Crashes Involving Senior Drivers in Michigan: 2014-2018

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Contents

1.0 Executive Summary

This report highlights the crash patterns related to senior drivers aged 65 and over in Michigan from 2014 to 2018. Highlights of the analysis include:

- Senior driver crashes have been steadily increasing over the last five years; these crashes have a slightly higher probability of involving injuries compared to crashes not involving senior drivers (20.8% vs. 17.5%).
- Senior driver crashes involved more head-on and angle crashes than crashes not involving senior drivers and fewer single motor vehicle crashes.
- Senior drivers are found to be involved in more crashes during weekday afternoons (11 am to 6 pm), in daylight conditions, and in clear weather, consistent with the travel patterns of senior drivers.
- Crashes involving senior drivers occurred more often at intersections and on mid-speed roads (speed limits 35-50 mph).
- Senior drivers were less often involved in alcohol crashes or pedestrian crashes compared to crashes involving only drivers younger than 65.

2.0 Introduction

This report utilizes crash data involving senior drivers age 65 and over in Michigan from 2014 to 2018. Michigan traffic crashes are defined as taking place on public roadways in Michigan, involving at least one motor vehicle in transport, and resulting in death, injury, or property damage of $1,000 or more. Safety problems for the senior driver are directly tied to the aging process, including changes in vision, physical fitness, and reflexes, which can contribute to driving errors[1]. Senior drivers generally drive less and at different times of day compared to younger drivers, so they have a different crash pattern. In this analysis, senior drivers are found to be involved in more crashes during the afternoon, on weekdays, in daylight, at moderate speed limits, and at intersections.

3.0 Crash Counts, Types, and Severity

As shown in Figure 1, crash counts for senior drivers have increased each year since 2014, increasing about 14.7% over this period. However, these crash counts are not normalized by exposure, making it difficult to determine whether the increase reflects an increase in the number of senior drivers on the road or a worsening of senior driver safety.

Michigan vehicle miles traveled (VMT) increased each over the same time period, which may have an impact on overall crash counts as well as those for senior drivers. Statewide VMT increased from 93.4 billion in 2014 to 102.4 billion in 2018, an increase of 9.6%. In addition, there was a greater proportion of senior drivers on the road. In 2014, 19.1% of the total licensed drivers in Michigan were age 65 and over. By 2018, the senior licensed driver percentage had increased to 21.1%. Between 2014 and 2018, the number of licensed drivers in Michigan increased by 12.2%. The number of senior drivers has increased every year since 2011 when baby boomers started turning 65.

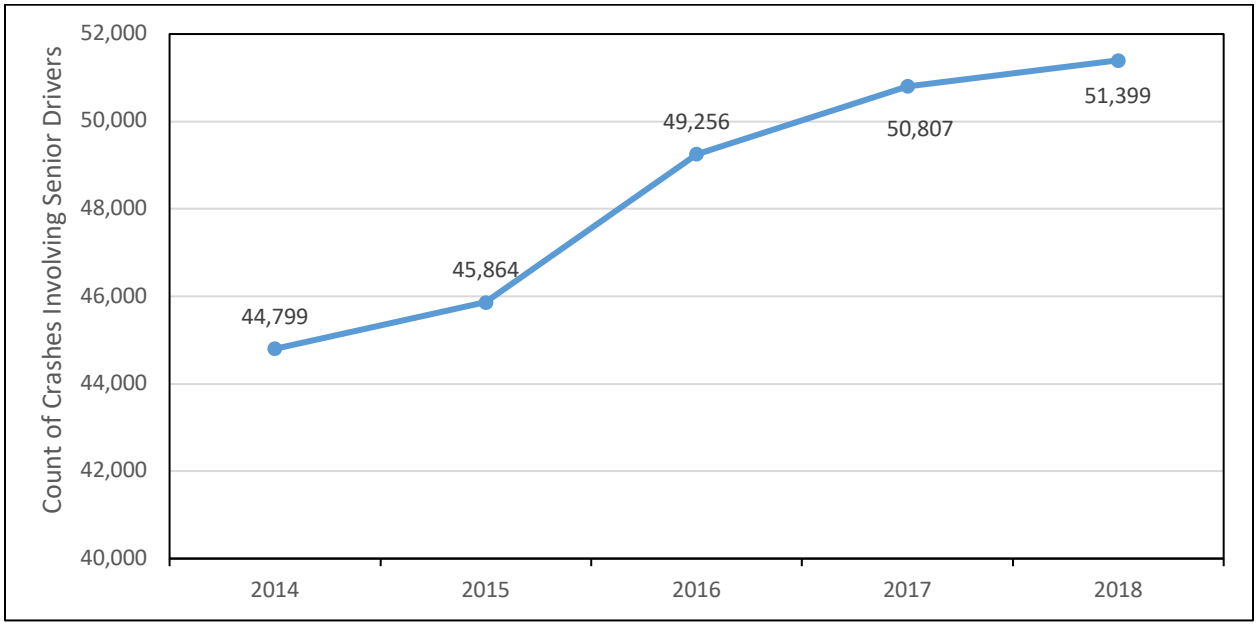

Figure 1 – Senior Driver Crashes by Year

[1] "Older Drivers," National Highway Transportation Safety Administration, https://www.nhtsa.gov/road-safety/older-drivers, (2019).

Table 1 shows the count and proportion of crashes broken down by worst injury in the crash and whether or not a senior driver was involved. Worst injury in the crash is coded using the KABCO scale, where K is Killed, A is Suspected Serious Injury, B is Suspected Minor Injury, C is Possible Injury and O is No Injury, sometimes called Property Damage Only (PDO). Figure 2 shows the same data in pie chart form, but all injury levels have been combined to make the charts more readable. The overall fatal crash rate is 0.4% for crashes involving a senior driver and 0.3% for crashes not involving a senior driver. The injury crash rate for senior driver crashes is 20.8% compared to crashes without a senior driver at 17.5%.

Table 1. Crash Severity for Senior Driver-Involved and Senior Driver Not Involved Crashes, 2014-2018

Senior Driver (Age≥65) Involved		Fatal Injury (K)	Suspected Serious Injury (A)	Suspected Minor Injury (B)	Possible Injury (C)	No Injury (O)	Total
Count	Yes	970	3,787	13,209	33,273	190,886	242,125
	No	3,551	18,457	60,795	147,577	1,063,108	1,293,488
Row Percent	Yes	0.4%	1.6%	5.5%	13.7%	78.8%	100.0%
	No	0.3%	1.4%	4.7%	11.4%	82.2%	100.0%

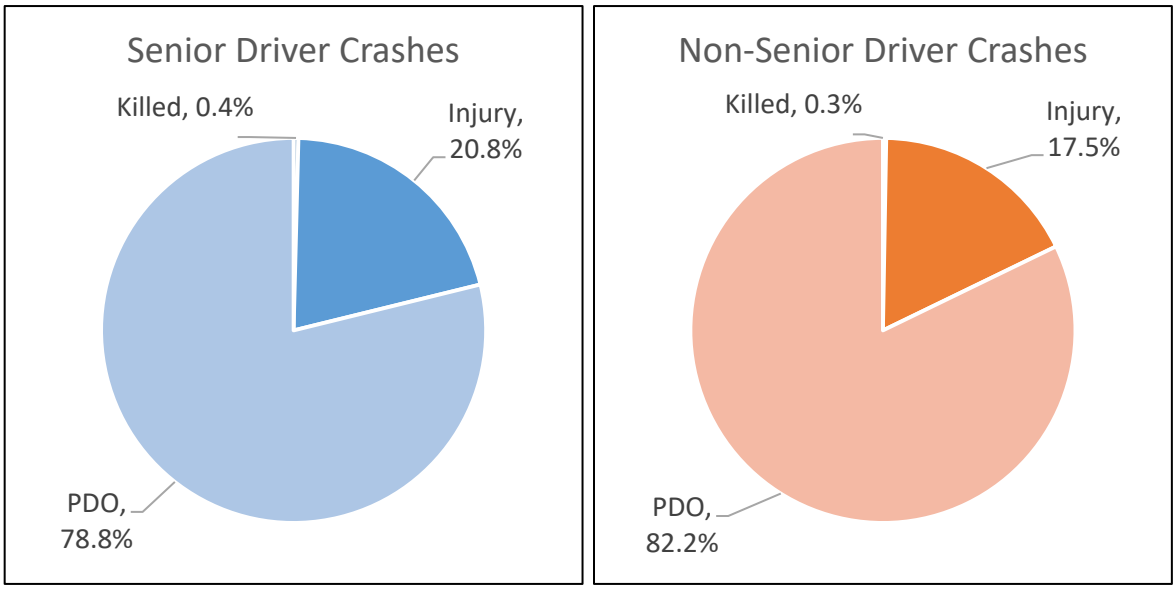

Figure 2 – Crash Severity in Crashes With and Without a Senior Driver, 2014-2018

The number of crashes with and without a senior driver by crash type is shown in Table 2. Table 3 shows the same breakdown for crashes in which at least one occupant sustained a suspected serious injury or fatality (KA crashes). For all crashes, senior driver-involved crashes are less likely to be single motor vehicle crashes than crashes not involving a senior driver (19.2% vs. 36.6%). Senior driver-involved crashes are more likely to be head-on and angle crashes than crashes not involving senior drivers. The same comparisons are true for senior driver and non-senior driver KA crashes.

Table 2. Senior Driver and Non-Senior Driver Crashes by Crash Type, 2014-2018

Crash Type	Senior Driver (Age≥65) Involvement			
	Count		Percent	
	Yes	No	Yes	No
Single motor vehicle	46,536	473,220	19.2%	36.6%
Head-on	11,485	41,392	4.7%	3.2%
Angle	55,818	177,654	23.1%	13.7%
Rear-end	72,078	355,084	29.8%	27.5%
Sideswipe	39,409	161,761	16.3%	12.5%
Backing	3,195	12,389	1.3%	1.0%
Other/Unknown	13,604	71,988	5.6%	5.6%

Table 3. Senior Driver and Non-Senior Driver KA Crashes by Crash Type, 2014-2018

Crash Type	Senior Driver (Age≥65) Involvement			
	Count		Percent	
	Yes	No	Yes	No
Single motor vehicle	1,035	10,627	21.8%	48.3%
Head-on	849	2,334	17.8%	10.6%
Angle	1,480	3,864	31.1%	17.6%
Rear-end	755	2,570	15.9%	11.7%
Sideswipe	259	947	5.4%	4.3%
Backing	4	9	0.1%	0.0%
Other/Unknown	375	1,657	7.9%	7.5%

3.0 Temporal Variables

3.1 Day of Week

The distribution of crashes with and without senior drivers by day of the week is shown in Figure 3 for all crashes and Figure 4 for KA injury crashes. Overall, crashes involving a senior driver tend to occur relatively more often during the week and less on Saturday and Sunday, compared to crashes that do not involve a senior driver. For KA injury crashes, the senior driver-involved crashes follow a similar trend. KA crashes not involving a senior driver show an opposite trend, with a higher percentage of more severe crashes occurring on weekends.

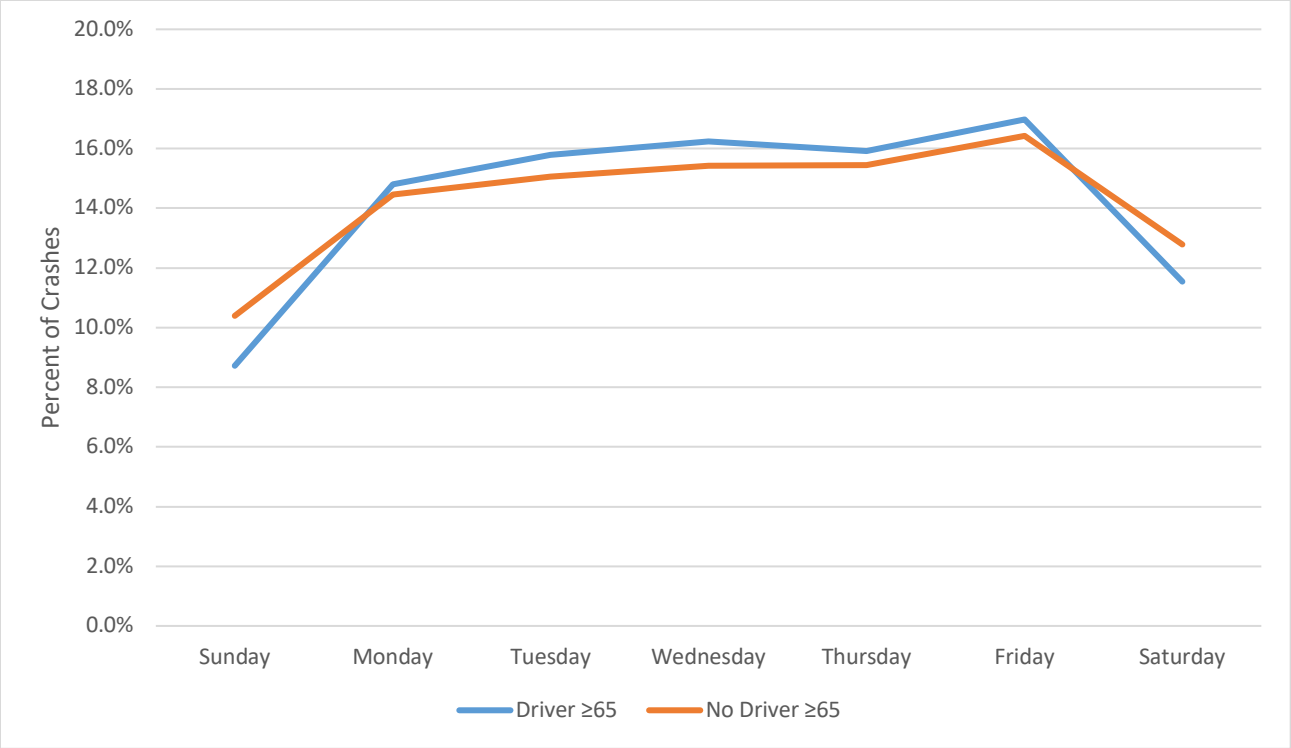

Figure 3 – Crashes With and Without Senior Drivers by Day of Week, 2014-2018

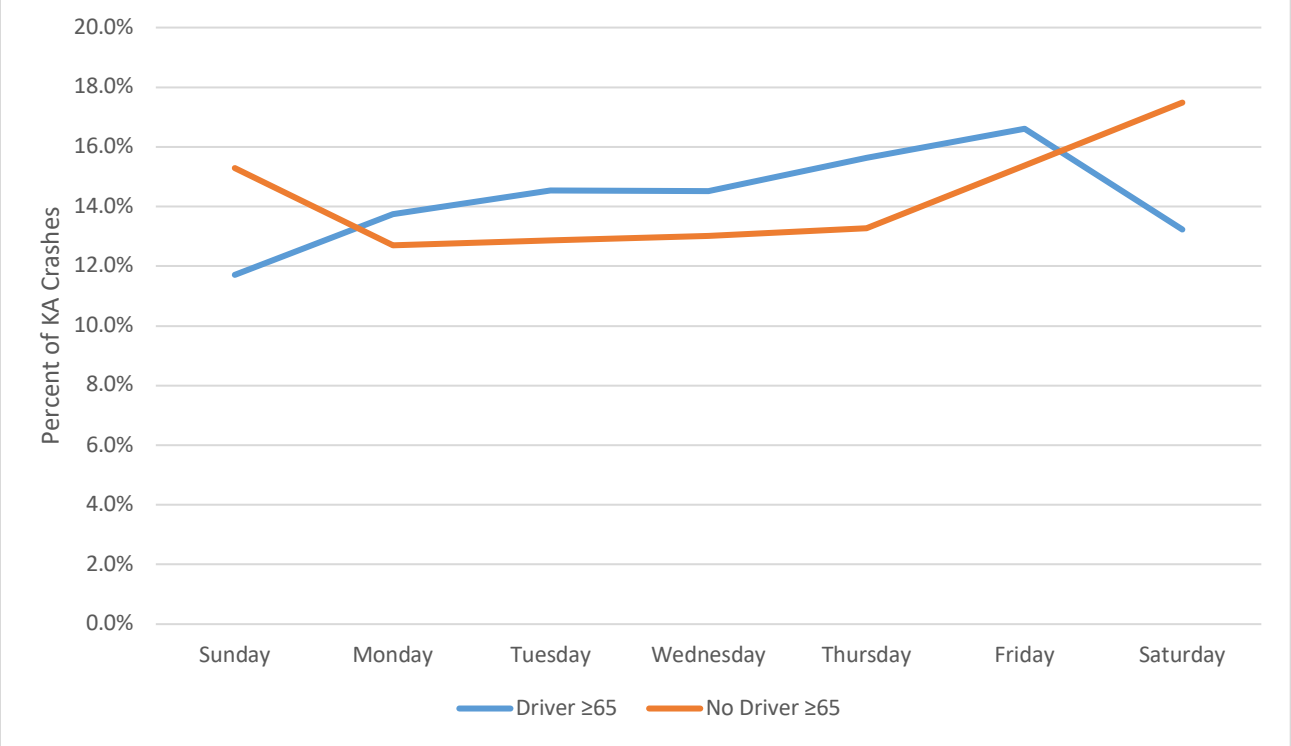

Figure 4 – KA Crashes With and Without Senior Drivers by Day of Week, 2014-2018

3.2 Time of Day

The distribution of crashes with and without senior drivers by time of day is shown in Figure 5 for all crashes and Figure 6 for KA injury crashes. The most common time for crashes with senior drivers is 11 am to 6 pm with a peak at the 3-4 pm hour, compared to 7 to 9 am and 3 to 7 pm for crashes without senior drivers. The crash distribution for senior-driver crashes is generally unimodal, while it is bimodal for other drivers, corresponding to morning and evening rush hours. These crash proportions align with the general understanding that senior drivers drive during off-peak hours, which results in an increase in senior drivers crashes during that period, compared to other times of day. When reviewing the times of crashes involving KA injury, the senior driver crash distribution has little change in its pattern relative to the total crash distribution. In contrast, the distribution of KA injury crashes not involving senior drivers varies greatly from the bimodal overall crash pattern and is more even over the hours of the day, with a peak during the 5 to 6 pm hour.

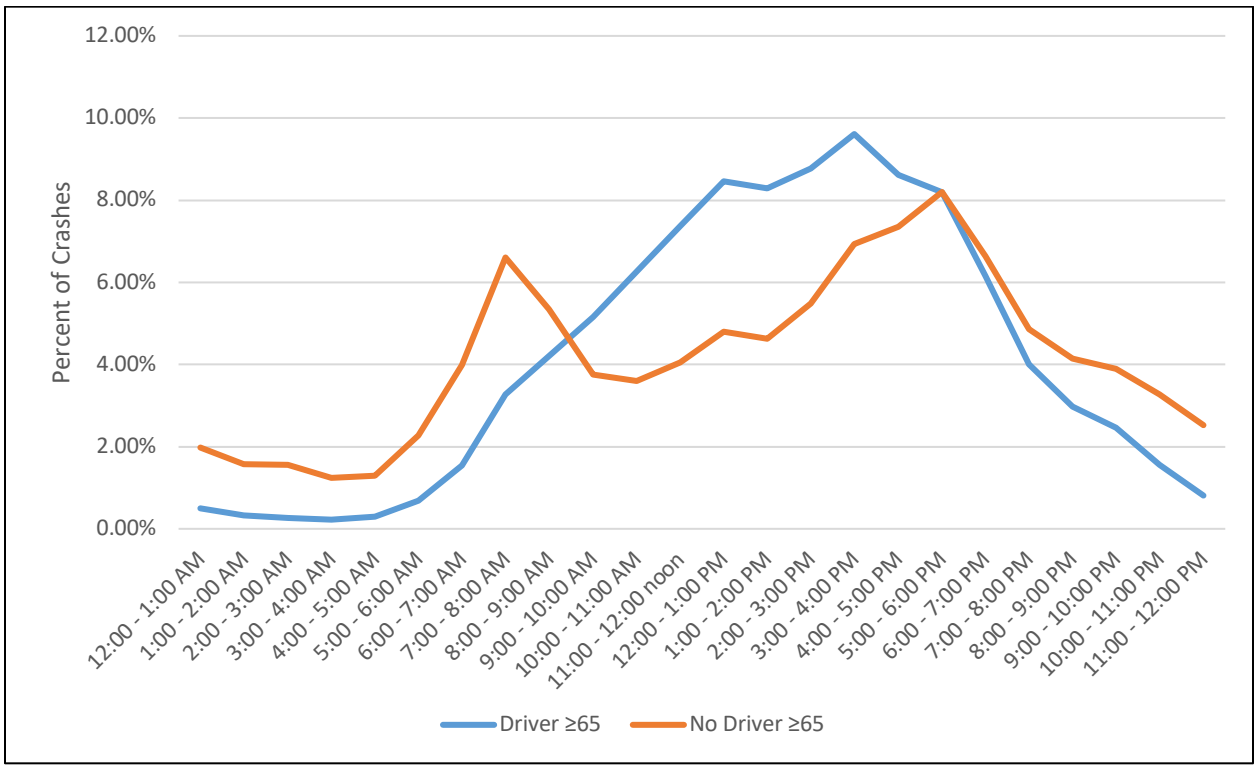

Figure 5 – Crashes With and Without Senior Drivers by Time of Day, 2014-2018

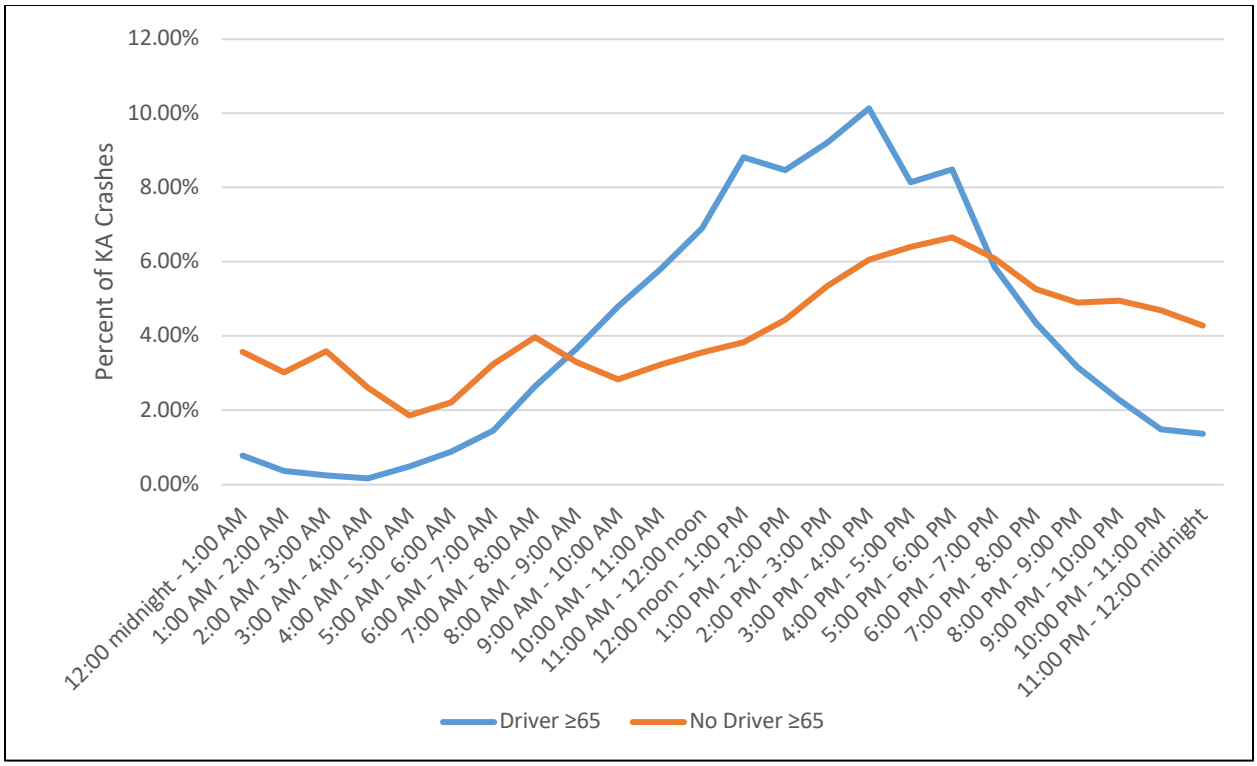

Figure 6 – KA Crashes With and Without Senior Drivers by Time of Day, 2014-2018

4.0 External/Environmental Conditions

4.1 Light Conditions

Figure 7 and Figure 8 show the distribution of crashes with and without senior drivers by light condition for all crashes and KA injury crashes, respectively. Other and unknown lighting conditions (14,870 or 1.0%) are excluded from the two figures. A higher percentage of senior driver crashes (78.5%) take place in the daylight compared with crashes that do not involve senior drivers (59.8%). Although crashes with senior drivers occur more frequently during the day, it is most likely due to limited exposure to night-time driving. The estimated VMT of senior drivers traveling at night or during daylight is not available to calculate this risk. The patterns observed in KA injury crashes are similar to those for all crashes. Crashes with a KA injury involving a driver age 65 or over occurred during the daylight 80.7% of the time compared to 55.0% during daylight lighting conditions for crashes not involving senior drivers.

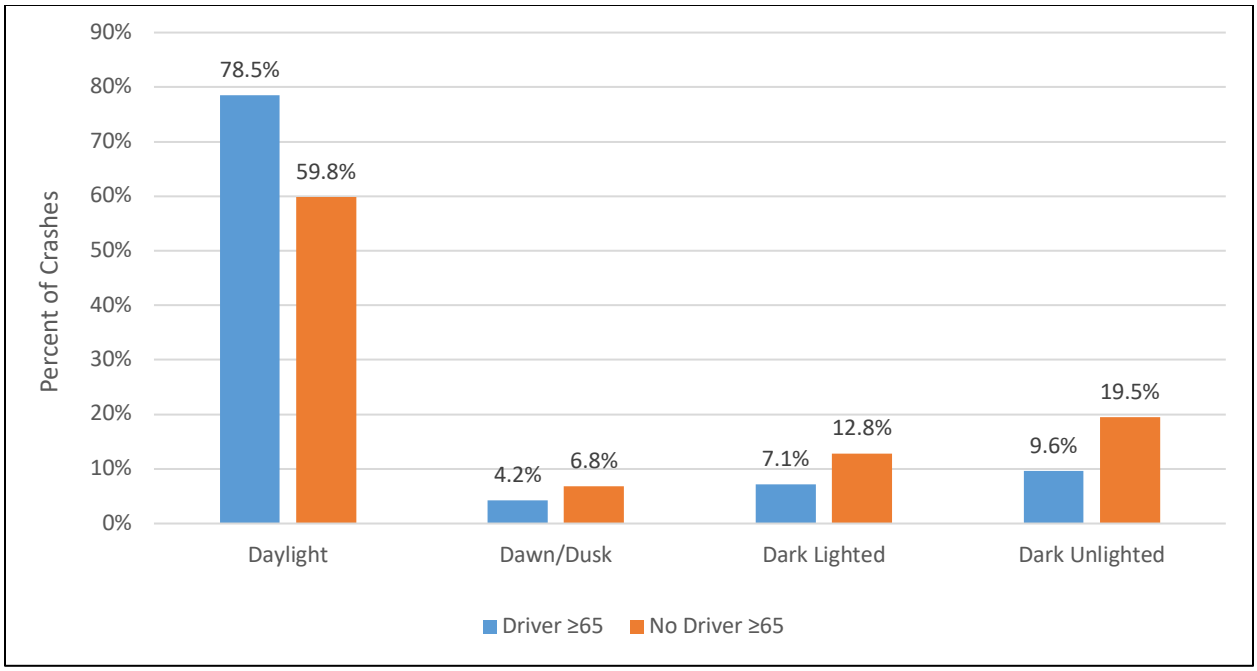

Figure 7 – Crashes With and Without Senior Drivers by Light Condition, 2014-2018

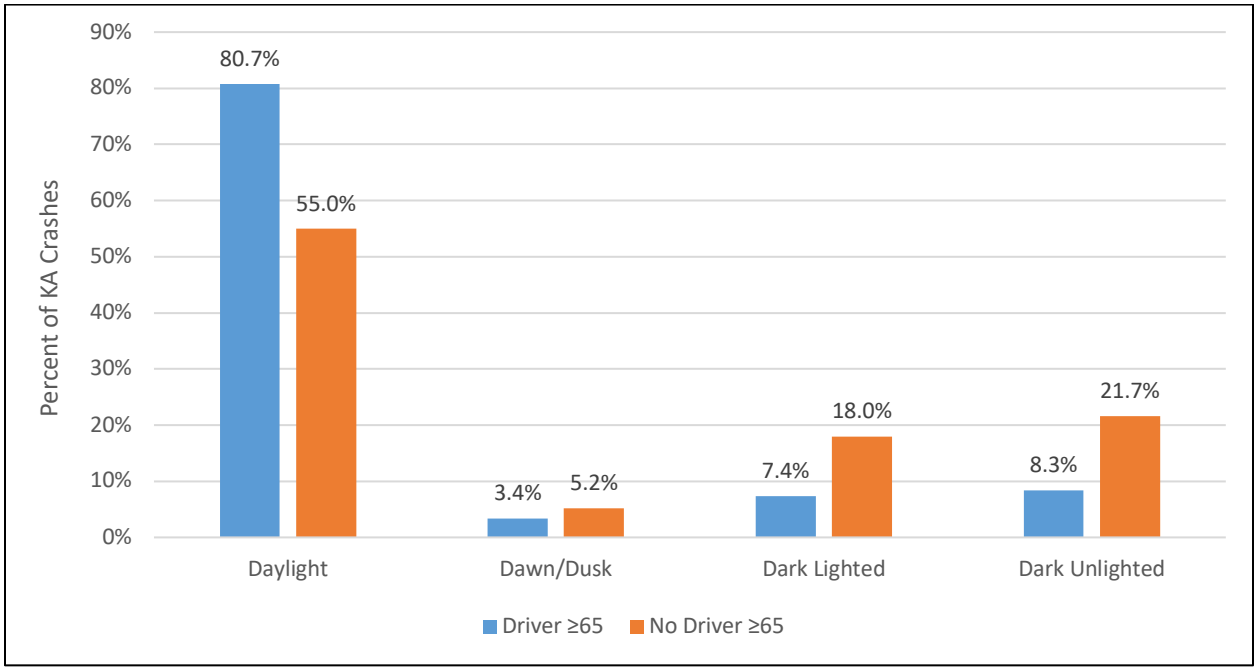

Figure 8 – KA Crashes With and Without Senior Drivers by Light Condition, 2014-2018

4.2 Weather Conditions

The distribution of crashes by weather condition with and without senior drivers is shown in Figure 9 for all crashes and Figure 10 for KA injury crashes. There were 42,098 (2.7%) other and unknown values for weather condition which have been removed from the graphs. In general, patterns for senior-driver crashes are very similar to crashes without senior drivers. However, senior driver crashes are somewhat less likely to occur in rainy or snowy conditions, possibly because senior drivers self-limit more than drivers under the age of 65. The pattern for KA crashes is very similar for the two age groups. The only weather condition with a higher percentage of senior drivers for KA crashes is cloudy.

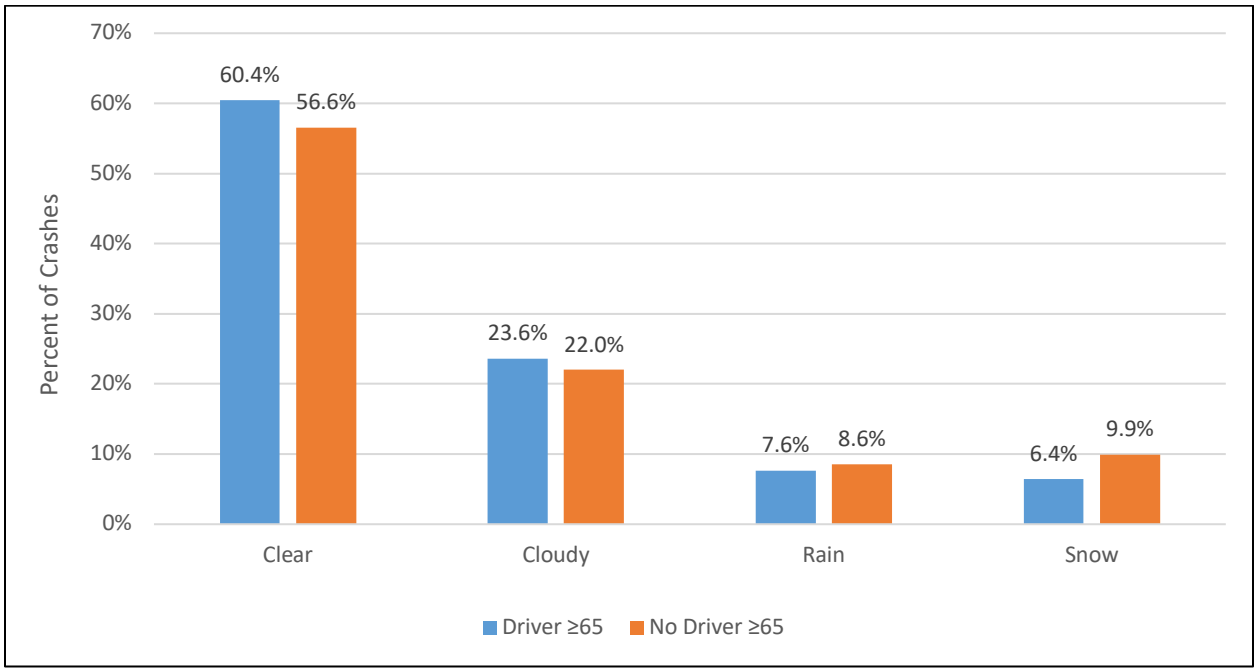

Figure 9 – Crashes With and Without Senior Drivers by Weather Condition, 2014-2018

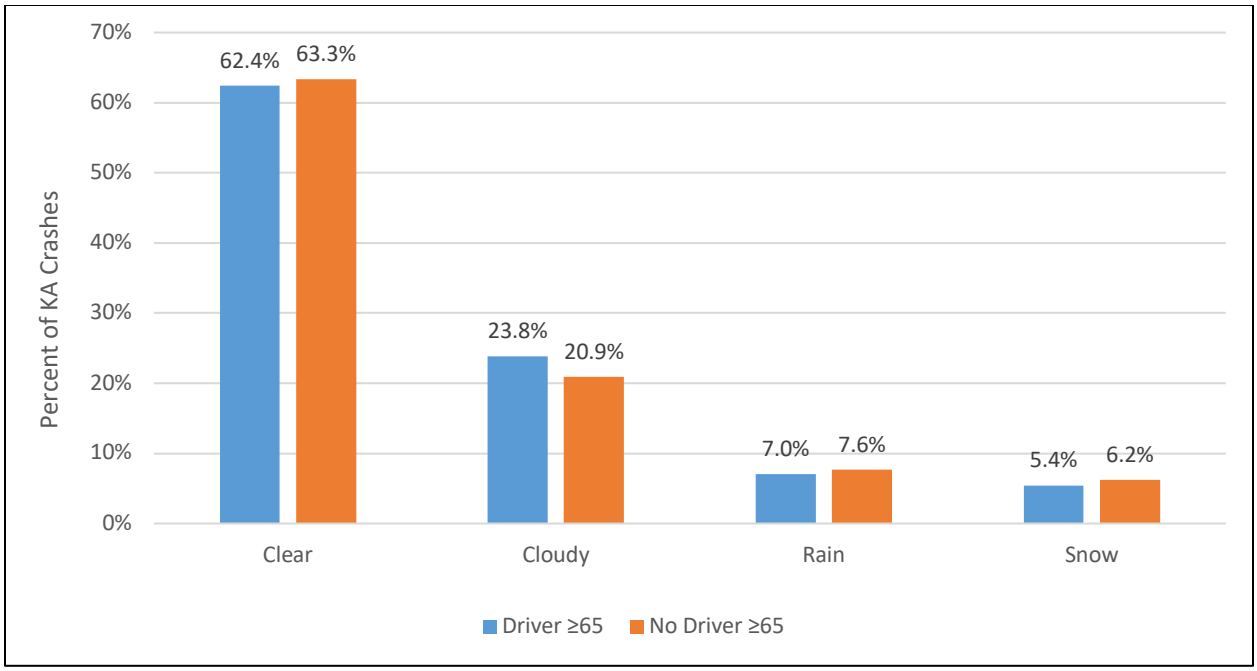

Figure 10 – KA Crashes With and Without Senior Drivers by Weather Condition, 2014-2018

5.0 Roadway Factors

5.1 Relation to Intersection

Table 4 shows the distribution of all crashes and KA injury crashes with and without senior drivers according to crash location relative to intersections. Senior driver crashes occur more frequently at intersections (41.7%) compared to crashes without senior drivers (29.9%). For KA crashes, the proportions at intersections are also greater for senior driver-involved crashes (47.0%) than for non-senior driver crashes (32.1%). These trends may reflect cognitive and physiological difficulties senior drivers can face in navigating complex traffic signals and flashing lights[2].

Table 4. All Crashes and KA Crashes by Relation to Intersection and Senior Driver Involvement, 2014-2018

Intersection-Related	All Crashes		KA Crashes	
	Driver ≥65	No driver ≥65	Driver ≥65	No driver ≥65
Yes	101,026 (41.7%)	386,891 (29.9%)	2,237 (47.0%)	7,063 (32.1%)
No	141,099 (58.3%)	906,597 (70.1%)	2,520 (53.0%)	14,945 (67.9%)

[2] Jane Stutts, Carol Martell, and Loren Staplin. "Identifying Behaviors and Situations Associated With Increased Crash Risk for Older Drivers," https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/811093.pdf, (June 2009).

5.2 Speed Limit

The distribution of crashes with and without senior drivers according to speed limit is shown in Figure 11 for all crashes and Figure 12 for KA injury crashes. A total of 18,256 crashes (1.2%) where speed limit was unknown have been excluded from the two figures, with 344 of those crashes involving a KA injury. Crashes occur most frequently at speed limits of 55 mph for both senior-involved crashes and non-senior-involved crashes. However, senior-driver crashes are overrepresented at moderate speeds (30-50 mph) for total crashes on Michigan roadways. These results suggest a preference for senior drivers to use urban arterial roads rather than highways in general. For KA crashes, senior-driver crashes have greater representation in each speed limit group from 40 through 55 mph crashes. This may reflect the higher crash risk for more severe crashes at these speeds for seniors, compared to speeds lower than 35 mph and higher than 55 mph. For both groups, the risk of a KA injury crash at 55 mph is much greater than for overall crashes. For crashes involving senior drivers, the crash rate changes from 21.8% in all crashes to 38.8% in KA injury crashes.

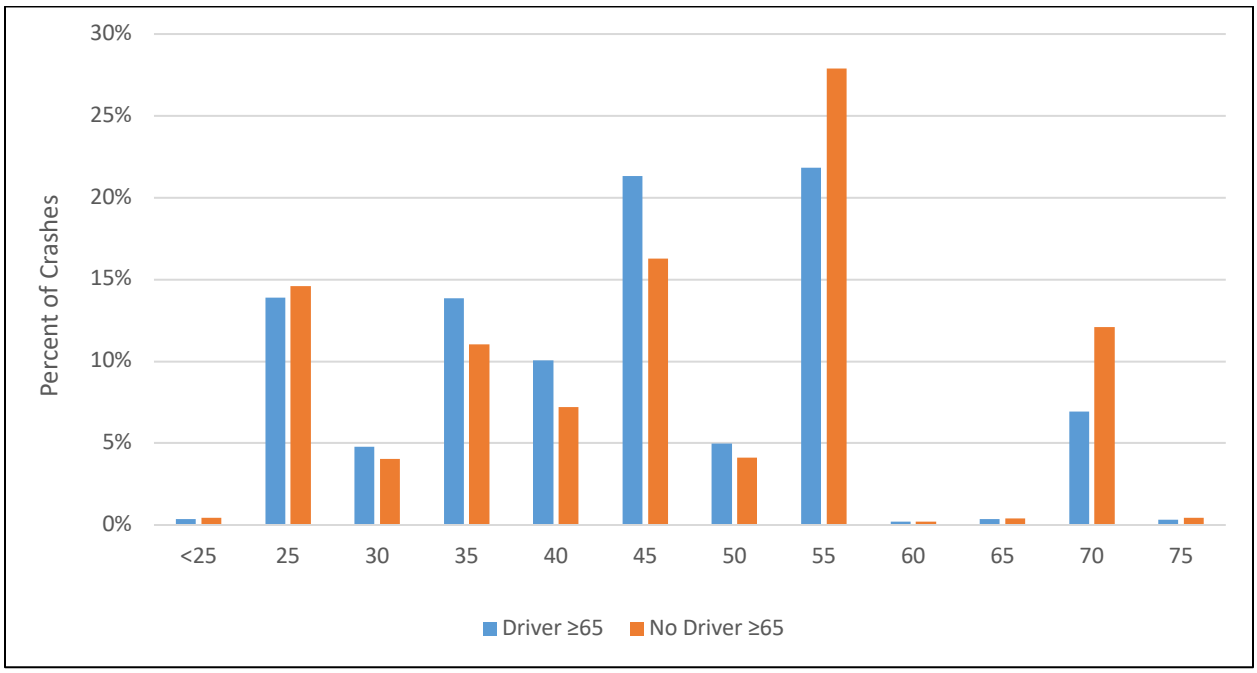

Figure 11 – Crashes With and Without Senior Drivers by Speed Limit, 2014-2018

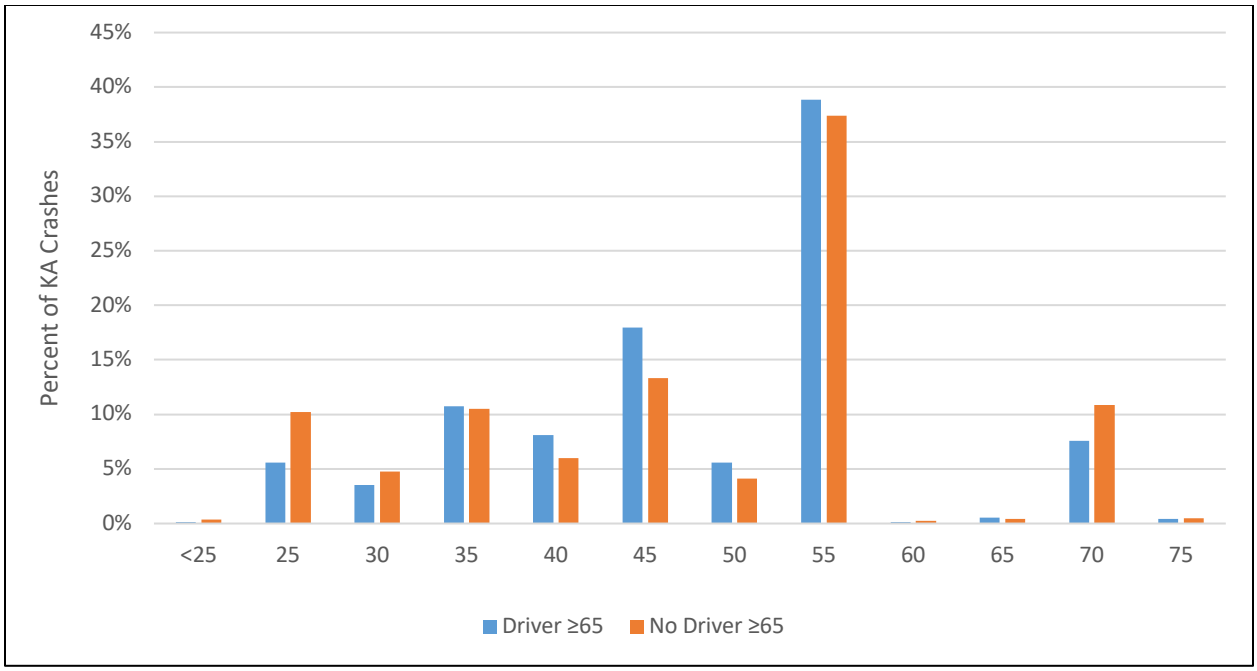

Figure 12 – KA Crashes With and Without Senior Drivers by Speed Limit, 2014-2018

5.3 Number of Lanes

Figure 13 and Figure 14 show the distribution of crashes with and without senior drivers by the number of lanes in the roadway for all crashes and KA injury crashes, respectively. There were 786 (0.1%) crashes that were not included in the figures with an unknown number of lanes or that occurred off of the roadway. Senior-driver crashes, including KA crashes, are underrepresented on two-lane roads and slightly overrepresented on roads with three or more lanes (especially 5-6-lane roads), compared to crashes not involving senior drivers.

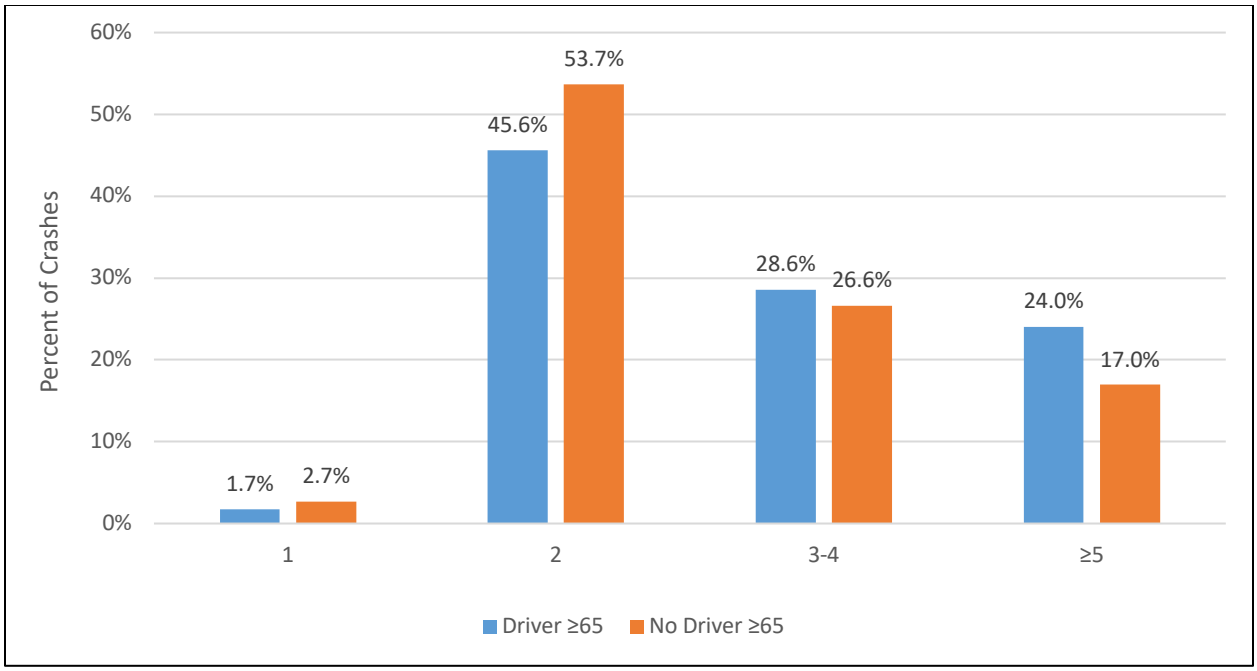

Figure 13 – Crashes With and Without Senior Drivers by Number of Lanes, 2014-2018

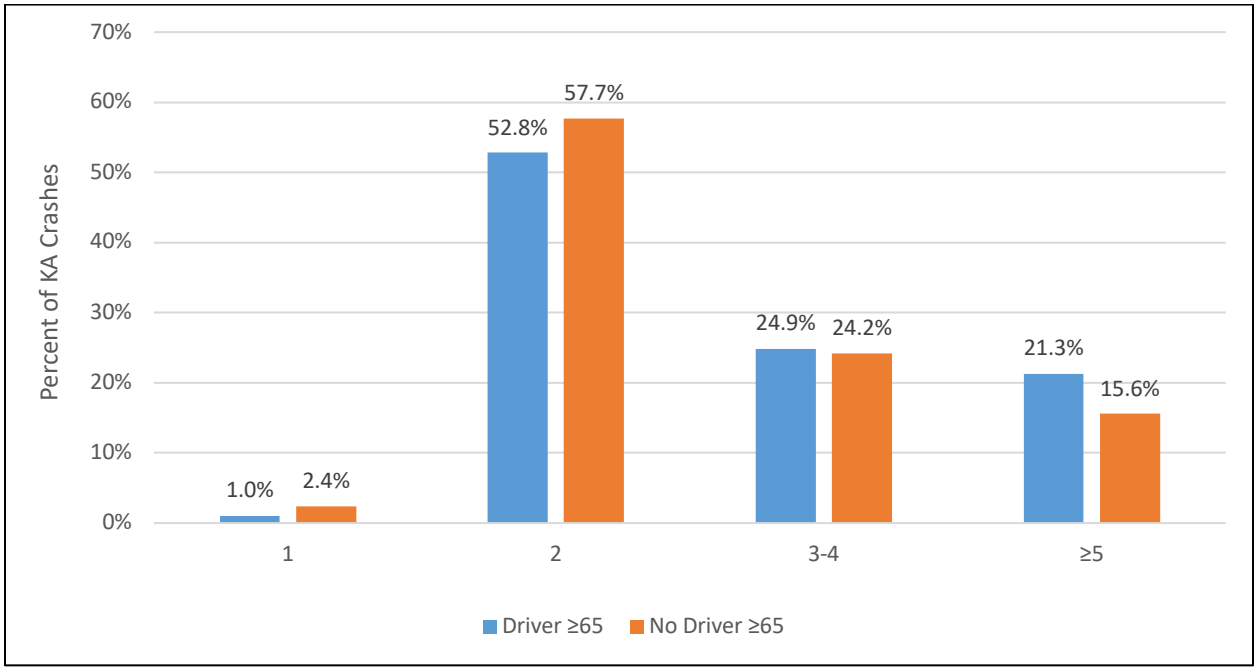

Figure 14 – KA Crashes With and Without Senior Drivers by Number of Lanes, 2014-2018

6.0 Other Factors

Two additional areas where senior-driver crashes differ from non-senior-driver crashes are alcohol involvement and pedestrian crashes. Table 5 shows the percentage of all crashes and KA crashes that involve drinking, broken down by senior driver involvement. Among senior driver-involved crashes, only 1.3% involve alcohol, compared to almost 3 times that for non-senior driver-involved crashes (3.5%). Among KA crashes, the relative proportions are similar. When there is a senior driver, the rate of alcohol involvement is 7.7%, about a third of that for non-senior driver-involved crashes (21.5%).

Table 5. Proportion of Alcohol Involvement Among All Crashes and KA Crashes by Senior Driver Involvement, 2014-2018

Alcohol Involvement	All Crashes		KA Crashes	
	Driver ≥65	No driver ≥65	Driver ≥65	No driver ≥65
Drinking Involved	1.3%	3.5%	7.7%	21.5%
No Drinking Involved	98.7%	96.5%	92.3%	78.5%

Table 6 shows all pedestrian and KA pedestrian crashes broken down by light level and senior driver involvement. Pedestrian crashes make up 0.5% of senior-driver-involved crashes and 0.8% of non-senior driver-involved crashes. The pattern of pedestrian crashes during daylight shows that pedestrian crashes involving senior drivers occur relatively more often (64.3%) than when no senior driver is involved (50.7%). This is particularly striking for KA pedestrian crashes which are more common in dark than light for non-senior driver-involved crashes but still slightly less common in darkness for senior driver crashes (49.6% vs. 35.2%). While pedestrians are still more vulnerable in darkness no matter the age of the driver, seniors' self-limiting to primarily daylight conditions (see Figure 7 and Figure 8) reduces their proportion of pedestrian crashes in darkness and may be responsible for their generally lower rate of pedestrian crashes overall.

Table 6. Proportion of Light Conditions Among all Pedestrian Crashes and KA Pedestrian Crashes by Senior Driver Involvement, 2014-2018

Light Condition	All Pedestrian Crashes		KA Pedestrian Crashes	
	Driver ≥65	No Driver ≥65	Driver ≥65	No Driver ≥65
Daylight	64.3%	50.7%	49.6%	35.2%
Dark	31.4%	43.6%	46.8%	59.3%
Dawn/Dusk	4.1%	5.0%	3.6%	4.9%
Other	0.2%	0.7%	0.0%	0.5%

7.0 Summary

Senior driver-involved crashes differ from other crashes in that they happen mostly during the daytime (generally early afternoon, not during rush hours) and on weekdays. Senior driver crashes occur on roads that have lower speed limits and in mostly clear conditions during the day. Senior drivers are

overrepresented in intersection-related crashes and in crashes on roadways consisting of three lanes or more, possibly due to cognitive challenges related to the aging process. Senior drivers are not involved in the majority of crashes happening in the dark or in crashes involving pedestrians, nor are they typically involved in alcohol-related crashes. The characteristics of crashes involving senior drivers are consistent with seniors' self-limiting (i.e., to daytime, better weather, and non-highway driving) as well as the idea that decreased cognitive and physiological ability (including vision) may make certain driving situations riskier for senior drivers than younger drivers.