



# Comparing Demographic Trends in Vulnerable Road User Fatalities and the U.S. Population, 1980–2019

## Summary

Vulnerable road users (VRUs) include motorcyclists, pedestrians, pedalcyclists, and other nonoccupants. VRUs are at an increased risk of fatality in motor vehicle traffic crashes compared to other road users. According to the National Highway Traffic Safety Administration's Fatality Analysis Reporting System (FARS), VRU fatalities have decreased overall from 14,308 in 1980 to 12,352 in 2019. However, the proportion of traffic fatalities for VRUs was 28 percent in 1980 and increased to 34 percent by 2019.

There are also fluctuations in the data from 1980 and 2019, showing the lowest proportions between the 1990s and early 2000s. Starting in 2000, VRU fatalities have been steadily increasing with some fluctuations. The increases in VRU fatalities and the VRU proportion of traffic fatalities since 2001 is concerning. These VRU fatality trends were further studied in this research note by looking at trends seen in the age group proportions of the U.S. population reported by the Census Bureau.

- U.S. population median age has increased from 30 in 1980 to 38 in 2019.
- In the U.S. population, the younger age group (<20 and 20-to-29 years old) proportions are decreasing, while older age group (50-to-59, 60-to-69, and 70+ years old) proportions are slowly increasing.
- VRU fatality median age has increased from 26 in 1980 to 46 in 2019.
- Since 2009 VRU fatality rates have been trending upward; 3.00 in 2009 to 3.68 in 2019 for overall VRU fatality rates, accounting for a 23-percent increase.
- Motorcyclist fatality rates showed decreasing trends in the younger age groups (<20 and 20-to-29) while

steadily increasing in some of the middle to older age groups (40-to-49, 50-to-59, and 60-to-69).

- Pedestrian fatality rates were the highest in the 70+ age group during most of the years.
- Pedalcyclist fatality rates decreased dramatically for the <20 age group from 1980 to 2019.

## Introduction

VRUs are people at the highest risk for fatalities in traffic crashes. These road users are motorcyclists, pedestrians, pedalcyclists, and other nonoccupants and are outside vehicles, subject to outdoor elements that may increase susceptibility to harmful events in traffic crashes. Additionally, VRUs pose a low risk to other road users.<sup>1 2 3</sup> NHTSA began reporting on the proportion of fatalities inside versus outside vehicles in the *2015 Motor Vehicle Crashes: Overview* (Report No. DOT HS 812 318).<sup>4</sup> This comparison explored the growing incidence of VRU fatalities seen each year.

<sup>1</sup> National Safety Council. (n.d.). *Road to zero safety priority statement vulnerable road users* [Web page]. <https://cloud.safe.nsc.org/road-to-zero-safety-priority-statements-vulnerable-road-users>

<sup>2</sup> Scientific Expert Group on the Safety of Vulnerable Road Users. (1998, August). *Safety of vulnerable road users*. Organisation for Economic Co-operation and Development. [https://safety.fhwa.dot.gov/ped\\_bike/docs/oecd\\_safety.pdf](https://safety.fhwa.dot.gov/ped_bike/docs/oecd_safety.pdf)

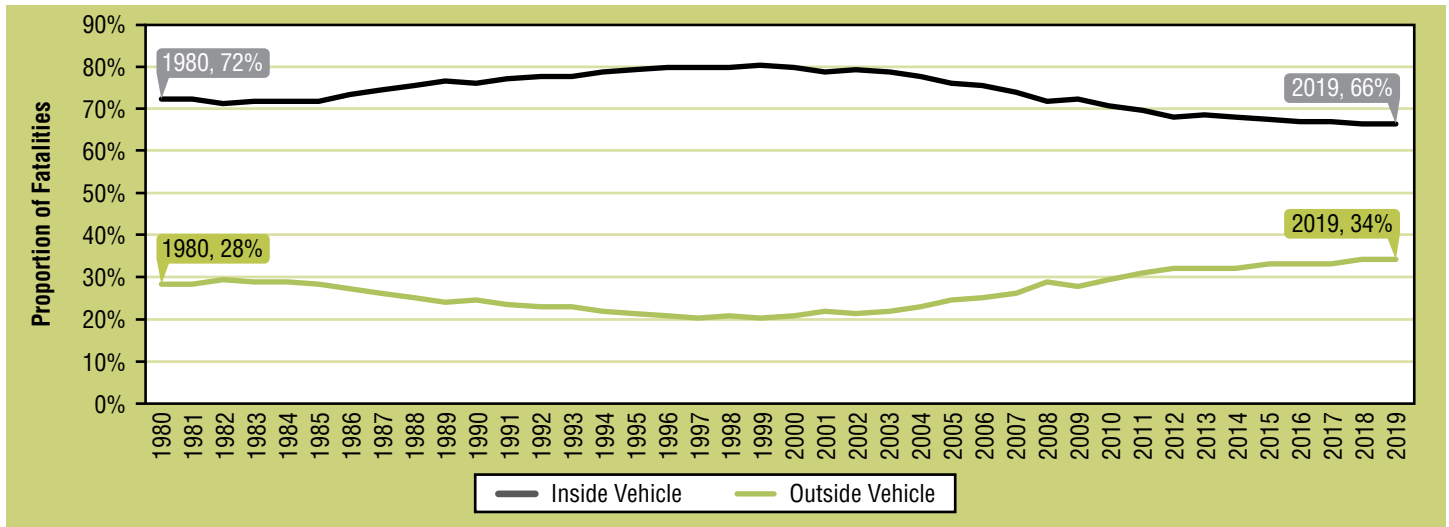
<sup>3</sup> Permanent International Association of Road Congresses. (n.d.). *Safety of vulnerable road users* [Web page and portal]. <https://rno-its.piarc.org/en/network-operations-its-road-safety/vulnerable-road-users>

<sup>4</sup> National Center for Statistics and Analysis. (2016, August). *2015 motor vehicle crashes: Overview* (Traffic Safety Facts Research Note. Report No. DOT HS 812 318). National Highway Traffic Safety Administration. Available at <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812318>

In 1980 the proportion of traffic fatalities outside vehicles was 28 percent, or 14,308 fatalities, as shown in Figure 1. A decrease in the proportion of these fatalities started in 1986 where it came down to the lowest at 20 percent in 1996. The 1990s and early 2000s showed the lowest proportions of fatalities of people outside vehicles. However, this reduction was short lived and the proportion of fatalities outside vehicles began to increase. Since 2001 the proportion of fatalities in traffic crashes for VRUs has been increasing and correspondingly the propor-

tion of fatalities of people inside vehicles (passenger car, light truck, large truck, bus, and other vehicle occupants) has been decreasing. Even though the number of fatalities inside vehicles is decreasing, the number of fatalities outside vehicles is increasing, which contributes to the increases in proportion of fatalities in traffic crashes. Starting in 2011 the proportion of fatalities outside of vehicles exceeded 30 percent. In 2019 the proportion of fatalities for the VRUs (outside vehicles) was 34 percent, or 12,352 fatalities.

Figure 1  
**Proportion of Fatalities Inside/Outside Vehicle, 1980–2019**



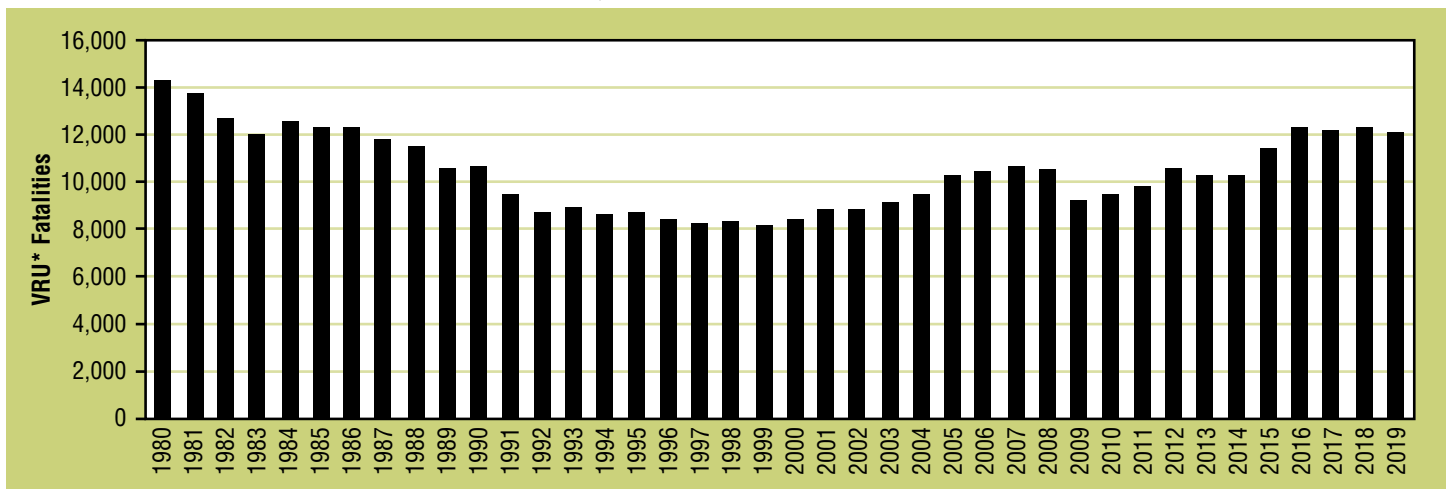
Source: FARS 1980-2018 Final File, 2019 ARF

Note: "Inside Vehicle" includes occupants of passenger cars, light trucks, large trucks, buses, and other vehicles. "Outside Vehicle" includes motorcyclists, pedestrians, pedalcyclists, and other nonoccupants.

Excluding the other/unknown nonoccupants, Figure 2 shows the counts of VRU fatalities from 1980 to 2019. Overall, VRU fatalities decreased followed by an increas-

ing trend in recent years. Similar to Figure 1, the VRU fatalities were lower in the 1990s to early 2000s.

Figure 2  
**Vulnerable Road User Fatalities in Traffic Crashes, 1980–2019**



Source: FARS 1980-2018 Final File, 2019 ARF

\*Excludes other/unknown nonoccupants.

While VRU fatalities are increasing as a whole, it is important to assess the fatality trends in the VRU categories separately.

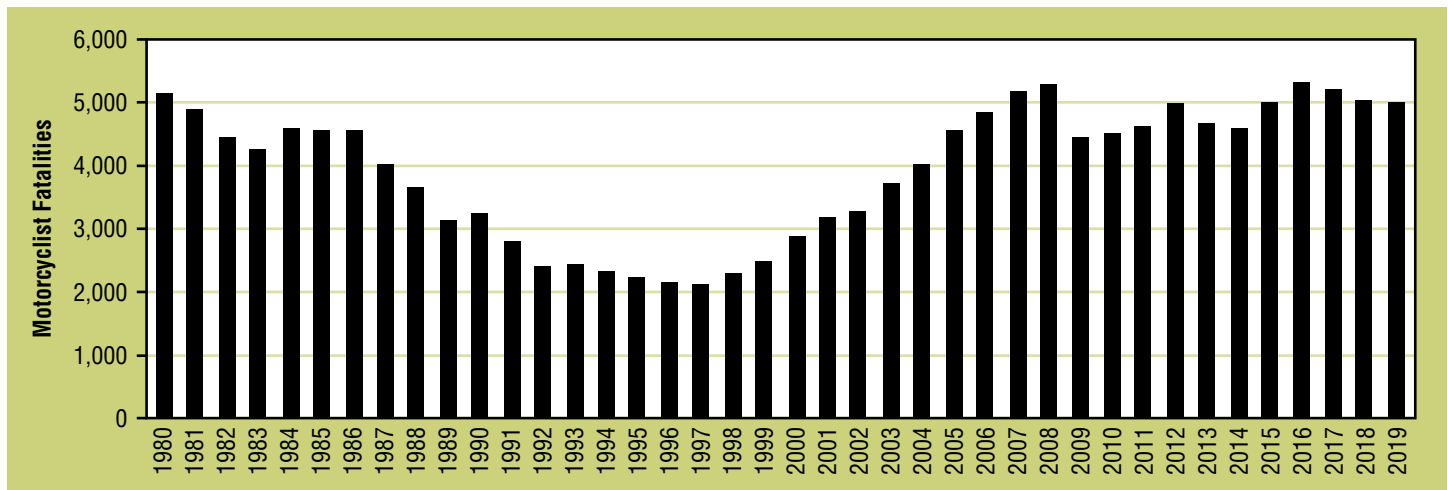
### *Motorcyclists*

In 1980 there were 5,144 motorcyclist fatalities, 40 percent of the total 14,308 VRU fatalities, as shown in Figure 3. Motorcyclist fatalities decreased to 2,116 in 1997. Starting in 1998 motorcyclist fatalities have been steadily increasing. In 2008 motorcyclist fatalities increased to 5,312, half of all VRU fatalities. In the following 6 years motorcyclist fatalities decreased and remained relatively steady. However, motorcyclist fatalities again exceeded 5,000 starting in 2015 and hit the highest on record number

at 5,337 in 2016. Motorcyclist fatalities in 2019 slightly decreased from 2018, from 5,038 to 5,014. In 2019, motorcyclist fatalities accounted for 41 percent of the VRU fatalities.

During this same time the number of registered motorcycles showed fluctuating trends. In 1980 there were 5,693,940 registered motorcycles according to the Federal Highway Administration (FHWA). Registered motorcycles decreased to the lowest in 1994 at 3,756,555. This decrease was short-lived and was followed by a steady increase. By 2019 there were 8,595,314 registered motorcycles.

Figure 3  
**Motorcyclist Fatalities in Traffic Crashes, 1980–2019**



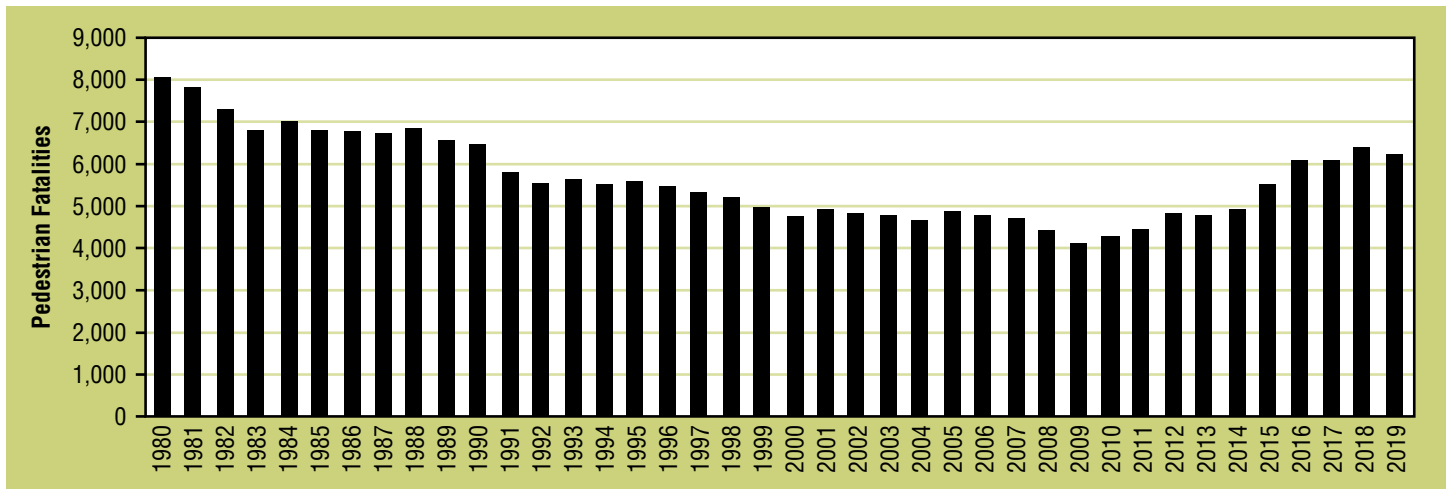
Source: FARS 1980-2018 Final File, 2019 ARF

### *Pedestrians*

Pedestrians had the greatest number of fatalities throughout the years of the VRU groups in this research note. In 1980 there were 8,070 pedestrian fatalities, 56 percent of VRU fatalities. Pedestrian fatalities then steadily decreased for nearly 30 years, as shown in Figure 4. In

2009 there were 4,109 pedestrian fatalities, the lowest number on record. However, starting in 2010 the number of pedestrian fatalities began increasing again. In 2019 there were 6,205 pedestrian fatalities, half of all VRU fatalities.

Figure 4  
**Pedestrian Fatalities in Traffic Crashes, 1980–2019**



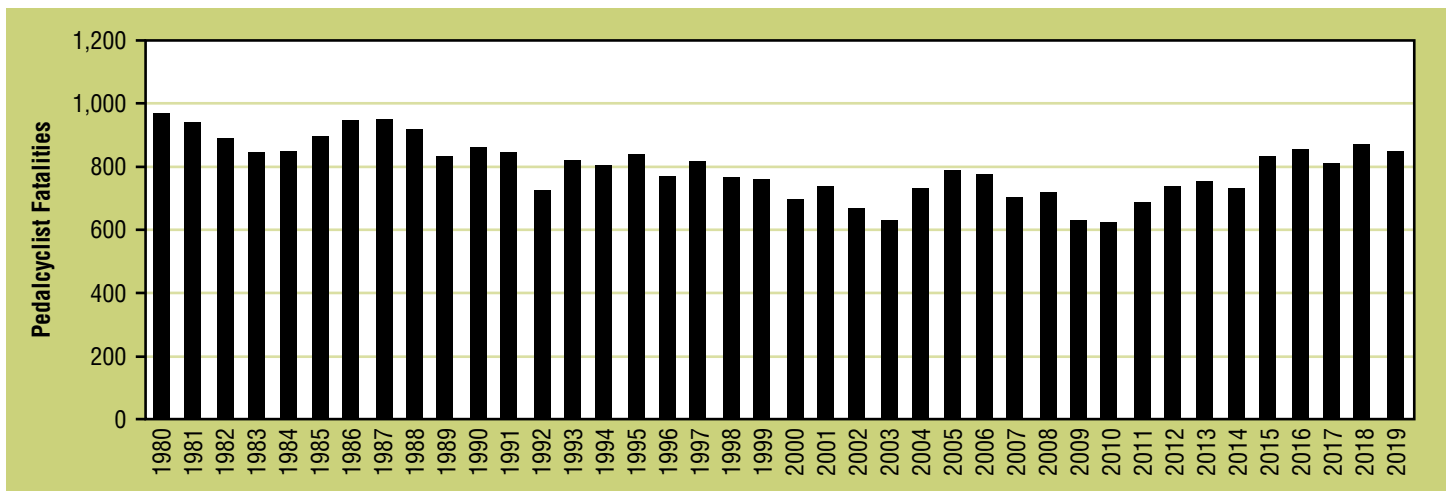
Source: FARS 1980-2018 Final File, 2019 ARF

### *Pedalcyclists*

Pedalcyclists (bicyclists and other cyclists) make up the lowest proportion of fatalities among the VRU categories. The number of pedalcyclist fatalities has fluctuated since 1980, as shown in Figure 5. In 1980 there were 965 pedalcyclist fatalities, only 7 percent of the VRU fatalities. The lowest number of pedalcyclist fatalities recorded was

623 in 2010, a 35-percent decrease from 1980. However, regardless of the overall decrease in fatalities, starting in 2011 the number of pedalcyclist fatalities started slowly increasing again. There were 846 pedalcyclist fatalities in 2019.

Figure 5  
**Pedalcyclist Fatalities in Traffic Crashes, 1980–2019**



Source: FARS 1980-2018 Final File, 2019 ARF

### **Data and Methodology**

This research note contains information on fatal traffic crashes based on data from FARS. Refer to the end of this publication for more information on FARS. This research note also contains U.S. population data from the Census

Bureau. Data was analyzed from 1980 to 2019 to examine if there were similar trends in the VRU fatalities and U.S. population.

## FARS

VRUs were the primary focus of this research note. Motorcyclist, pedestrian, and pedalcyclist fatalities and fatality rates per resident population were explored for trends in age and sex while comparing these trends to those in the U.S. population. Other/unknown nonoccupant fatalities were excluded from the total VRU count for the rest of this analysis (only Figure 1 had other/unknown nonoccupants included in the calculation).

Age was broken down into seven groups of interest (<20, 20-to-29, 30-to-39, 40-to-49, 50-to-59, 60-to-69, and 70+). Within each age group, a breakdown of sex (male versus female) is shown. The proportions and traffic fatality rate per 100,000 population for males and females in each age group was analyzed to see if there were any comparisons between these same groups in the U.S. population.

## Census Bureau

For this analysis the total U.S. population data from the Census Bureau for age and sex was used. It was assumed that the full U.S. population is considered a VRU since data is not available to understand the overall proportion of people who participate in riding motorcycles, riding bicycles, or walking every day.

The same seven age groups were used. Like the VRU fatalities, these age groups were separated by sex. The

proportions for males and females of each age group were calculated to compare to the breakdown of VRU fatality trends.

## Data Analysis

### U.S. Population

When looking at age groups, there are visible population trends, as seen in Table 1.

From 1980 to 2019:

- The proportion of the population in the <20 age group decreased from 32 percent to 25 percent.
- Similarly, the proportion of the population in 20-to-29 age group decreased from 18 percent to 14 percent.
- In both the 30-to-39 and 40-to-49 age groups there were increases in the proportions of the population followed by decreases.
- With the 50-to-59 age group there was a slight decrease followed by a steady increase in the proportion of the population.
- In the 60-to-69 age group the proportion of the population remained steady with little fluctuation, but then started to gradually increase.
- The 70+ age group proportions are slowly increasing.

Table 1

**Percentage of U.S. Population, by Age Group and Sex, 1980–2019**

Year	Age Group, by Sex																				
	<20			20-29			30-39			40-49			50-59			60-69			70+		
	%M	%F	%T	%M	%F	%T	%M	%F	%T	%M	%F	%T	%M	%F	%T	%M	%F	%T	%M	%F	%T
1980	33	30	<b>32</b>	19	18	<b>18</b>	14	14	<b>14</b>	10	10	<b>10</b>	10	10	<b>10</b>	8	9	<b>8</b>	6	9	<b>7</b>
1985	31	28	<b>30</b>	19	17	<b>18</b>	16	16	<b>16</b>	11	11	<b>11</b>	9	9	<b>9</b>	8	9	<b>9</b>	6	10	<b>8</b>
1990	30	27	<b>29</b>	17	16	<b>16</b>	17	16	<b>17</b>	13	13	<b>13</b>	9	9	<b>9</b>	8	9	<b>8</b>	7	10	<b>8</b>
1995	30	27	<b>29</b>	14	14	<b>14</b>	17	16	<b>17</b>	14	14	<b>14</b>	9	10	<b>9</b>	7	8	<b>8</b>	7	11	<b>9</b>
2000	30	27	<b>29</b>	14	13	<b>14</b>	16	15	<b>15</b>	15	15	<b>15</b>	11	11	<b>11</b>	7	8	<b>7</b>	7	11	<b>9</b>
2005	29	27	<b>28</b>	14	13	<b>14</b>	14	13	<b>14</b>	15	15	<b>15</b>	13	13	<b>13</b>	8	8	<b>8</b>	7	10	<b>9</b>
2010	28	26	<b>27</b>	14	13	<b>14</b>	13	13	<b>13</b>	14	14	<b>14</b>	14	14	<b>14</b>	9	10	<b>10</b>	8	10	<b>9</b>
2015	27	25	<b>26</b>	15	14	<b>14</b>	13	13	<b>13</b>	13	13	<b>13</b>	14	14	<b>14</b>	11	11	<b>11</b>	9	11	<b>10</b>
2019	26	24	<b>25</b>	14	13	<b>14</b>	14	13	<b>13</b>	12	12	<b>12</b>	13	13	<b>13</b>	11	12	<b>12</b>	10	12	<b>11</b>

Source: Census Bureau

Overall, the proportion of U.S. population in the younger age groups are decreasing while those in the older age groups are increasing. When combining data for those 50 and older, the proportion was 26 percent in 1980, but jumped to 36 percent in 2019. This trend is opposite of the youngest age group (<20) who represented 32 percent of the population in 1980 compared to 25 percent in 2019.

Few differences are observed between the population proportions for males and females in each age group. The <20 and 70+ age groups showed the biggest difference in male and female proportions. Throughout the years studied there was a 2- to 3-percent difference in the <20 age group and a 2- to 4-percent difference in the male and female proportions of the 70+ age group for each year of Table 1.

Table 2  
**Median Age of U.S. Population and Road User Fatalities, 1980–2019**

Year	Population	Non-Vulnerable Road Users	Vulnerable Road Users			
			Total*	Motorcyclists	Pedestrians	Pedalcyclists
1980	30	27	26	24	34	15
1985	31	29	27	24	36	16
1990	32	31	32	27	39	23
1995	34	34	36	30	40	27
2000	35	35	39	36	43	36
2005	36	36	41	38	45	41
2010	37	39	44	42	46	46
2015	37	39	45	42	48	48
2019	38	42	46	42	49	51

Sources: FARS 1980–2018 Final File, 2019 ARF; Population—Census Bureau  
\*Excludes other/unknown nonoccupants.

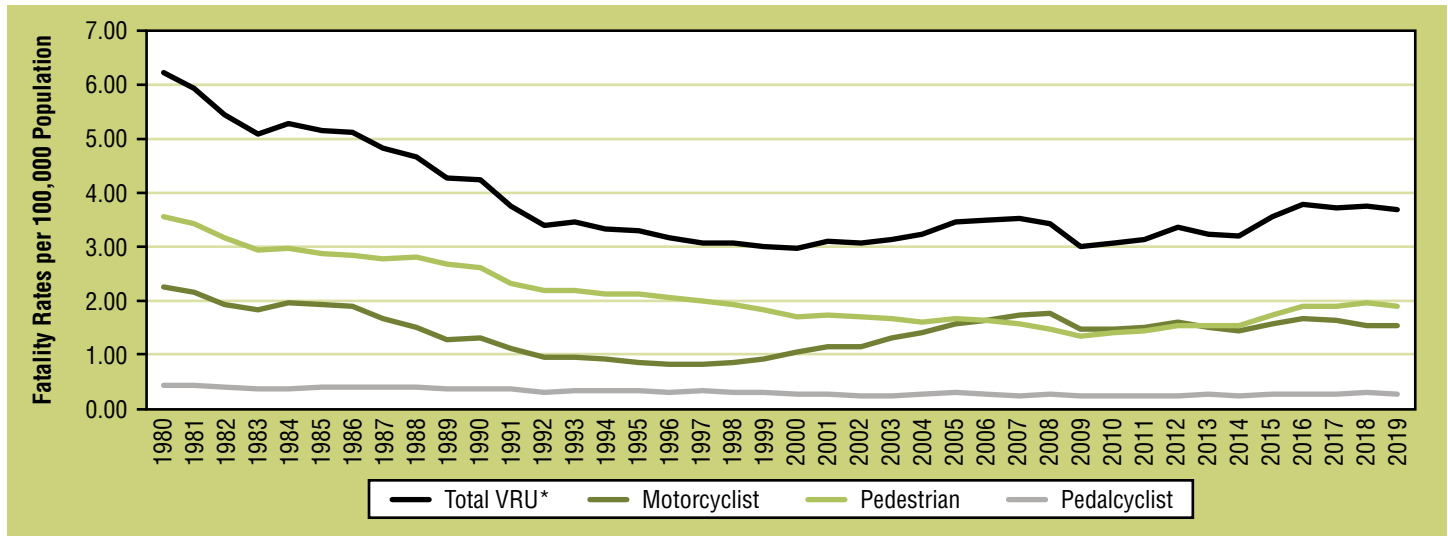
The overall VRU fatality rate started at 6.24 per 100,000 population in 1980, as shown in Figure 6. The overall fatality rate steadily decreased until 2000 when it reached the lowest fatality rate of 2.96 per 100,000 population. Unlike pedestrian and pedalcyclist fatality rate trends, the motorcyclist fatality rate started to increase

### *Vulnerable Road Users*

The median age of the U.S. population has been gradually increasing. In 1980, the first year in which exposure data was available by age, the population median age was 30 and rose to 38 by 2019, as seen in Table 2. Similarly, the median age of VRU fatalities has been increasing but at a faster pace. The median age of VRU fatalities was 26 in 1980 and increased to 46 in 2019. Pedalcyclist fatalities had the lowest median age among VRU groups in 1980 but by 2019 jumped to the highest. For pedestrian fatalities the median age has been the highest of VRU groups until 2010. For motorcyclist fatalities the median age was 24 in 1980 but rose to 42 by 2019. Non-VRU fatalities have also been increasing in age, but not as fast as VRUs.

in 1998. All fatality rates showed varying drops in 2009 followed by gradual increases with slight fluctuations. Pedalcyclist fatality rates were the lowest of the VRU groups throughout all the years, which makes it harder to see these trends.

Figure 6  
**Vulnerable Road User Fatality Rates, 1980–2019**



Sources: FARS 1980-2018 Final File, 2019 ARF; Population—Census Bureau  
 \*Excludes other/unknown nonoccupants.

### Motorcyclists

Overall, the female motorcyclist fatality rates were much lower than the male motorcyclist fatality rates in all age groups, as shown in Figure 7.

For the <20 and 20-to-29 age groups motorcyclist fatality rates were the highest in the early years for males and females. The motorcyclist fatality rates for males and females in the <20 age group steadily decreased since 1980. Similarly, the 20-to-29 age group fatality rates gradually decreased but started fluctuating around 2000.

With the 30-to-39 age group, there were more noticeable changes in the male motorcyclist fatality rates than the female motorcyclist fatality rates. The male motorcyclist fatality rates for the 30-to-39 age group were higher in the earlier years and steadily declined until around 1998,

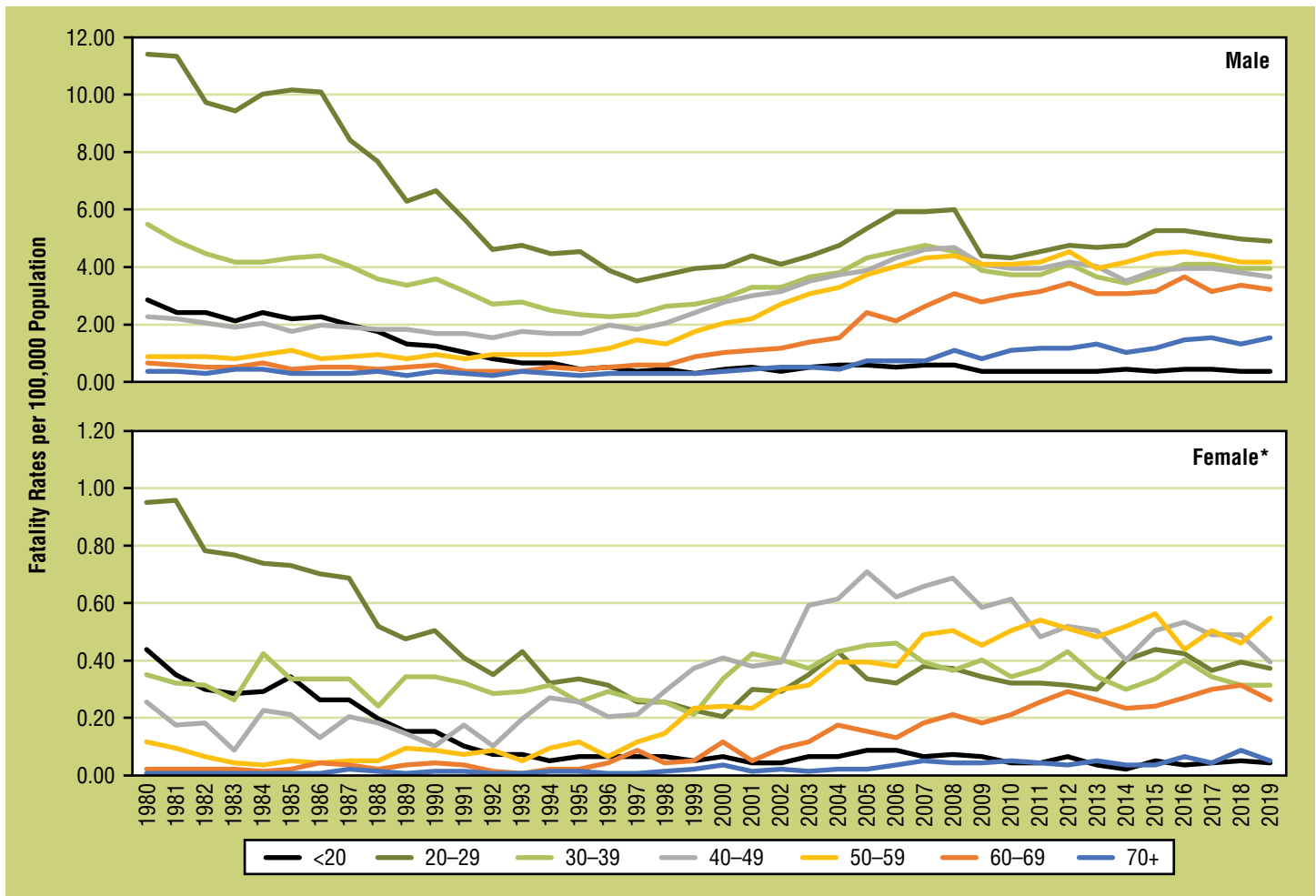
when the rates started to increase. However, the female motorcyclist fatality rates for the 30-to-39 age group did not show a consistent pattern.

The motorcyclist fatality rate for males in the 40-to-49 age group started to slowly increase in the 1990s. Starting in 1998 the female motorcyclist fatality rate for the 40-to-49 age group jumped before it started to decrease again.

In the 50-to-59, 60-to-69, and 70+ age groups, there were similar trends in motorcyclist fatality rates showing gradual increases since the 1980s. Of these three groups, females in the 70+ age group showed very minor increases in fatality rates. These three age groups show slight variations.



Figure 7  
**Motorcyclist Fatality Rates per 100,000 Population, by Age Group and Sex, 1980-2019**



Sources: FARS 1980-2018 Final File, 2019 ARF; Population—Census Bureau  
 \*Y-axis bounds differ from the Male graph to show detail of the data.

## Pedestrians

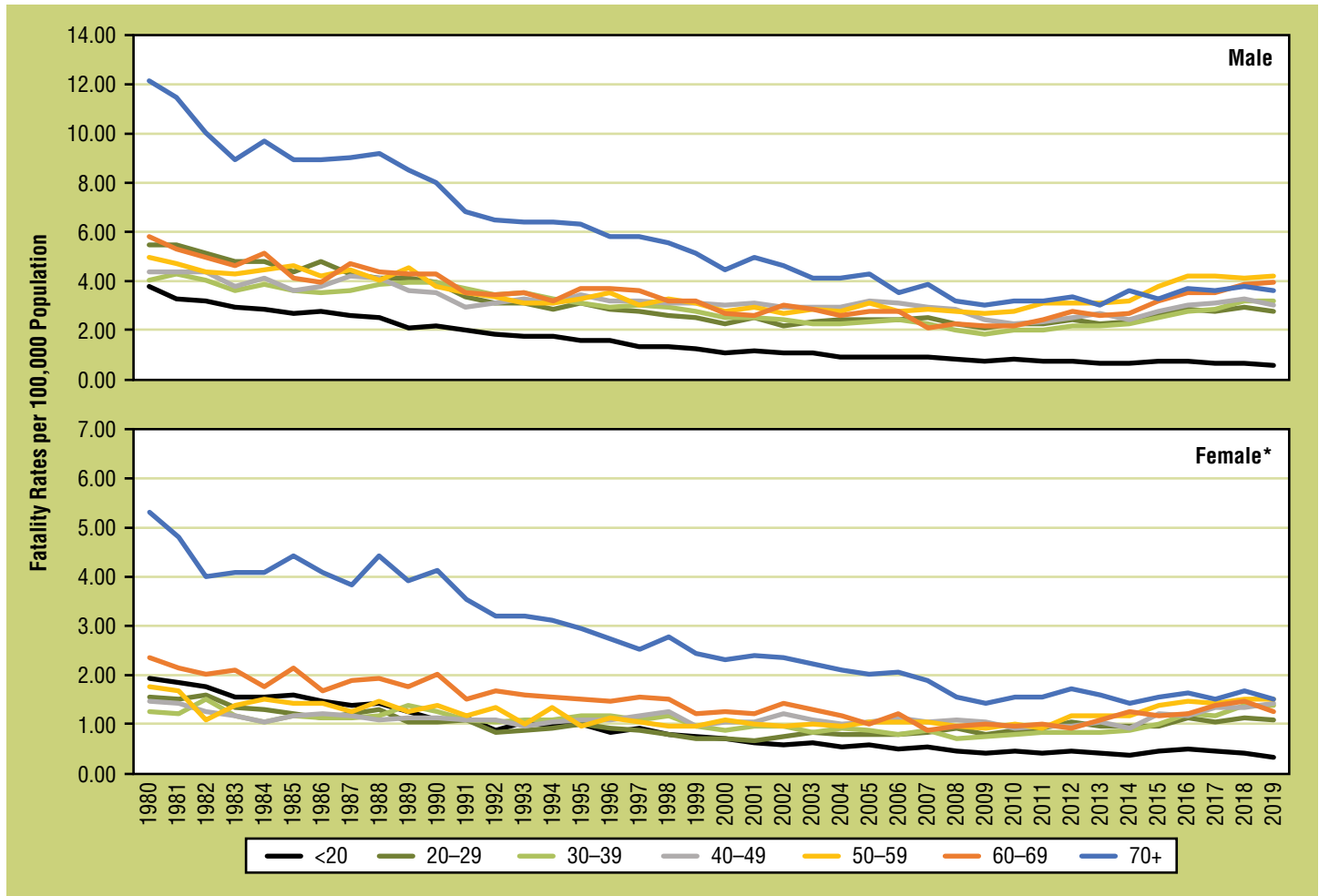
Pedestrian fatality rates showed similar trends throughout the years between males and females in all the age groups, as shown in Figure 8. Like the motorcyclist fatality rates, the pedestrian fatality rates were lower for females. In general, pedestrian fatality rates declined in all the age groups regardless of sex from 1980 to 2019 with the most dramatic decreases being in the 70+ age group. However, there were still a few increasing trends.

The <20 age group showed declines in the pedestrian fatality rates from 1980 to 2019. In 2011 and 2012 pedes-

trian fatality rates started to increase in the 20-to-29, 30-to-39, 40-to-49, 50-to-59, and 60-to-69 age groups for males and females. This trend is also shown in the overall pedestrian and VRU fatality rates in Figure 6, as those overall rates started increasing around 2010. Following the ongoing declines in the 70+ age group, there was a plateau from 2010 to 2019. The <20 age group continues to show a decreasing trend in males and females.



Figure 8  
**Pedestrian Fatality Rates per 100,000 Population, by Age Group and Sex, 1980-2019**



Sources: FARS 1980-2018 Final File, 2019 ARF; Population—Census Bureau  
 \*Y-axis bounds differ from the Male graph to show detail of the data.

### *Pedalcyclists*

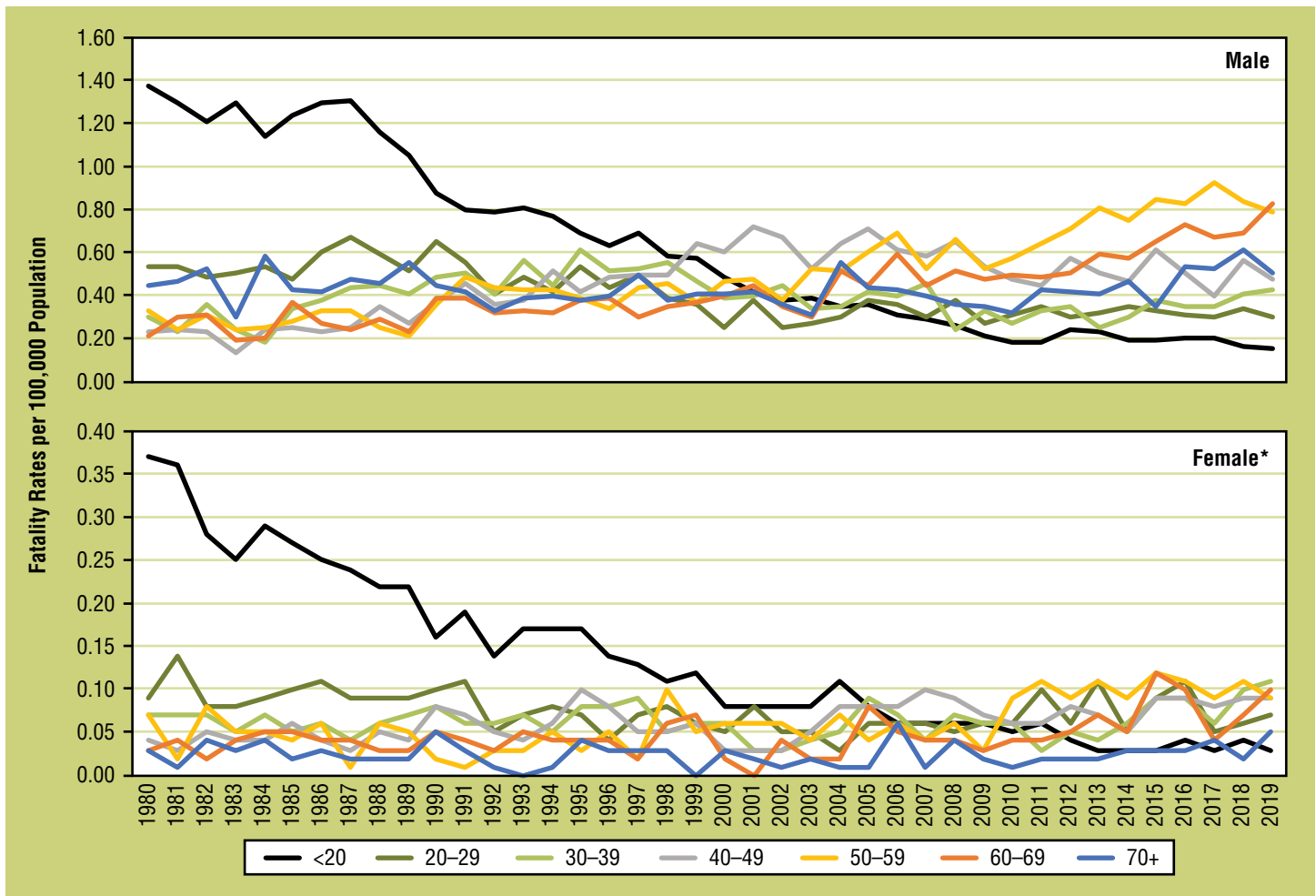
As with the other VRU groups, females had lower fatality rates than males, as shown in Figure 9.

The pedalcyclist fatality rates showed consistent drops in the <20 age group for both males and females, with few years showing variations in this downward trend. In the 20-to-29 and 30-to-39 age groups, there are many fluctuations. The male pedalcyclist fatality rates in the 20-to-29 age group overall showed slight decreases from 1980 to 2019.

The 40-to-49 and 70+ age groups had many variations. Overall, the males and females in the 40-to-49 age group showed slight increases in fatality rates since 1980. The 70+ age group fluctuated greatly and had small increases overall for the male fatality rate.

Male and female pedalcyclist fatality rates are increasing in the 50-to-59 and 60-to-69 age groups. The female pedalcyclist fatality rate showed more fluctuations from 1980 to 2010 in these two age groups.

Figure 9  
**Pedalcyclist Fatality Rates per 100,000 Population, by Age Group and Sex, 1980-2019**



Sources: FARS 1980-2018 Final File, 2019 ARF; Population—Census Bureau  
 \*Y-axis bounds differ from the Male graph to show detail of the data.

## Conclusions

Specific VRU exposure measures are not available for the U.S. population by age and sex from the Census Bureau. Therefore, this analysis assumed that the whole U.S. population is considered a VRU. However, the actual proportion of VRUs in the population could be different. Within the U.S. population as the proportion of the younger age groups decrease year-to-year the older age groups are slowly increasing. Even though the <20, 20-to-29, and 30-to-39 age group proportions are decreasing, these groups still make up over half of the U.S. population. Specifically, the <20 age group accounted for 25 percent of the U.S. population in 2019.

The median age of the U.S. population has been steadily increasing since 1980, which is understandable based on the increasing proportions in the older age groups. This trend may be due to specific generations such as the

baby boomers (those born from mid-1946 to mid-1964) aging.<sup>5</sup> The baby boom era was marked with a rise in birth rates, and now there is an increase in the proportions of people age 50 and older that may be attributable to this birth cohort. Per the Census Bureau, it is projected that over 20 percent of the U.S. population will be over the age of 65 in the year 2030, and by 2056 this age group is expected to surpass the 18 and younger group.<sup>5</sup>

<sup>5</sup> Colby, S. L. & Ortman, J. M. (2014). *The baby boom cohort in the United States: 2012 to 2060*. Current Population Reports, P25-1141. U.S. Census Bureau. Available at [www.census.gov/content/dam/Census/library/publications/2014/demo/p25-1141.pdf](http://www.census.gov/content/dam/Census/library/publications/2014/demo/p25-1141.pdf)

The Census Bureau also projects the total population's life expectancy to increase by about six years in 2060.<sup>6</sup> An increasing life expectancy may be influential to the median age increase.

Increases in the fatality rates seen throughout the VRUs could be influenced by these generational changes to the population. Additionally, the data suggests that older people are participating in more active forms of transportation, such as biking and walking, in 2019 compared to 1980. The most noticeable similarities found were between the motorcyclist fatality rates and the age shift in population proportions, which showed the younger

age groups decreasing while the older age groups were increasing. Pedalcyclist fatality rates shifted with the largest rates in the <20 and 20-to-29 age groups in the 1980s to the 40-to-49, 50-to-59, and 60-to-69 age groups in 2019. In 2019, the <20 age group had the lowest motorcyclist, pedestrian, and pedalcyclist fatality rates.

In summary, this research note observed similar trends in the VRU fatality rates and U.S. population age group proportions. These trends might be influenced by generational age changes in the U.S. population, increasing life expectancy, and increased mobility in the older population.

## Fatality Analysis Reporting System

FARS contains data on every fatal motor vehicle traffic crash within the 50 States, the District of Columbia, and Puerto Rico. To be included in FARS, a traffic crash must involve a motor vehicle traveling on a public trafficway that results in the death of a vehicle occupant or a nonoccupant within 30 days of the crash. The Annual Report File (ARF) is the FARS data file associated with the most recent available year, which is subject to change when it is finalized the following year to the final version known as the Final File. The additional time between the ARF and the Final File provides the opportunity for submission of important variable data requiring outside sources, which may lead to changes in the final counts. More information on FARS can be found at [www.nhtsa.gov/crash-data-systems/fatality-analysis-reporting-system](http://www.nhtsa.gov/crash-data-systems/fatality-analysis-reporting-system).

The updated final counts for the previous data year will be reflected with the release of the recent year's ARF. For example, along with the release of the 2019 ARF, the 2018 Final File was released to replace the 2018 ARF. The final fatality count in motor vehicle traffic crashes for 2018 was 36,835, which was updated from 36,560 in the 2018 ARF. The number of total VRU fatalities from the 2018 Final File was 12,503, which was updated from 12,339 from the 2018 ARF.

The 2016 and 2017 Final Files have been amended, but this amendment did not change the overall number of fatal crashes or fatalities. However, the number of motorcycle fatalities from the 2017 amended Final File was 5,226, which was updated from 5,229 from the 2017 Final File.

<sup>6</sup> Medina, L., Sabo S., & Vespa, J. (2020). *Living longer: Historical and projected life expectancy in the United States, 1960 to 2060*. Current Population Reports, P25-1145. U.S. Census Bureau. Available at [www.census.gov/content/dam/Census/library/publications/2020/demo/p25-1145.pdf](http://www.census.gov/content/dam/Census/library/publications/2020/demo/p25-1145.pdf)

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