fatalities	1169	739	969	14	379	3270
Percent of All Fatalities	35.7%	22.6%	29.6%	0.4%	11.6%	100.0%
Number of Individuals Involved in crashes[b]	1,112,000	478,000	1,264,000	2,000	9,000	2,864,000
Fatality Rate (Per 10,000 road users)	10.5	15.5	7.7	70	443.6	11.4

[a] Other category includes individuals in parked vehicles or buildings

[b] Number of individuals involved in crashes are rounded estimates

Risk Factors Affecting Fatality Rates in Teen Driver Crashes

A number of risk factors were also examined in the context of fatal teen-related crashes. Table 2 shows the number and proportion of crashes:

- Where the teen driver was driving in a vehicle with all teen passengers, driving with an adult or driving by themselves.
- Involving young teen drivers (ages 16-17) versus older teen drivers (18-19).
- Involving speeding.

- Occurring at nighttime (9 p.m.-5 a.m.) versus daytime (5 a.m.-9 p.m.).
- Occurring during the summer (June- August) versus the rest of the year.

Fatality rates also differed according to these risk factors, shown in Table 3. The fatality rates are also compared in Table 3 using a fatality rate *ratio*, which represents the fatality rate for the group of interest divided by the rate for the reference group (marked by *). For example, the *ratio* of the fatality rate for teen drivers during nighttime driving is 3.6 (27.4 [Night] divided by 7.7 [Day]); thus, the fatality rate of teen drivers occurring at night is 3.6 times that of the fatality rates in daytime crashes.

Table 2: People killed in fatal crashes involving teen drivers by risk factor, 2016

Factor	Teen Drivers		Passengers of Teen Drivers		Other Motorists		Pedestrians and Cyclists		Total
	n	%	n	%	n	%	n	%	n
Overall	1169	35.7%	739	22.6%	969	29.6%	379	11.6%	3270
All passengers ages 13-19	287	27.4%	414	39.5%	266	25.4%	79	7.5%	1048
At least one passenger age 35 and over	18	10.7%	105	62.5%	35	20.8%	10	6.0%	168
No passengers	762	47.2%	NA	0.0%	599	37.1%	240	14.9%	1613
Driver age 16-17	404	34.8%	285	24.6%	352	30.3%	114	9.8%	1160
Driver age 18-19	759	36.0%	451	21.4%	626	29.7%	265	12.6%	2110
Driver speeding	479	49.6%	314	32.5%	138	14.3%	35	3.6%	966
Driver not speeding	629	28.9%	405	18.6%	802	36.8%	330	15.1%	2179
Crash 9 PM- 5 AM	420	37.3%	299	26.6%	227	20.2%	171	15.2%	1125
Crash 5 AM- 9 PM	735	34.5%	439	20.6%	741	34.8%	207	9.7%	2128
Crash during Summer	301	34.2%	214	24.3%	265	30.1%	97	11.0%	881
Crash during rest of year	868	36.3%	525	22.0%	704	29.5%	282	11.8%	2389

Table 3: Fatality rate per 10,000 road users involved in teen-driver crashes, 2016

Factor	Teen Drivers		Passengers of Teen Drivers		Other Motorists		Pedestrians and Cyclists		Total	
	Fatality Rate	Fatality Rate Ratio	Fatality Rate	Fatality Rate Ratio	Fatality Rate	Fatality Rate Ratio	Fatality Rate	Fatality Rate Ratio	Fatality Rate	Fatality Rate Ratio
Overall	10.5		15.5		7.7		443.6		11.4	
All passengers 13-19	14.2	1.4	15.4	NA	10.3	1.6	475.6	1.2	14.3	1.5
At least one passenger age 35 and over	3.8	0.4	13.7	NA	5.1	0.8	438.6	1.1	8.7	0.9
No passengers*	9.8		NA		6.6		405.7		9.5	
Driver age 16-17	9	0.8	13.7	0.8	6.7	0.8	373.5	0.8	9.8	0.8
Driver age 18-19*	11.8		17.5		8.1		482.6		12.6	
Driver speeding	40.3	6.3	57.5	5.9	13.2	1.9	3097.3	7.8	34.8	4.1
Driver not speeding*	6.4		9.8		6.9		398.4		8.5	
Crash 9 PM- 5 AM	27.4	3.6	38.8	3.5	18.7	2.9	1033.2	3.4	31.9	3.8
Crash 5 AM- 9 PM*	7.7		11		6.5		300.5		8.5	
Crash during Summer	10.9	1.0	18.1	1.2	8.5	1.1	441.1	1.0	12.4	1.1
Crash during rest of year*	10.4		14.6		7.4		444.5		11.1	

* Indicated for reference groups

Three major risk factors that increase the fatality rates in a crash are described in greater depth below, including nighttime driving, speeding, and carrying a passenger.

In 2016, there were 1,125 fatalities in crashes that occurred between 9 p.m. and 5 a.m. and involved a teen driver. While there were more teen driver-related crash fatalities during the day (2,128), fatality rates of teen driver-related crashes at night were 3.8 times that of fatality rates of these types of crashes during the day (31.9 versus 8.5 deaths per 10,000 individuals involved).

There were 966 fatalities in crashes that involved a speeding teen driver. Overall, in teen driver-related crashes, the fatality rate increased fourfold (rate ratio = 4.1) for crashes involving a speeding teen driver versus crashes in which the teen driver was not speeding (34.8 versus 8.5 deaths per 10,000 individuals involved).

It is important to note that the fatality rate of nonmotorists in crashes where the teen driver is speeding is almost eight times that in crashes involving a teen driver obeying the speed limit (3,097 versus 398 nonmotorist deaths per 10,000 nonmotorists involved). In simpler terms, roughly 3 out of 10 nonmotorists die in crashes where a speeding teen driver is involved. This increase in fatalities is likely present in speeding drivers of other age groups as well.

The presence of teen passengers in teen drivers' vehicles was associated with an increase in the fatality rate for people involved in a crash. There were 1,048 deaths in crashes that involved a teen driver carrying only teen passengers. Of these deaths, 287 were the teen drivers themselves and 414 passengers of these teen drivers. Overall, there was a 51% increase in the rate of fatalities for people involved in a crash with a teen driver carrying only teen passengers compared with crashes in which teen drivers were riding by themselves (14.3 versus 9.5 deaths per 10,000 individuals involved).

In addition, carrying only teen passengers in a teen driver's vehicle increased the risk of dying in a crash not only for the occupants of the vehicle but also for other people who share the road with them. Other motorists involved show a 56% increase (rate ratio = 1.6) in fatalities where they are involved in a crash with a teen driver, while nonmotorists experience a 17% increase (rate ratio = 1.2) in the same crashes compared with crashes in which the teen driver is driving alone.

Interestingly, when the teen driver is carrying at least one passenger age 35 and over, the overall fatality rate for those involved in a crash decreased by 8% compared to crashes in which teen drivers were riding by themselves (8.7 versus 9.5 deaths per 10,000 individuals involved). For teen drivers, the rate of fatality also drops by 61% (rate ratio = 0.4).

Seasonal factors (or time of year) also influenced the observed fatality rates. Results show that there was a slight increase in the fatality rate during the summer as opposed to the rest of the year (12.4 versus 11.1 deaths per 10,000 individuals involved). Also, teen driver age (16-17 versus 18-19 years) yielded different fatality rates. There was a slight decrease in fatality rate for people involved in a crash with a teen driver ages 16 to 17 versus teen drivers ages 18 to 19 (9.8 versus 12.6 deaths per 10,000 individuals involved).

DISCUSSIONS

The current results are consistent with previous findings (Tefft, 2015; Tefft, 2012a); of crashes where a teen driver is involved, the drivers represent roughly one-third of all fatalities. Roughly two other road users die for every one teen driver fatality. Upon further examination of the risk factors, it is evident that some factors increase the risk of fatality more than others.

For example, speeding and nighttime driving were identified as major fatal risk factors among crashes with teenage drivers, which is similar to the results revealed in other studies (Foss et al., 2011; Williams, 2003). Fatality rate drastically increases for all road users when these factors are involved — especially for pedestrians and cyclists involved in these types of crashes. At night, 1 out of 10 pedestrians involved in teen-driver related crashes dies. In cases where a speeding teen driver is involved, 3 out of 10 pedestrians in these crashes die. It is important to note that the vulnerability of pedestrians in these crashes would be evident regardless of the age of the driver.

Furthermore, this brief also shows that there is an increase in the risk of fatality in crashes where the teen driver is carrying only teen passengers. This increase not only applies to the occupants of the teen driver's vehicle but to everyone else on the road. However, there is a decrease in the risk of fatality in crashes where the teen driver is carrying a passenger age 35 or older.

These findings are similar to the findings of Tefft, Williams, and Grabowski (2012b) wherein the risk of teen driver death in a crash increased given the presence of younger passengers (ages 21 and younger). It should also be noted that in the same study, the risk of death for these drivers decreased in the presence of a passenger age 35 and older.

Collectively, these results underscore the impact that teen driver crashes have on other road users. Risky driving conditions, such as those examined here, not only increases the risk of fatality for teen drivers, but also for other individuals who share the road with them. As young novice drivers continue to develop their driving skills, it is important to educate and make them aware of the increased danger certain factors such as speeding, driving at night and carrying passengers pose.

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