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An Analysis of the Influence of Speed on Fatal Accidents in Ohio

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List of Acronyms

BAC – Blood Alcohol Content

FARS – Fatality Analysis Reporting System

FHA – Federal Highway Administration

NHTSA – National Highway Traffic Safety Administration

FARS Codes & Meanings

A_RU	Land Use
A_INTER	Interstate
A_RELRD	Relationship to Trafficway
A_ROADFC	Roadway Function Class
A_MANCOL	Manner of Collision
A_TOD	Time of Day
A_DOW	Day of Week
A_CT	Crash Type
A_MC	Involving Motorcycle
A_SPCRA	Involving Speeding
A_PED	Involving a Pedestrian
A_POSBAC	Involving a Driver with Positive BAC

Abstract

Through data collected by NHTSA and FARS, Ohio crash data resulting in fatalities were analyzed through four different breakdowns to determine variables correlating to the fatalities. The breakdowns include dividing data from overall Ohio data, reports involving speeding, then from there to single-vehicle crashes. That data was divided down to only include male drivers and then finally only motorcycles. This data was analyzed as it was broken down to find trends with each category. Through these analyses, the trends were developed to suggest recommendations to implement through education and laws to help reduce the number of crashes resulting in fatalities.

Section 1: Introduction

In 2021, there were about 233 million licensed drivers in the United States as well as about 282 million registered vehicles according to the Federal Highway Administration. With this, there is a licensed drivers to total United State population ratio of 0.70 and a licensed drivers to driving age population ratio of 0.87 (Highway Statistics 2021). Trends show that this has generally increased over since 1949, meaning more people are receiving their driver's license and are theoretically driving on the roadways. As more individuals join the roadways, more accidents can occur and will occur unless proper safety measures and education is implemented for all road users to follow. Advancements in technology have also allowed cars to become lighter and faster. Individuals sometimes do not realize their speed in newer vehicles because the ride is smooth, and the roadway may seem safe to travel at those speeds. Accidents can occur at any time especially when speeding is involved.

The National Highway Traffic Safety Administration, NHTSA, is an organization geared to "save lives, prevent injuries, and reduce economic costs due to road traffic crashes, through education, research, safety standards, and enforcement" (NHTSA). NHTSA uses the Fatality Analysis Reporting System, FARS, to analyze crash data, specifically fatalities, to allow them to create informed decisions on what and who may be causing crashes in the United States. This data is expansive, relating anywhere from the type of car to the roadway classification from the 1970s to today.

The following analysis takes data from FARS and NHTSA to create a comprehensive breakdown of speed related fatalities in Ohio. The data will be broken down from the immense amount of fatalities, to specifically speed related ones to determine who may be causing these

crashes. A look into a specific section - motorcycles - of these speed related fatalities will cast an outlook of what may need to be changed to help reduce the amount of these types of fatalities.

Section 2: Background

Data obtained in this analysis is from FARS through NHTSA. FARS encompasses fatal motor vehicles occurring since 1975 in all 50 states of the United States as well as the District of Columbia and Puerto Rico. Reports that qualify for this census have to meet the following: crash involved a vehicle traveling on a public trafficway and resulted in the death of an individual – motorist or non-motorist – within thirty days of the accident (FARS Analytical User's Manual, 1975-2020, p.13). For simplicity within the reports, various categories' names are shortened into codes. For example, "land use" is coded into A_RU and "roadway function class" is coded into A_ROADFC. The 50 states, District of Columbia and Puerto Rico are also given their own number, one through fifty-six.

For each variable, multiple attributes are given a number and value to explain their meaning. Below is an example of this for the roadway function class variable. For this specific example, the counts are from all locations included in the studies over the 2002-2019 years.

Variable Information: A_ROADFC				2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Variable Name	Variable Description	Attributes	Formatted Values																		
A_ROADFC	Roadway Function Class	1	Interstate, principal arterial	4,903	4,813	4,949	5,138	4,865	4,646	4,166	3,619	3,748	3,688	3,532	3,650	3,633	3,947	4,495	4,277	4,269	4,168
		2	Freeway and expressway, principal arterial	1,340	1,437	1,500	1,589	1,542	1,374	1,372	1,218	1,134	1,185	1,058	966	1,017	1,918	1,532	1,447	1,418	1,358
		3	Principal arterial, other	8,955	8,998	8,900	9,078	8,959	8,820	8,126	7,788	7,543	7,510	7,913	7,975	8,182	9,254	10,581	10,291	10,083	9,987
		4	Minor arterial	6,879	7,520	7,767	7,535	7,313	7,093	6,062	5,253	5,474	5,391	6,021	5,729	5,898	6,342	7,057	7,226	7,369	7,284
		5	Collector	8,288	8,040	7,901	8,048	8,036	7,842	7,083	6,450	5,889	5,799	5,928	5,410	5,247	5,486	6,531	6,286	6,243	6,096
		6	Local	7,868	7,369	6,961	7,343	7,409	7,404	7,038	6,314	6,151	6,019	6,288	6,324	5,825	5,328	4,383	4,918	4,436	4,151
		7	Unknown	258	300	466	521	524	256	325	220	357	275	266	148	254	263	169	115	101	200
Total Fatal Crashes				38,491	38,477	38,444	39,252	38,648	37,435	34,172	30,862	30,296	29,867	31,006	30,202	30,056	32,538	34,748	34,560	33,919	33,244

Figure 1: Example of Variable Information Table for Roadway Function Class (FARS Analytical User's Manual, 1975-2020, p.18)

So, for the year 2019, there was a total of 33,244 fatal crashes, but of those, 1,358 were attribute 2 which is on a freeway and expressway - a principal arterial roadway. The raw data was analyzed in this fashion, by decoding each variable and attribute to determine trends within the crash reports.

Section 3: Speed-Related Fatalities in Ohio

Section 3.1: Involved Speeding

Firstly, data from FARS from 2018, 2019 and 2020 was divided down into reports that involved speeding as indicated by an attribute of 1 for the variable code A_SPCRA, to begin the analysis of only crashes involving speeding. As seen in Table 4 in the appendix and emphasized by the following tables, different variables stood more prominent than others as possible factors as to what may have contributed to fatal crashes involving speeding. This report highlights some variables I thought were interesting to mention and develop further. Throughout Table 4 in the appendix, the majority numbers were highlighted to emphasize which attribute had a larger amount of fatal crashes due to speeding. Each of these categories for Table 4 had the same attribute as the majority for each variable except for whether or not the crash occurred on rural or urban roadways. In Figure 2, urban crashes outrank rural or unknown crashes for 2019 and 2020 with 149 of 291 crashes and 169 of 315 crashes, respectively. Although in 2019, rural crashes rank higher than urban or unknown crashes with 132 of 268 crashes.

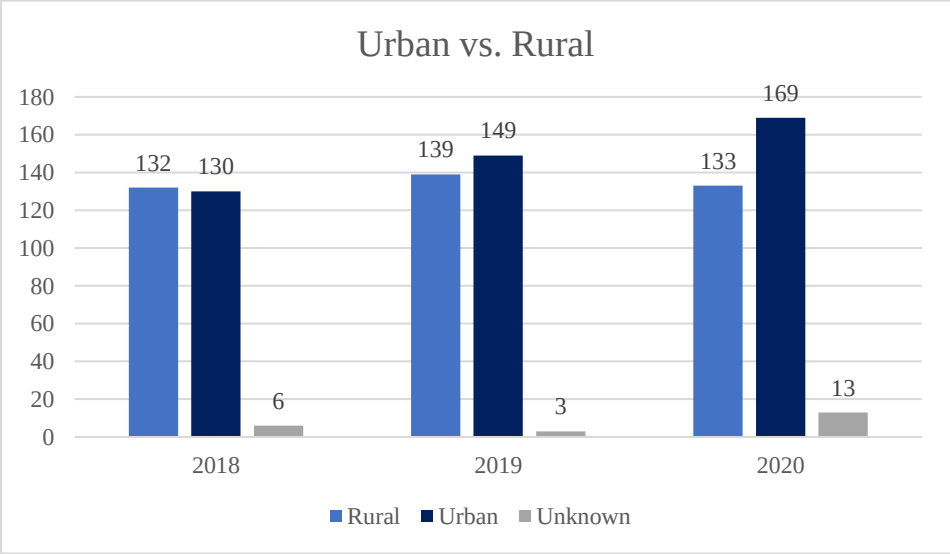

Figure 2: Urban vs. Rural Roadway Fatal Crashes Involving Speeding

It is noted, though, that the difference between urban and rural crashes for 2019 is only two which could be deemed negligible. This data suggests that speed-related crashes more often occur in the city rather than in the countryside.

Figure 3 and Figure 4 reveal that fatal crashes involving speeding occur more often on non-interstate roadways and more specifically collector streets.

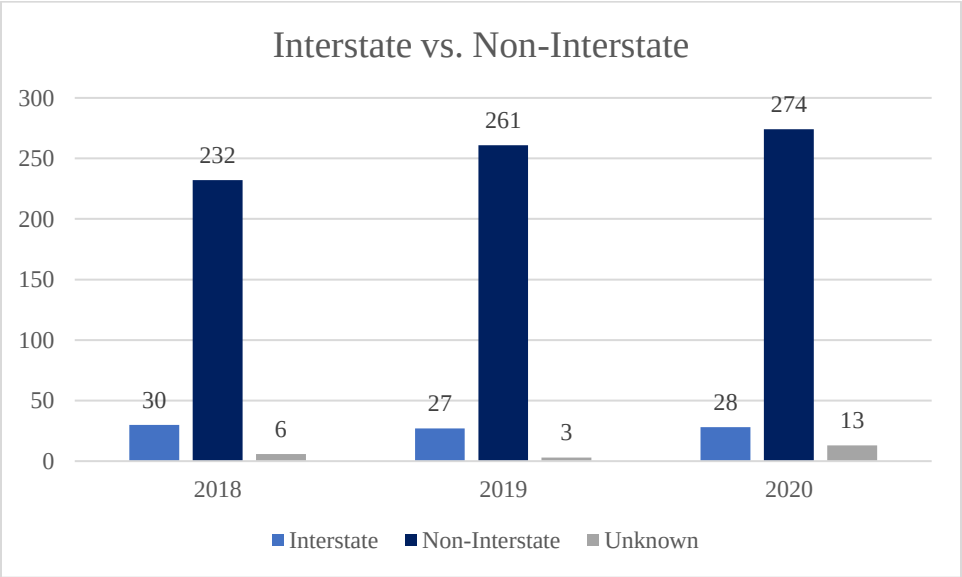

Figure 3: Interstate vs. Non-Interstate Speeding Involved Fatal Crashes

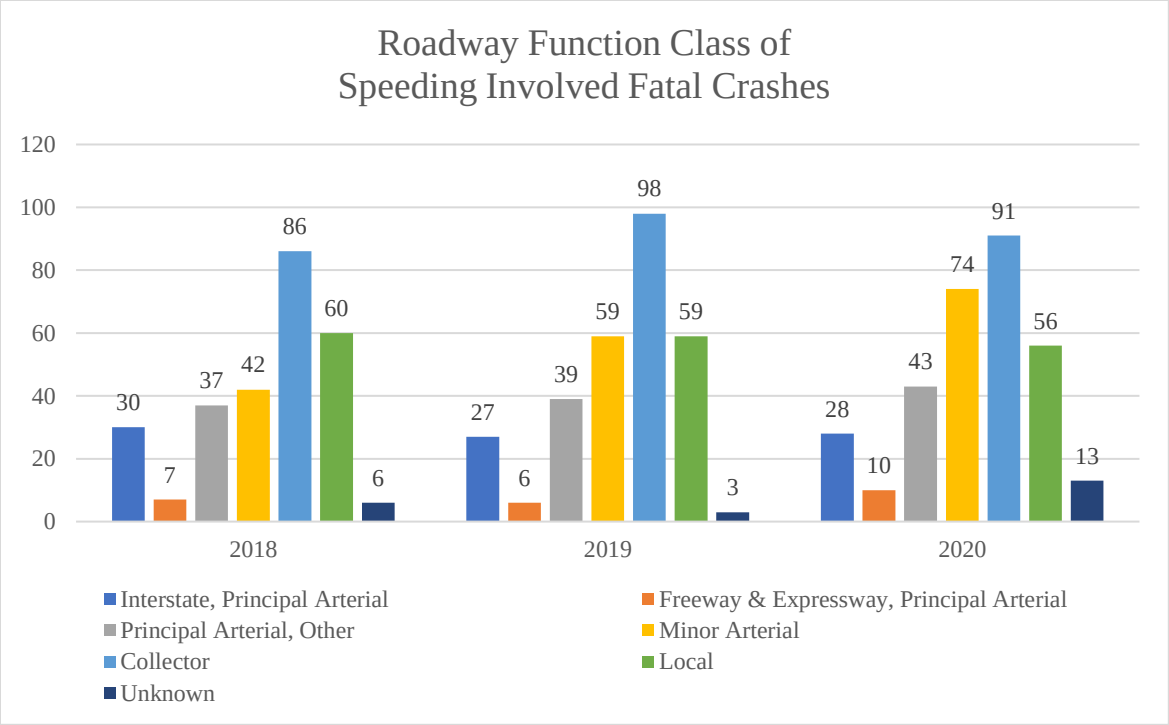

Figure 4: Roadway Function Class of Speeding Involved Fatal Crashes

It might be thought that fatal crashes that involved speeding would more likely be on highways or interstates, but in those situations, there are less objects to collide with whereas in urban areas on collector streets, there are much more obstacles that could be struck and inflicting serious and life threating injuries. Engineers must design a sufficient clear zone when constructing and maintaining a roadway so that if a car does veer from the roadway, they have more room to correct or come to a stop before meeting a tree or other object. But in typical observation, urban collector roads do not have to maintain as large of a clear zone as would be required on an interstate, thus if a car is speeding at interstate speeds or even ones above the posted speed limit and veers from the roadway, they would not have that barrier of grass to come to a stop or correct their mistake.

In Figure 5 and Figure 6, the time of day and day of week are summarized. The graphs reveal that unanimously nighttime and during the weekday are points of concern for speed involved fatal crashes.

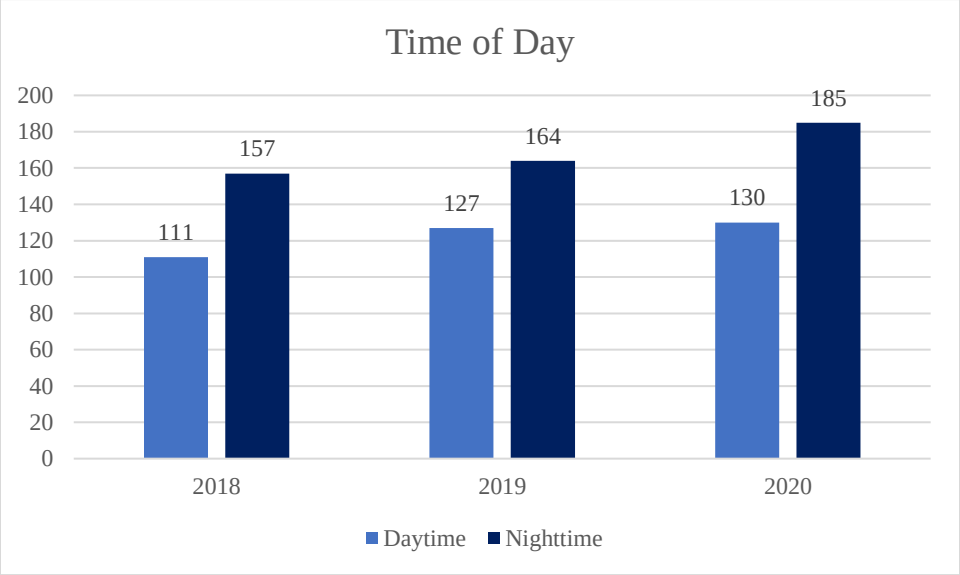

Figure 5: Time of Day Speed Involved Fatal Crashes Occurred

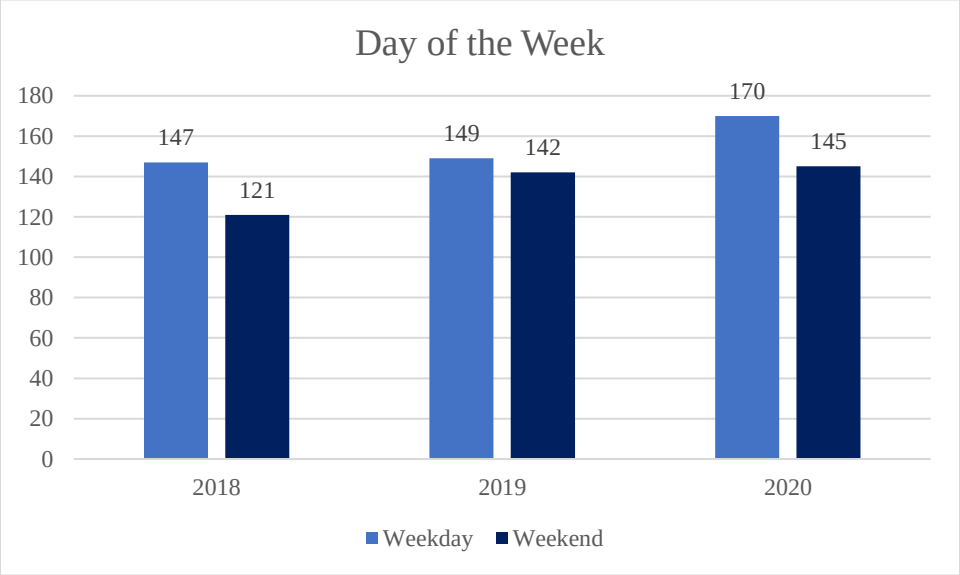

Figure 6: Day of the Week Speed Involved Fatal Crashes Occurred

Although, the difference between the time of day being daytime or nighttime as well as the day of the week being during the week or the weekend was not drastic. The number of crashes for just 2 days during the weekend is almost as much as the number of crashes during a 5-day period during the week. For example, in 2018 there were 147 weekday crashes which amounts to about 0.565 crashes per day for the 260 weekdays over the course of the year. For the same year, there were 121 weekend crashes which amounts to about 1.16 crashes per day over the 104 weekend days. With this outlook, it could be stated that per day more crashes occurred during the weekend than during the week since the amount per day for the weekend is over double that of the weekday.

Another important aspect of fatal crashes is whether or not other vehicles are involved in the crash. Figure 7 shows that from 2018 to 2020, the majority of crashes were single vehicle crashes.

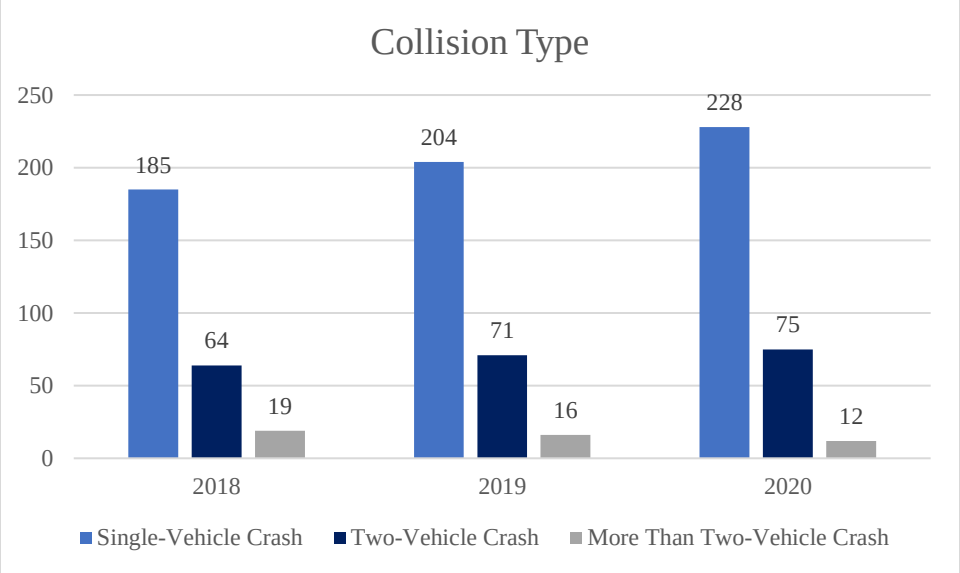

Figure 7: Collision Type of Speeding Involved Fatal Crashes

Each single-vehicle crash statistic is over double that of the combined two-vehicle crash and more than two-vehicle crash attributes. This is a key factor in the following section of narrowing down the data into who or what maybe be contributing most to speeding involved fatal crashes.

Many drivers after the crashes were also tested to see if they had any blood alcohol content. Figure 8 reveals that's the majority of drivers did have a BAC above zero.

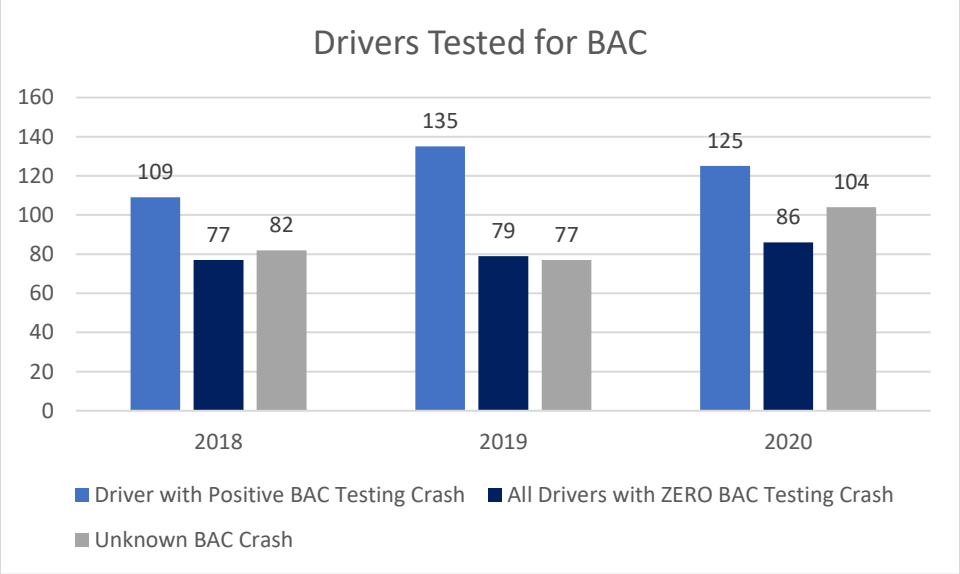

Figure 8: Drivers Tested for BAC in Speeding Involved Fatal Crashes

This does not mean that they were at or above the legal limit of 0.08 BAC, but simply tested above zero. This does mean that those drivers had been drinking prior to driving. Further analysis can decipher which ones were over the legal limit thus creating a greater chance of harm unto themselves and others.

Through each of these variables as well as many more listed in Table 4, trends are able to be identified. For this broad overlook of crashes in Ohio over the course of 2018, 2019, and 2020 that involved speeding the following narrative is made: the drivers of speeding involved crashes were 16-24 years old, had a positive BAC when tested, were not distracted and drove on urban,

collector roadways during weeknights. When the crash occurred, the vehicles typically left the roadway without striking another vehicle.

Section 3.2: Single-Vehicle Crashes

Since single-vehicle crashes were drastically more than other types – two-vehicle and more than two-vehicle – as shown in Figure 7, the data was divided down and eliminated the two-vehicle and more than two-vehicle crashes to focus on single-car crashes that involved speeding in Ohio over the 2018, 2019, and 2020 years. For this breakdown, the total number of fatalities and how many fatalities per crash is depicted in Figure 9.

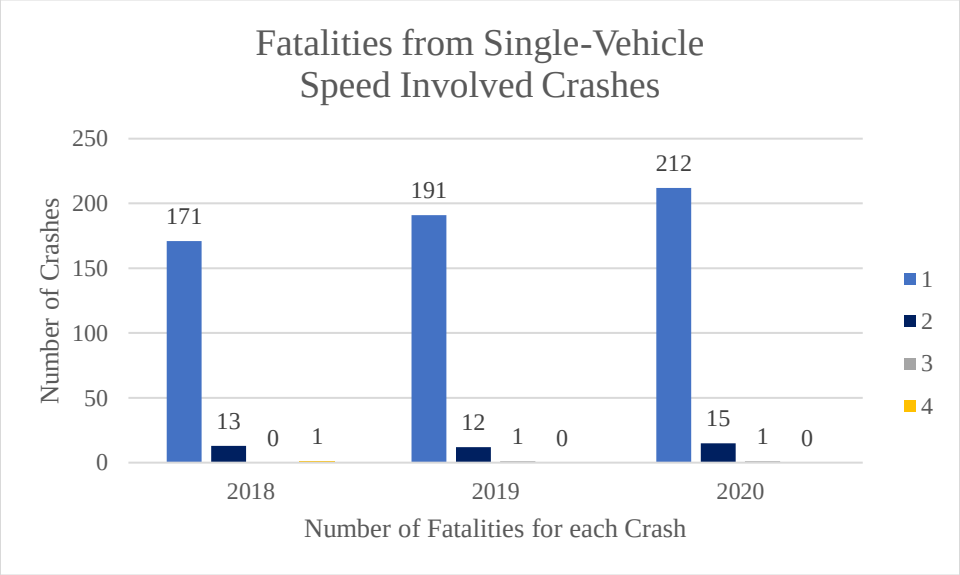

Figure 9: Fatalities from Single-Vehicle Speed Involved Crashes in Ohio

The majority of single-vehicle crashes resulted in one fatality per crash, but some did cause more than one death. The total number of fatalities were 201 for 185 crashes in 2018. There were 218 fatalities for 204 crashes in 2019. In 2020, there were 245 fatalities for 228 crashes.

Unlike in the broad overview of speeding involved fatalities, for the single-vehicle specific crashes there were a majority of crashes on rural roadways over urban roadways, seen in Figure 10.

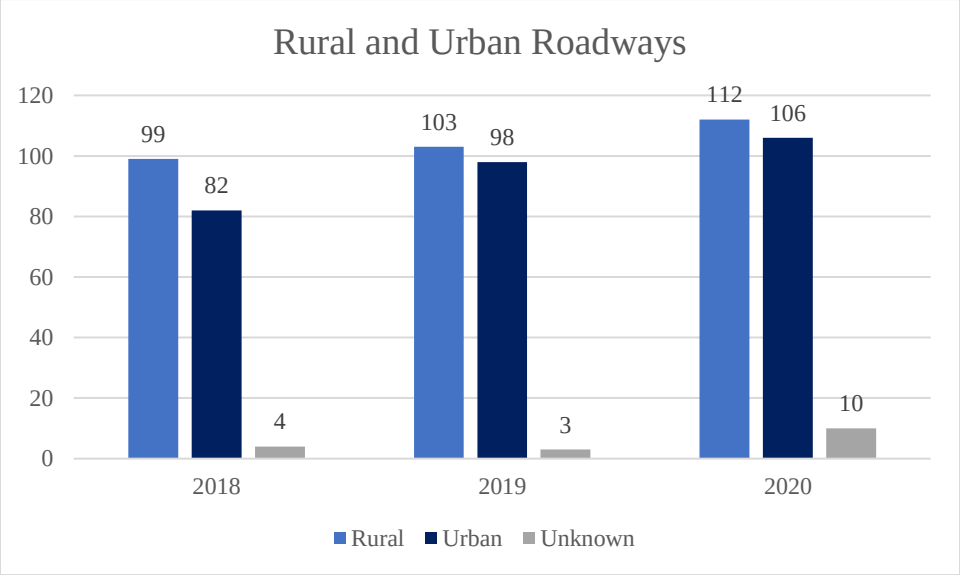

Figure 10: Number of Rural and Urban Roadways Single-Car Crashes Occurred

It is noted that the difference between the number of rural and urban roadway crashes is close, with a maximum difference over the three years of 17 reports. This could be attributed to the feeling of freedom that drivers encounter more often on rural roadways due to them often being wide open, possibly through farm fields, and often straight. Shown below in Figure 11, the trend of collector streets having the most amount of speeding involved crashes and still single-vehicle crashes stays true.

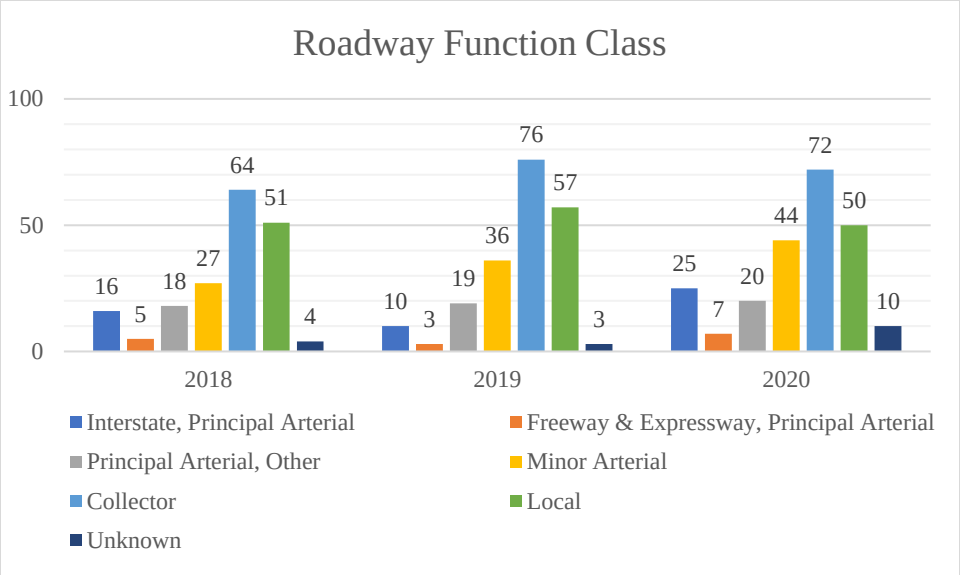

Figure 11: Roadway Function Class Single-Vehicle Crashes Occurred

Also, as shown in Figure 12, the trend of nighttime crashes being the majority stays the same since narrowing down to single-vehicle crashes.

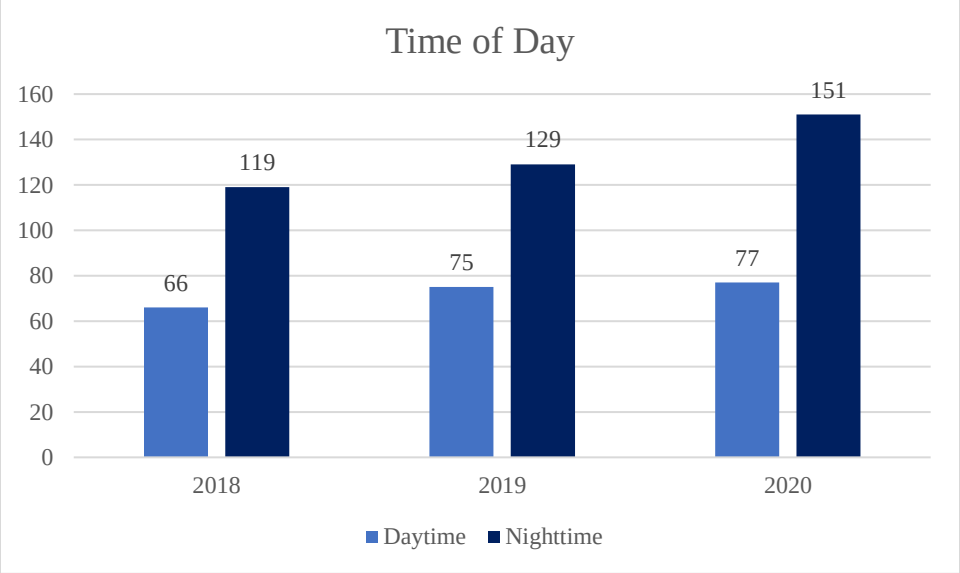

Figure 12: Time of Day of Single-Vehicle Crashes

But for the day of week, the weekday and weekend statistics do not propose a majority and in 2019, the weekend does present the majority whereas in 2018 and 2020 the weekday presents a majority.

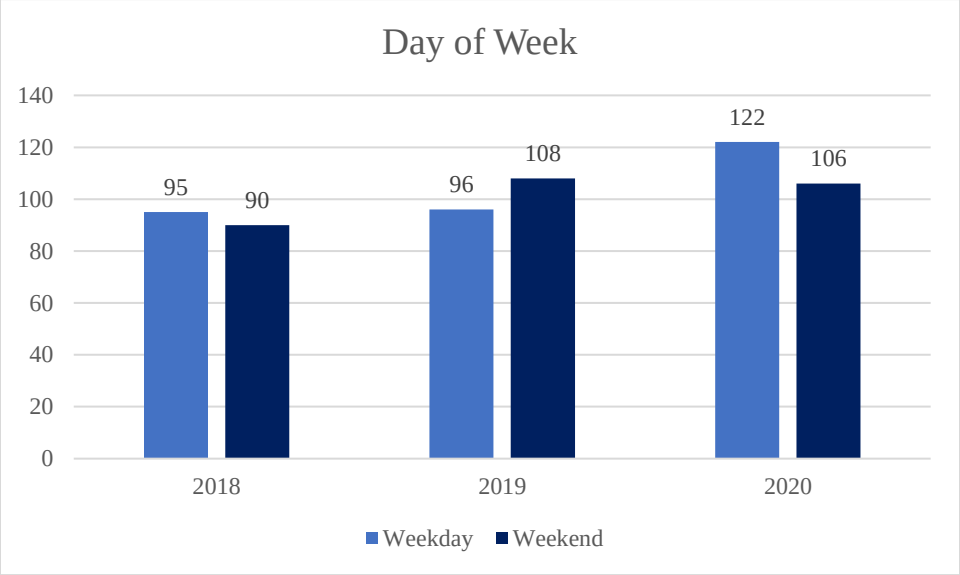

Figure 13: Day of Week of Single-Car Crashes

As previously developed, in the broader overview of speeding involved crashes, for the single-vehicle crashes the amount of crashes per day can be broken down. For example, in 2018 there were about 0.37 crashes per day of a 5-day week and 0.87 crashes per day of a 2-day weekend. Again, this presents that there were over double the number of crashes during the weekends as there were during the weekdays.

Broken down into single-vehicle crashes, the drivers who tested a positive BAC still claimed the majority over those with zero BAC or those where it is unknown as shown in Figure 14.

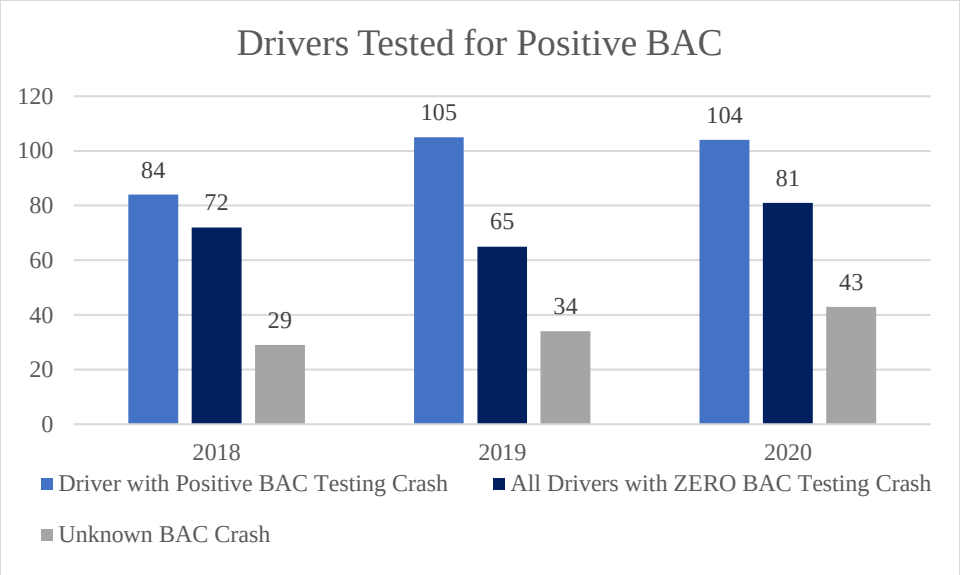

Figure 14: Drivers Tested for Positive BAC of Single-Vehicle Crashes

Figure 15 develops a more in-depth look into the exact blood alcohol content of the drivers.

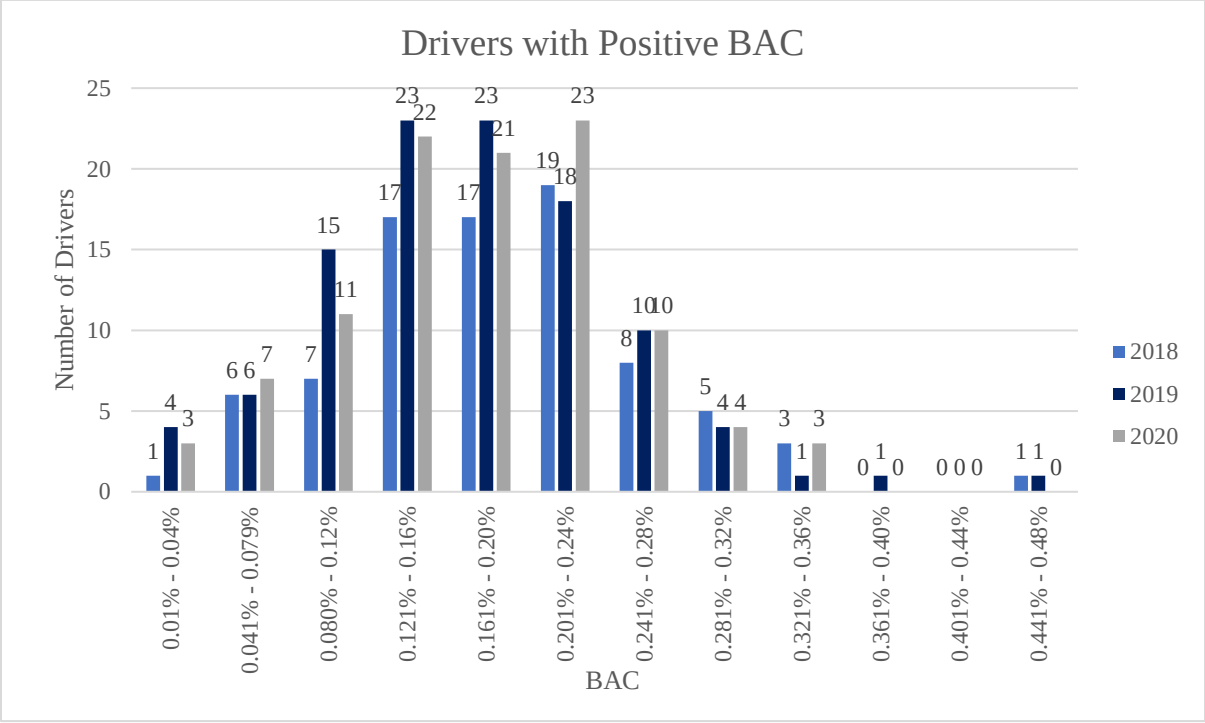

Figure 15: Drivers with Positive BAC in Single-Vehicle Crashes

Through just looking at the drivers that tested a positive BAC, 92%, 91%, and 90% of the drivers were over the legal limit of 0.08 in 2018, 2019, and 2020, respectively. Not only were almost all of those who tested for positive BAC over the legal limit, most were over double the legal limit with some almost six times the legal limit.

It is also very important to consider the age of the individuals who are involved in speed-related, single-vehicle crashes. As shown in Figure 16, the driver's age in the 35-44 years old range has more than other age ranges.

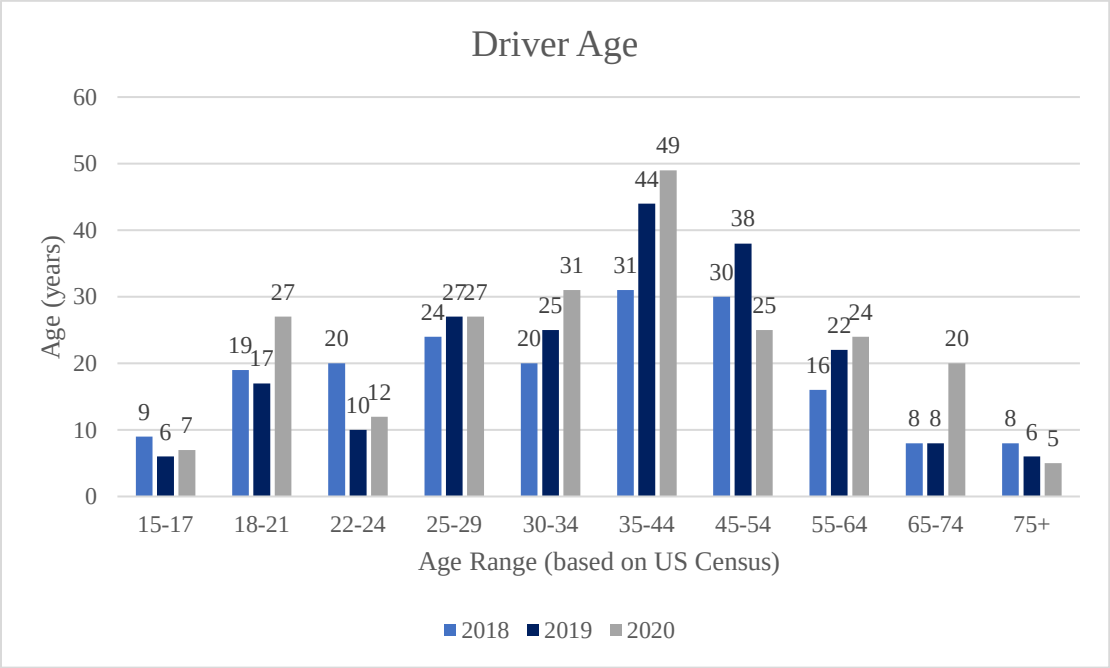

Figure 16: Driver Age of Single-Vehicle Crashes

In this age range, individuals are generally getting to an age where their children are growing up – getting into middle school and high school - and their income is steadier. This may lead to individuals, especially men, not being as protective over themselves and possibly wanting to go buy the vehicle they've always wanted. Generally, those are sports cars or motorcycles and with

those vehicles comes dangerous speeds. In Figure 17, men are drastically shown to be involved in single-vehicle, speeding involved crashes.

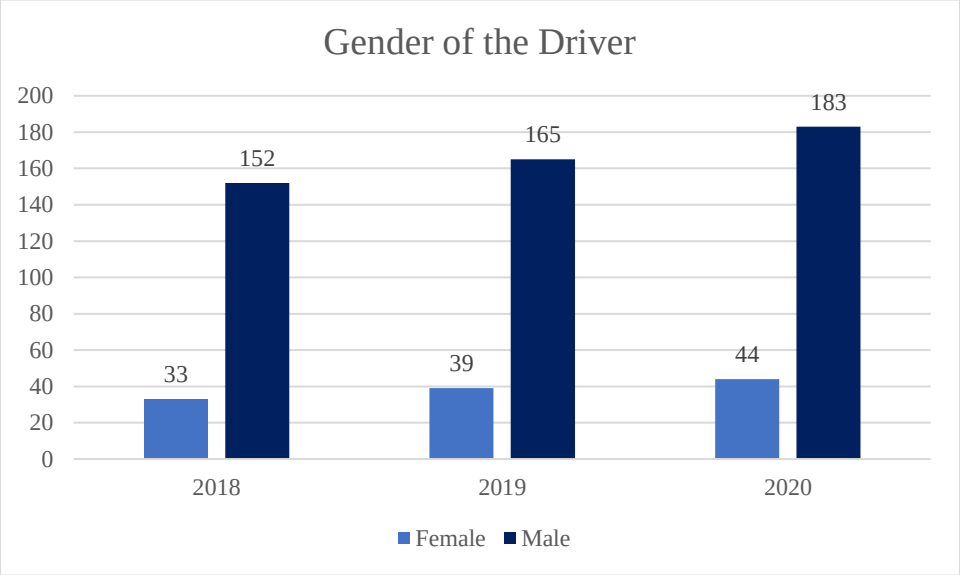

Figure 17: Gender of the Driver in Single-Vehicle Crashes

For 2018, 2019, and 2020 men were about 82%, 81%, and 81%, respectively, of the drivers involved in these crashes. This is an astonishing variance from male to female which indicates men are indeed riskier drivers than women.

Section 3.3: Male Drivers

Because males are so much more likely than women to be involved in fatal crashes, specifically single-vehicle, speeding-related, the data has been further narrowed to exclude females from the analysis. For this section, vehicle types will also be looked into alongside some of the previously mentioned variables. As shown in Table 7 in the appendix, there were 165, 176, and 192 total fatalities in 2018, 2019, and 2020, respectively. Of those fatalities, there were 152 crashes in 2018, 165 crashes in 2019, and 183 crashes in 2020. The majority of the crashes

caused a singular death. The crashes more often occurred on rural roadways, as shown in Figure 18.

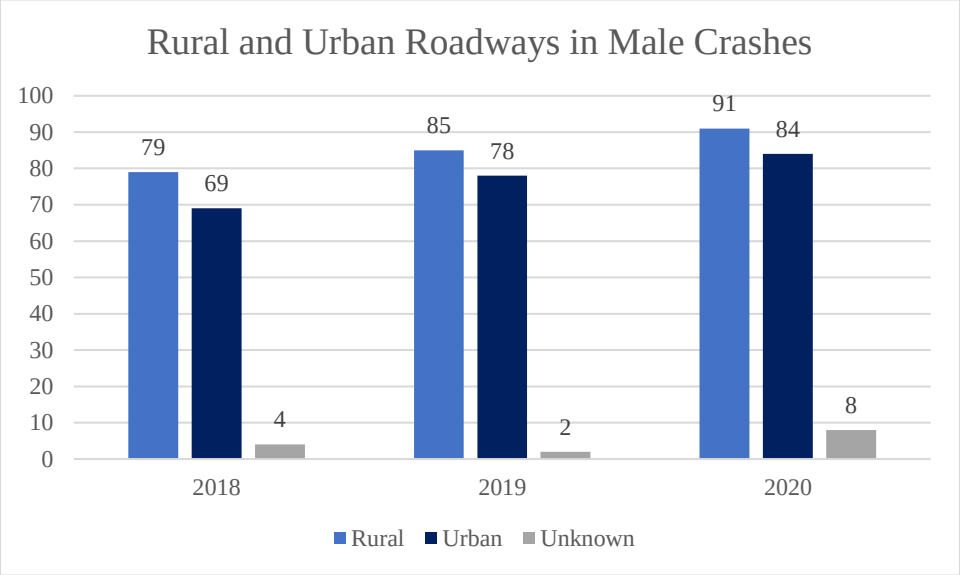

Figure 18: Rural and Urban Roadways in Male Crashes

As seen in previous sections, the difference between rural and urban crashes is minimal with the highest for this male only data section is 10 crashes in 2018 when there was a total of 152 crashes.

These male driver crashes are shown to occur during the nighttime, as seen in Figure 19. But when looking at the day of the week, in Figure 20, it is not unanimous across 2018-2020. For 2018 and 2019, more crashes occurred on the weekend, whereas in 2020, more crashes occurred during the week.

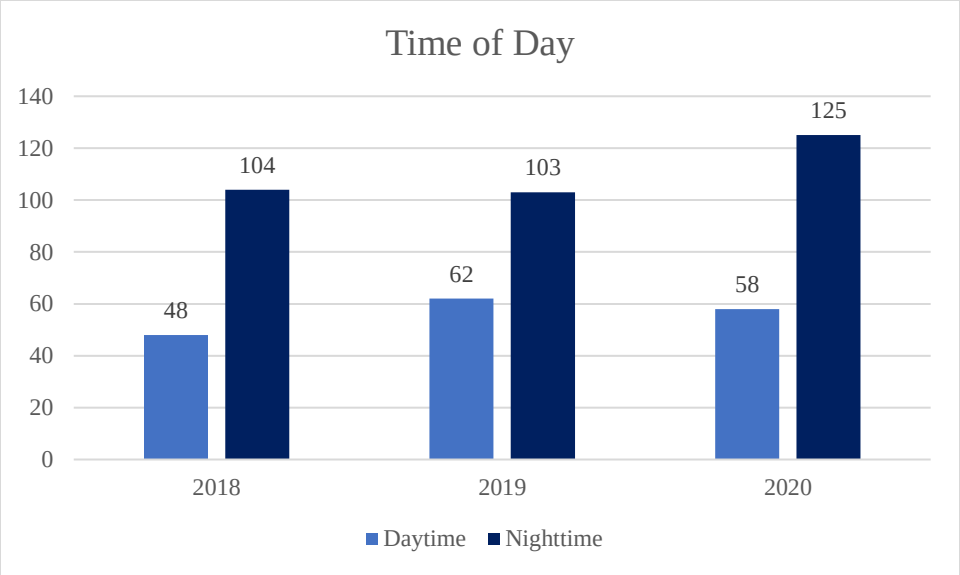

Figure 19: Time of Day Crashes Occurred by Male Drivers

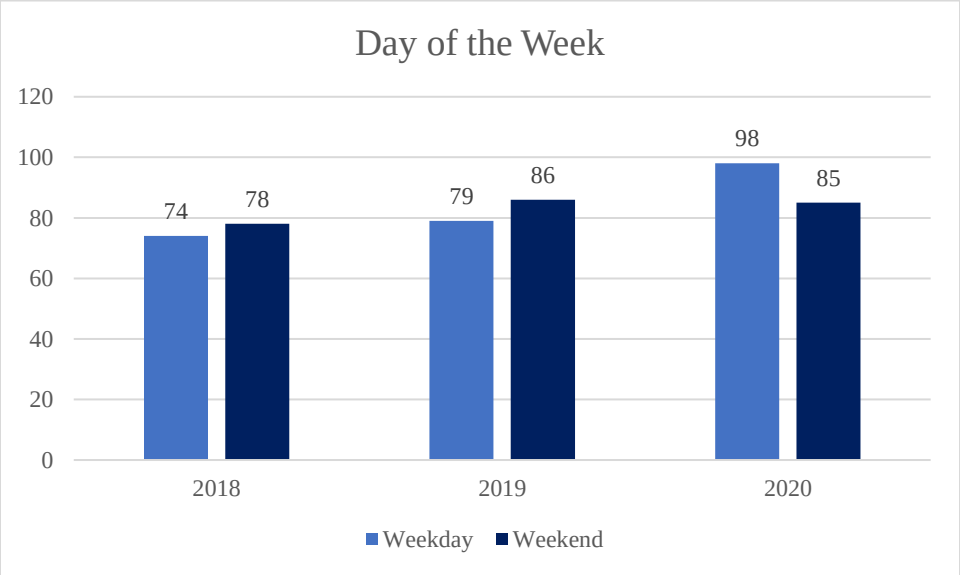

Figure 20: Day of the Week Crashes Occurred by Male Drivers

A possible theory to explain this difference could be that COVID-19 allowed more men to have free time during the week which they would not have had in the previous years where they most likely would have been at work or knew they had to be at work the next morning. Without the expectation of having to physically go into work throughout the week – most companies allowed remote work during this time – their personal expectation of themselves could have declined as

well as their mental health due to lack of seeing peers. Going on drives allowed many people to escape their homes during the COVID lockdowns and entertain themselves outside of the home they feel they are trapped in due to the circumstances. Specific hours of the day are also reported and seen in Figure 21.

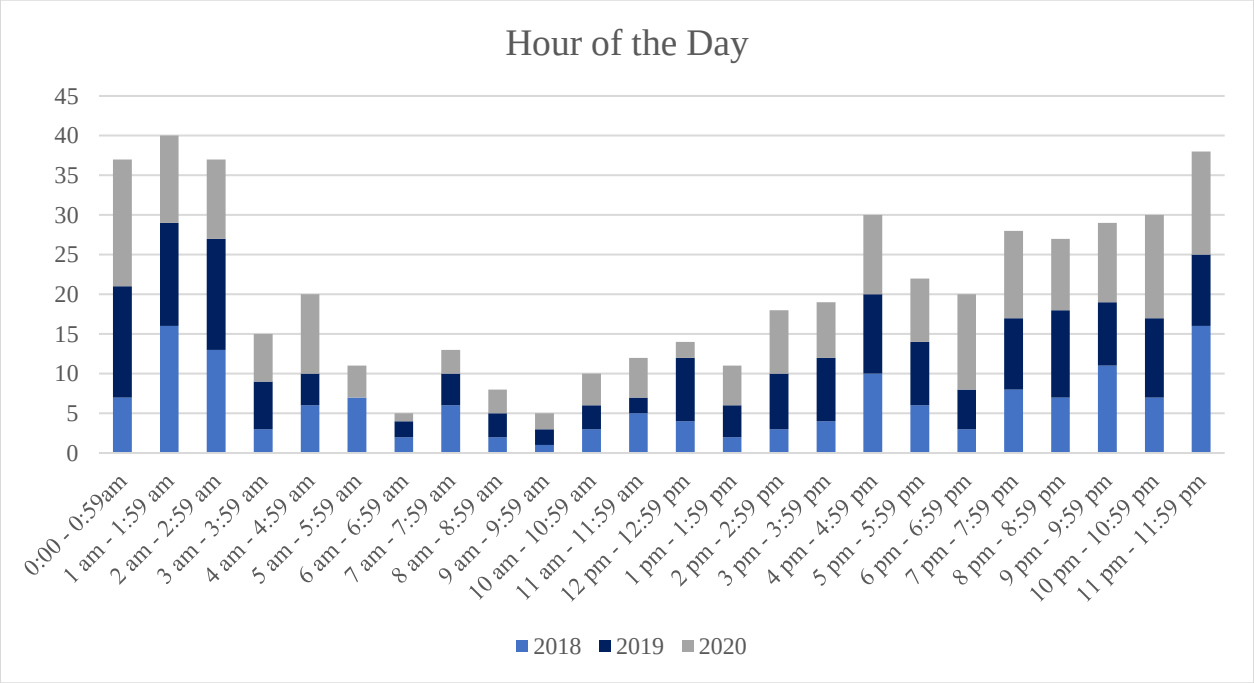

Figure 21: Hour of the Day Crashes Occurred by Male Drivers

From the hours of about 3 am to about 4 pm, the number of crashes occurred is significantly lower than the hours of 4 pm to 3 am. The time block of 3 am – 4 pm encompasses the main portion of the workday where the time block of 4 pm – 3 am encases the time where individuals are getting off work, traveling home, running errands, going to bars, and generally just using their free-time as they see fit – or fun. An increase in travel during these times is proportionate to the increase in accidents. Also, Figure 21 reveals how many more fatal crashes occurred during the 2020 years compared to 2019 and 2018.

For this section, motorcycles were also investigated to see how many male drivers were driving motorcycles in these fatal crashes. In Table 1, motorcycles are not the majority of crashes but are a significant number of them.

Table 1: Motorcycles Involved in Male Crashes

A_MC	**2018**	**2019**	**2020**
Involved Motorcycle	29	40	56
Other Crash	123	125	127

For 2018, 2019, and 2020, the vehicles were motorcycles about 19%, 24%, and 31% or the time, respectively. In Section 3.4, the data will be broken down once more to exclude all other vehicles except for motorcycles.

Motorcycles are not the only vehicles investigated, though. The following Table 2 depicts which vehicle types were the majority of vehicles that were involved in crashes with male drivers. For 2018 and 2019, 4-door hardtop sedans were more often driven by males who got into speeding involved fatal crashes. But for 2020, two-wheel motorcycles narrowly passed the 4-door hardtop sedans to be the leading vehicle type involved in these crashes. It is noted that for 2019, there was only one less motorcycle involved than there were 4-door hardtop sedans.

Table 2: Vehicle Type of Male Drivers in Speed-Involved Crashes

Vehicle Type	**2018**	**2019**	**2020**	**Total**
2-door sedan, hardtop, coupe	2	6	16	24
3-door/2-door hatchback	4	3	1	8
4-door sedan, hardtop	53	41	45	139
5-door/4-door hatchback	4	1	2	7
ATV/ATC [All-Terrain Cycle]	2	6	2	10
Cab Chassis Based (includes Rescue Vehicle, Light Stake, Dump, and Tow Truck)	1	0	0	1
Compact Utility (Utility Vehicle Categories "Small" and "Midsize")	15	19	15	49
Convertible *(*excludes sun-roof, t-bar)	2	3	3	8
Farm equipment other than trucks	1	0	0	1
Large utility (ANSI D16.1 Utility Vehicle Categories and "Full Size" and "Large")	1	2	5	8
Large Van-Includes van-based buses (B150-B350, Sportsman, Royal Maxiwagon, Ram, Tradesman,...)	1	2	0	3
Light Pickup	24	33	21	78
Medium/heavy Pickup (GVWR greater than 10,000 lbs.)	0	2	0	2
Minivan (Chrysler Town and Country, Caravan, Grand Caravan, Voyager, Voyager, Honda-Odyssey, ...)	3	1	0	4
Motor Scooter	0	0	2	2
Off-road Motorcycle	0	0	2	2
Recreational Off-Highway Vehicle	0	1	4	5
Single-unit straight truck or Cab-Chassis (GVWR greater than 26,000 lbs.)	1	1	2	4
Single-unit straight truck or Cab-Chassis (GVWR range 19,501 to 26,000 lbs.)	0	1	1	2
Station Wagon (excluding van and truck based)	4	0	7	11
Truck-tractor (Cab only, or with any number of trailing unit; any weight)	3	2	2	7
Two Wheel Motorcycle (excluding motor scooters)	28	40	52	120
Unknown body type	0	0	1	1
Utility station wagon (includes suburban limousines, Suburban, Travellall, Grand Wagoneer)	2	1	0	3

Driver details were also investigated for this group of data but are outlined in Table 8 in the appendix. Briefly, for male driven, single-vehicle, speeding-involved crashes trends include white, middle-aged men who had a BAC over the legal limit.

Section 3.4: Motorcycles

In this section, the data from Section 3.3 was divided down into a significantly smaller pool of data to only include speeding involved, single vehicle crashes, with male drivers of motorcycles. Tables 10, 11, and 12 in the appendix provide a fuller outlook on data analyzed in this section. For these motorcycle crashes in Ohio, there were a total of 30, 41, and 58 fatalities in 2018, 2019, and 2020, respectively, with all but four crashes only causing one death.

Table 3: Number of Fatalities of Speed-Involved, Single-Vehicle, Male Driven Motorcycle Crashes

FATALS	2018	2019	2020
1	28	39	54
2	1	1	2
Total Fatalities	30	41	58

These crashes were mostly on urban roadways in 2018 and 2019, as shown in Figure 22, but in 2020 there was an increase in rural roadway crashes to surpass the urban trend.

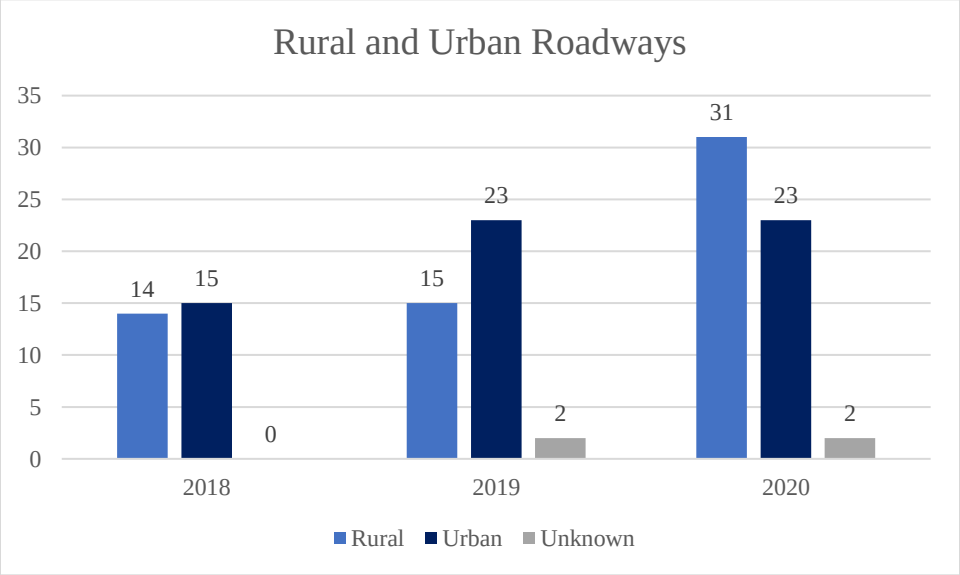

Figure 22: Rural and Urban Roadways in which Motorcycle Crashes Occurred

But even despite the change from urban to rural from 2019 to 2020, the roadway function class kept the same across the three years as a collector, shown in Figure 23.

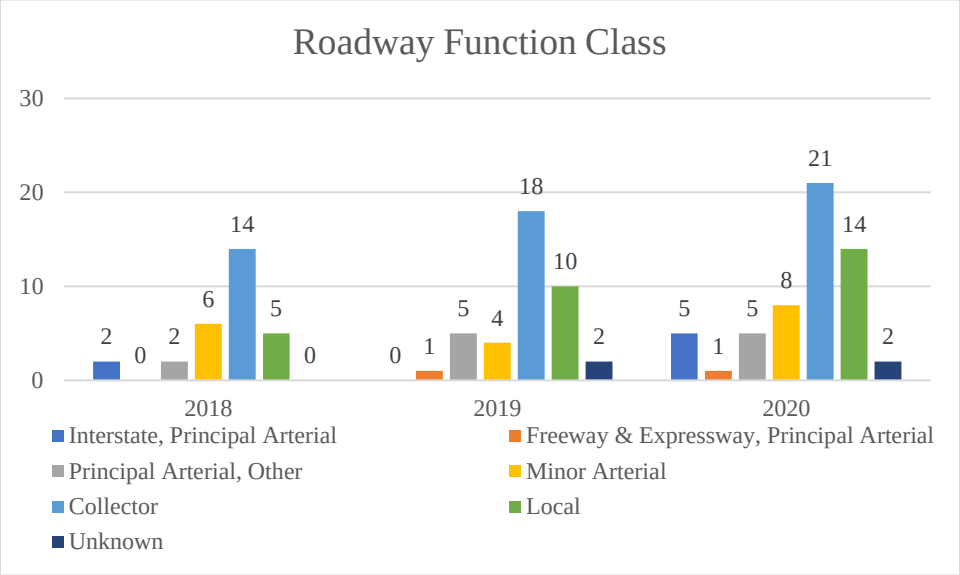

Figure 23: Roadway Function Class of Motorcycle Crashes

From each breakdown, beginning at the general overlook of just speeding-involved drivers to this section with the motorcycle only data, collector streets have been a constant trend of where these fatalities result.

The time of day has also stayed constant throughout each breakdown. In Figure 24, nighttime is still the majority of when crashes occur. For motorcycles, Figure 25 creates a more in-depth look into what hour of the day accidents are happening. For 2020, the highest amount of crashes took place during the 4'oclock hour which is not during the nighttime as shown previously. From about 1 pm to 3 am, there is about a constant rate of accidents occurring. Nice sunny, warm weekend days during non-winter months, outlined in Figure 26 and Figure 27, help to paint a picture of why motorcyclists would be out driving during daylight hours. If it's a nice enough day, for example, bikers often meet with each other for drinks at the local bar near the

evening which then turns into night. Joyful gatherings can turn into dangerous drives at night to get home. For motorcycles, speed plays a massive role in the handling of a bike and if there is alcohol in an individual's system, perception of the handling can become swayed and ultimately dangerous.

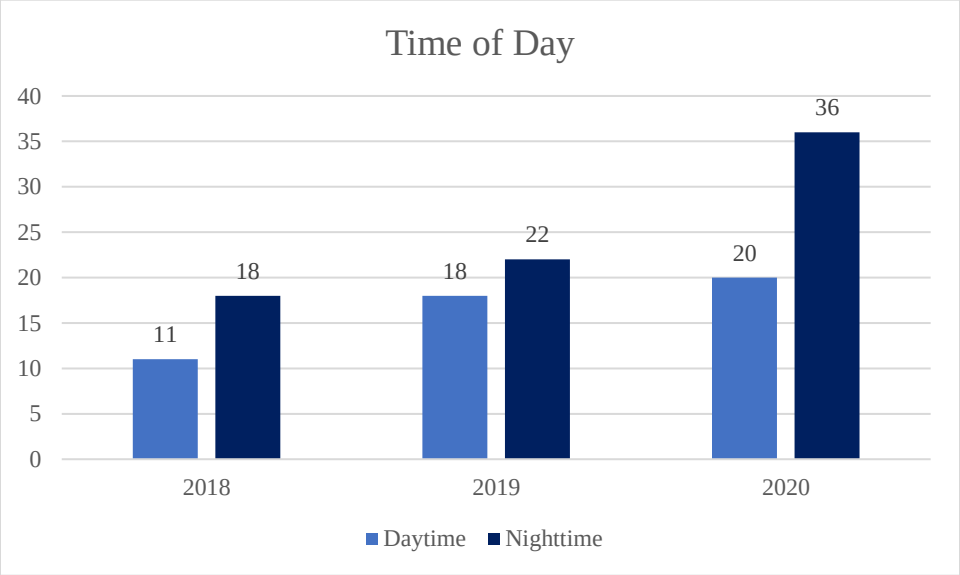

Figure 24: Time of Day of Motorcycle Crashes

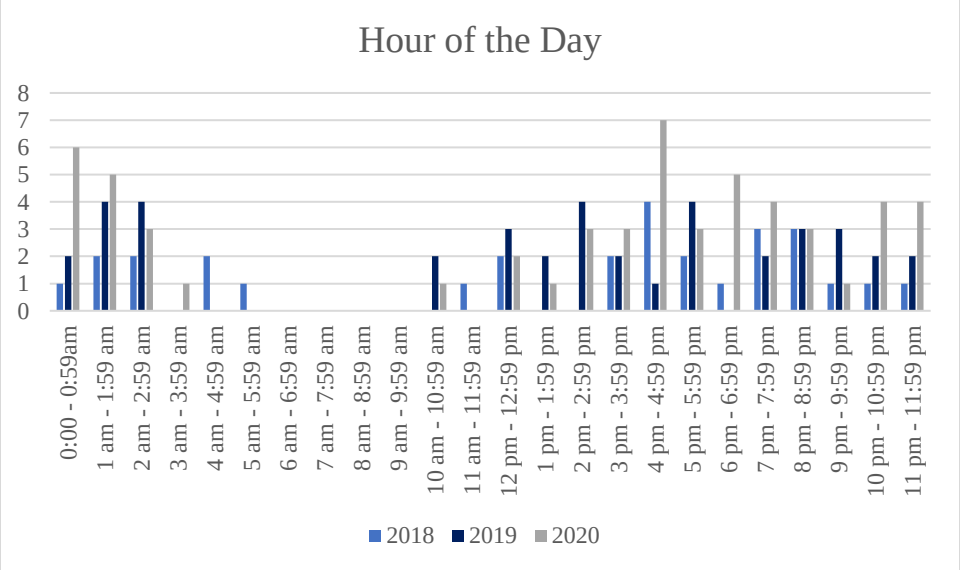

Figure 25: Hour of the Day of Motorcycle Crashes

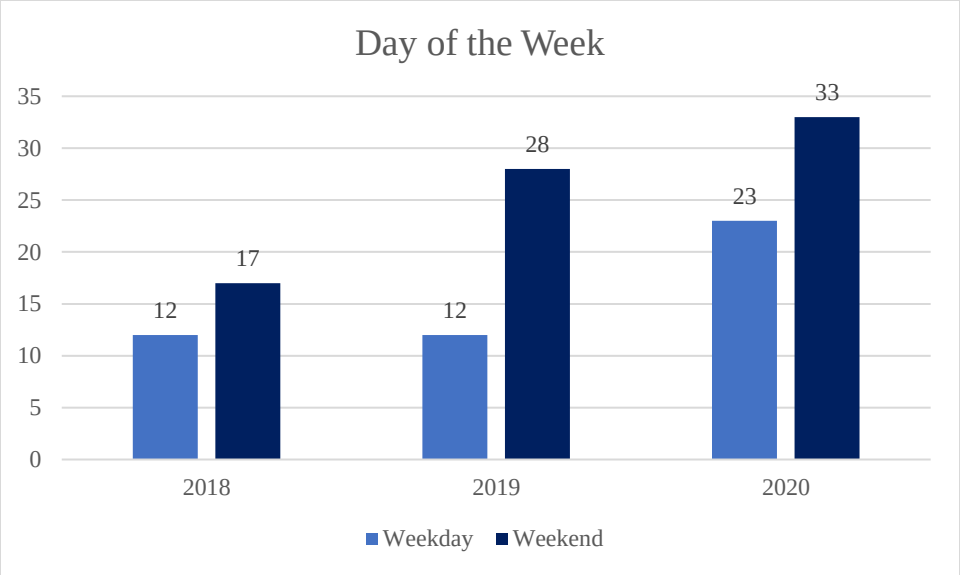

Figure 26: Day of the Week of Motorcycle Crashes

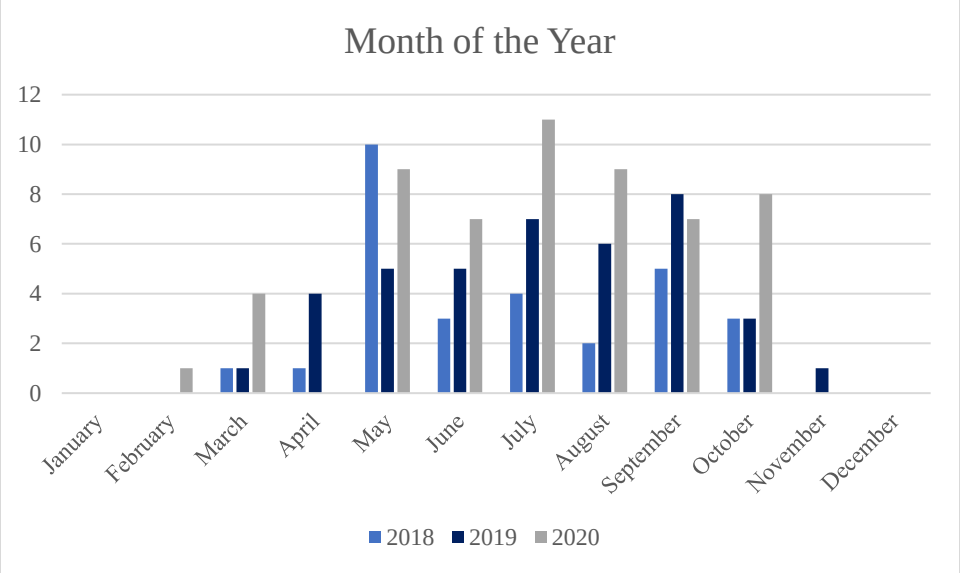

Figure 27: Month of The Year of Motorcycle Crashes

Specific person details are important to determining a target audience if change needs to be addressed. Figure 28 indicates that those 35 years old and above are more likely to have fatal accidents than those who are younger. There is a striking 19 persons in 2020 who were in the 35 – 44-year-old range involved in a fatal motorcycle accident.

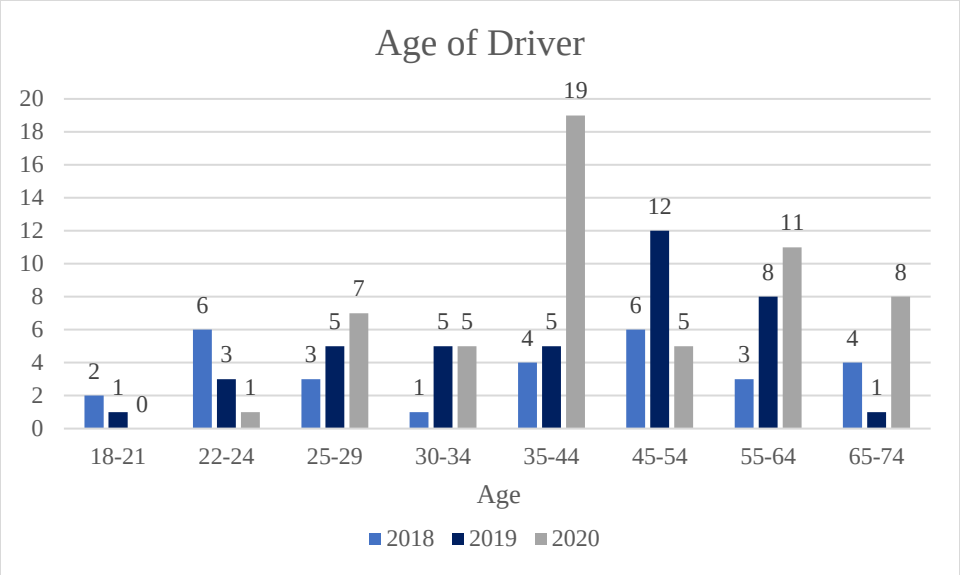

Figure 28: Age of the Driver of Motorcycle Crashes

In these upper age ranges, men often want to get back to the "good ole days" of riding bikes and being free, as mentioned in the previous section. A mid-life crisis can turn into a motorcycle purchase and finding that freedom again. But also at these ages, bodies are more vulnerable, and an injury can become more life threatening.

In the hypothetical example earlier, motorcyclists met to get drinks together and have a fun night. Figure 29 backs this story by showing that many motorcyclists had a positive BAC and most who did were well over the legal limit of 0.08%.

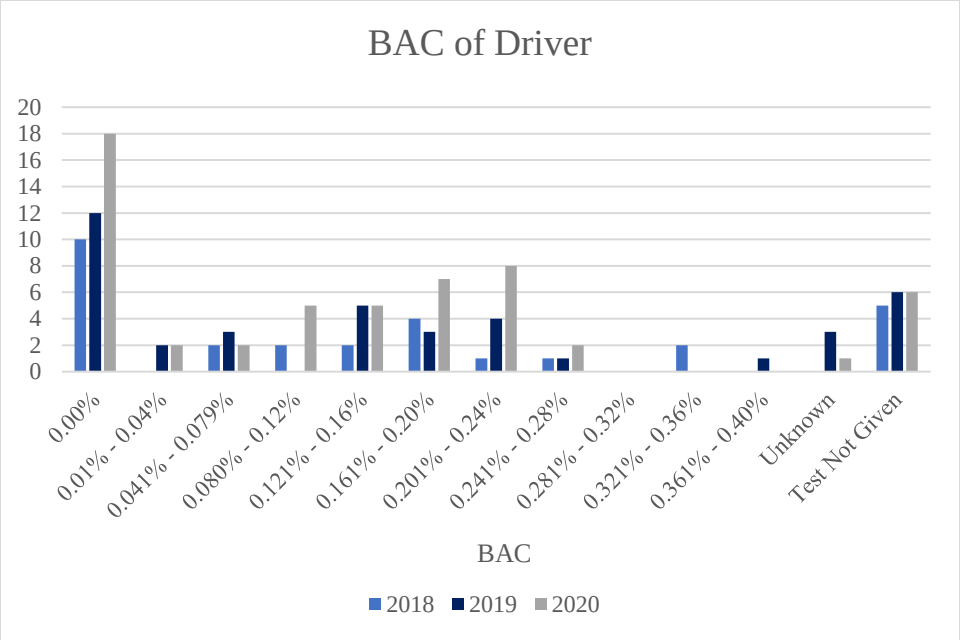

Figure 29: BAC of the Driver of Motorcycle Crashes

For 2018, 2019, and 2020, of those who had a positive BAC, the average was 0.17%, 0.16%, and 0.17%, respectively. Each of these are double or over double the legal limit.

A key factor in helping to understand the deaths of motorcycle users in speed-involved crashes is whether or not a helmet was used.

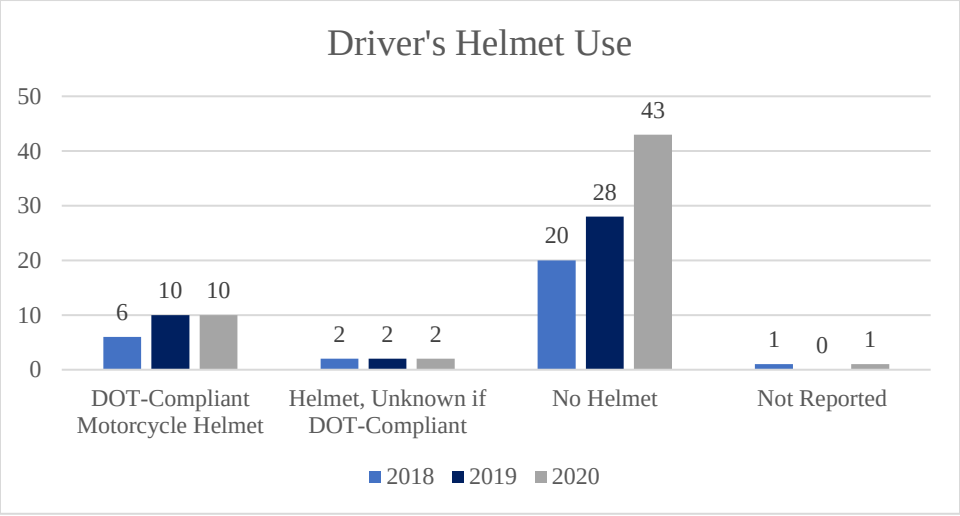

Figure 30: Helmet Use of the Driver of Motorcycle Crashes

As shown in Figure 30, most drivers in these fatal accidents did not wear a helmet – 69%, 70%, and 77% for 2018, 2019, and 2020, respectively. Riding a motorcycle without a helmet is extremely dangerous and can increase your risk of death by 37% according to Steelhorse Law who specialize in motorcycle injury lawyers (SteelHorse Law). Also, for Ohio, the Ohio Revised Code Section 4511.53 states that novice and underage riders are required by law to wear helmets and eye protection (Ohio Revised Code). This may contribute to older riders feeling as though they do not need to wear a helmet thus resulting in a higher death rate of older riders as seen in Figure 28.

Also attributed to the older crowd, the motorcycle make further backs the data of older riders being more vulnerable. Figure 31 shows that Harley-Davidson motorcycles dominate the field of makes of motorcycles, even significantly outranking Honda.

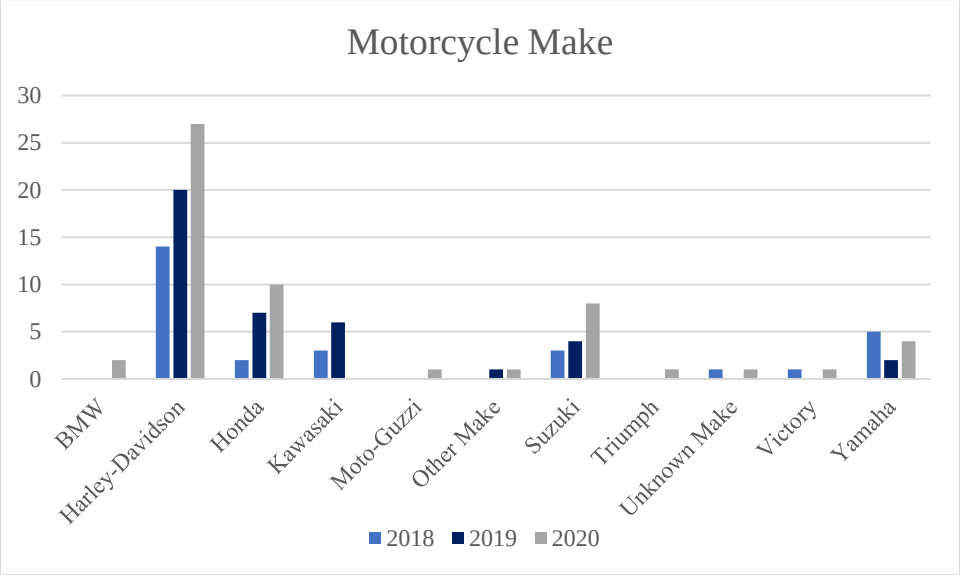

Figure 31: The Make of the Motorcycle in the Crashes

Harley-Davidson motorcycles are notoriously more expensive than other motorcycle makes ranging from about $7,000 up to $44,000 (U.S. News). For example, Honda motorcycles range

from just under $2,000 to $29,000 (Honda). Younger riders usually cannot afford Harley-Davidson motorcycles, which indicates that older riders are the ones that own them. Harley-Davidson also has a culture surrounding them which lends to riders forming groups to ride with each other. With groups like this, it is more likely that riders will not wear helmets.

Section 4: Conclusion & Recommendations

Section 4.1: Conclusion

Throughout the breakdown of NHTSA and FARS data collected to investigate speed-involved fatalities, various trends were observed. For the first set of data the included just speed-involved crashes in Ohio from 2018 to 2020, drivers were more likely to be men who drove on urban, non-interstate roadways - often collector streets – during the week and at nighttime. Usually, it was a single vehicle crash resulting in usually one fatality per crash. For the second section which broke the initial data down to now only include reports where single-vehicles were involved saw a lot of the same trends. Men continued to be the majority of those who caused accidents. They also continued to be on collector roads, but instead a majority were on rural roadways.

For the third section, the data was broken down from the previous section into only male drivers. Trends from previous sections tended to stay true – the male drivers were involved in accidents generally over the weekend at night on collector roadways. These drivers were more likely to be in 4-door, hard top sedans, but it was observed that there were a decent amount of motorcycles involved in the crashes. This observation allowed for the final breakdown into solely motorcycle crashes from the previous data breakdown. This final trend developed that middle-aged white men, were involved in single-vehicle, speed-involved fatal crashes on

collector roadways. These motorcyclists were more likely to have a positive BAC, with the majority of those being over the legal limit. Along with this, those drivers generally did not wear a helmet, thus drastically increasing their risk of death.

Through these analyses, recommendations can be developed to create change in the future. It is a general rule to try and reduce the number of crashes resulting in fatalities to help save the lives of not only those involved but the friends and family of such.

Section 4.2: Recommendations

With 36,560, 36,096, and 38,824, deaths caused by traffic accidents in 2018, 2019, and 2020, respectively, in the United States (NHTSA), change needs to be made to increase the safety and education of drivers and pedestrians using the roadways. Specifically, for this analysis, since a main focus was the breakdown of those who were involved in speed-related motorcycle crashes, laws should be implemented to require the use of helmets when riding a motorcycle on public roadways. As seen earlier, most of the users involved in these types of crashes did not wear a helmet thus significantly increasing their risk of death from the start. Each of these accidents involved speeding as well. Reinforcing speeds on the roadways most utilized by these drivers is important. Educating the riders on the impact that speed has on the handling of a bike as well as the consequences if something goes slightly wrong during a ride at high speeds, can help riders to think about their actions before taking part in them. A contributing factor to the speed was most likely alcohol induced, as well. Stricter regulations of bars on serving policies could help reduce the number of motorcyclists who leave the bar at the legal limit and well over it. Through an increase in education and awareness, as well as new law implementations, the number of those affected by these reckless drivers can be reduced alongside the number of fatalities.

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Section 6: Appendix

Note: Tables are highlighted to emphasize which attribute had the majority over the others.

Table 4: Extensive Overview of Variables from Speed-Involved Fatalities for Section 3.1

Involved Speeding			
Year	**2018**	**2019**	**2020**
Total Crashes	268	291	315
A_RU			
Rural	132	139	133
Urban	130	149	169
Unknown	6	3	13
A_INTER			
Interstate	30	27	28
Non-Interstate	232	261	274
Unknown	6	3	13
A_RELRD			
On Roadway	76	96	95
Off Roadway/Shoulder	1	3	3
Off Roadway/Median	9	6	5
Off Roadway/Other	182	185	212
Other/Unknown	0	1	0
A_INTSEC			
Intersection	44	52	66
Non-Intersection	224	239	249
A_ROADFC			
Interstate, Principal Arterial	30	27	28
Freeway & Expressway, Principal Arterial	7	6	10
Principal Arterial, Other	37	39	43
Minor Arterial	42	59	74
Collector	86	98	91
Local	60	59	56
Unknown	6	3	13
A_MANCOL			
Not Collision with Motor Vehicle in Transport	202	213	242

Rear-End	16	11	11
Head-On	13	26	8
Angle	30	34	51
Sideswipe	7	7	3
Other	0	0	0
Unknown	0	0	0
A_TOD			
Daytime	111	127	130
Nighttime	157	164	185
A_DOW			
Weekday	147	149	170
Weekend	121	142	145
A_CT			
Single-Vehicle Crash	185	204	228
Two-Vehicle Crash	64	71	75
More Than Two-Vehicle Crash	19	16	12
A_MC			
Involved Motorcycle	51	61	91
Other Crash	217	230	224
A_PED			
Involved Pedestrian	5	2	4
Other Crash	263	289	311
A_POSBAC			
Driver with Positive BAC Testing Crash	109	135	125
All Drivers with ZERO BAC Testing Crash	77	79	86
Unknown BAC Crash	82	77	104
A_DIST			
Involving a Distracted Driver	12	16	12
Not Distracted	256	275	303

Table 5: Extensive Overview of Variables from Speed-Involved, Single-Vehicle Fatalities for Section 3.2

Speeding, Single-Vehicle			
Year	**2018**	**2019**	**2020**

Total Crashes	184	204	228
FATALS			
1	171	191	212
2	13	12	15
3	0	1	1
4	1	0	0
A_RU			
Rural	99	103	112
Urban	82	98	106
Unknown	4	3	10
A_INTER			
Interstate	16	10	25
Non-Interstate	165	191	193
Unknown	4	3	10
A_RELRD			
On Roadway	9	17	14
Off Roadway/Shoulder	1	3	3
Off Roadway/Median	5	5	5
Off Roadway/Other	170	178	206
Other/Unknown	0	1	0
A_INTSEC			
Intersection	14	33	24
Non-Intersection	171	171	204
A_ROADFC			
Interstate, Principal Arterial	16	10	25
Freeway & Expressway, Principal Arterial	5	3	7
Principal Arterial, Other	18	19	20
Minor Arterial	27	36	44
Collector	64	76	72
Local	51	57	50
Unknown	4	3	10
A_TOD			
Daytime	66	75	77
Nighttime	119	129	151

A_DOW			
Weekday	95	96	122
Weekend	90	108	106
A_MC			
Involved Motorcycle	30	41	57
Other Crash	155	163	171
A_POSBAC			
Driver with Positive BAC Testing Crash	84	105	104
All Drivers with ZERO BAC Testing Crash	72	65	81
Unknown BAC Crash	29	34	43
A_DIST			
Involving a Distracted Driver	7	10	9
Not Distracted	178	194	219
Month			
January	14	10	9
February	11	8	8
March	14	14	15
April	16	14	12
May	21	19	19
June	21	23	22
July	14	23	28
August	12	20	23
September	12	24	22
October	22	16	30
November	13	22	18
December	15	11	21
Hour			
0:00am-0:59am	7	17	17
1:00am-1:59am	17	18	13
2:00am-2:59am	13	17	12
3:00am-3:59am	6	8	7
4:00am-4:59am	8	5	11
5:00am-5:59am	8	2	4
6:00am-6:59am	2	3	3
7:00am-7:59am	8	7	4
8:00am-8:59am	5	4	5
9:00am-9:59am	3	3	3

10:00am-10:59am	3	4	5
11:00am-11:59am	6	2	6
12:00pm-12:59pm	5	10	2
1:00pm-1:59pm	3	6	6
2:00pm-2:59pm	4	8	11
3:00pm-3:59pm	5	8	10
4:00pm-4:59pm	16	10	11
5:00pm-5:59pm	6	10	10
6:00pm-6:59pm	4	7	17
7:00pm-7:59pm	9	9	15
8:00pm-8:59pm	8	12	11
9:00pm-9:59pm	13	9	14
10:00pm-10:59pm	7	13	15
11:00pm-11:59pm	19	12	15

Table 6: Driver Variables in Speed Involved, Single-Vehicles Crashes Developed in Section 3.2

Involved Speeding (Drivers)				
Year	**2018**	**2019**	**2020**	
Total Drivers	185	204	227	
Driver Ages				
15	0	2	1	
16	6	2	3	
17	3	2	3	
18	5	2	4	
19	3	6	7	
20	3	4	6	
21	8	5	10	
22	8	5	0	
23	8	1	6	
24	4	4	6	
25	7	5	3	
26	4	2	5	
27	6	3	7	
28	2	9	9	
29	5	8	3	
30	4	5	5	
31	5	4	6	
32	3	8	9	
33	3	1	5	
34	5	7	6	

35	4	3	8
36	0	4	3
37	4	4	5
38	4	5	4
39	0	5	5
40	1	3	7
41	8	5	10
42	5	6	3
43	2	4	1
44	3	5	3
45	1	5	4
46	8	2	2
47	4	4	1
48	2	3	3
49	3	5	4
50	2	4	1
51	5	5	3
52	2	3	1
53	1	4	5
54	2	3	1
55	2	2	1
56	3	2	4
57	1	2	0
58	0	0	5
59	2	1	2
60	0	5	4
61	4	2	4
62	0	4	2
63	1	3	0
64	3	1	2
65	1	2	1
66	0	0	2
67	2	0	2
68	3	0	6
69	1	1	2
70	0	0	2
71	1	0	4
72	0	3	1
73	0	2	0
75	1	1	0
76	1	0	0
77	0	0	1

79	0	0	1	
81	0	3	1	
82	0	0	1	
85	2	0	0	
86	1	0	0	
87	0	1	0	
89	0	1	1	
92	1	0	0	
95	1	0	0	
97	1	0	0	
Not Reported	0	1	0	
Gender				
Female	33	39	44	
Male	152	165	183	
BAC				
0.00%	71	63	80	
0.01% - 0.04%	1	4	3	
0.041% - 0.079%	6	6	7	
0.080% - 0.12%	7	15	11	
0.121% - 0.16%	17	23	22	
0.161% - 0.20%	17	23	21	
0.201% - 0.24%	19	18	23	
0.241% - 0.28%	8	10	10	
0.281% - 0.32%	5	4	4	
0.321% - 0.36%	3	1	3	
0.361% - 0.40%	0	1	0	
0.401% - 0.44%	0	0	0	
0.441% - 0.48%	1	1	0	
Unknown	1	7	7	
Test Not Given	29	28	36	

Table 7: Extensive Overview of Variables from Speed-Involved, Single-Vehicle, Male Driver Fatalities for Section 3.3

Involved Speeding			
Year	**2018**	**2019**	**2020**
Total Crashes	152	165	183

FATALS			
1	139	155	174
2	13	9	9
3	0	1	0
A_RU			
Rural	79	85	91
Urban	69	78	84
Unknown	4	2	8
A_INTER			
Interstate	13	7	17
Non-Interstate	135	156	158
Unknown	4	2	8
A_RELRD			
On Roadway	7	14	10
Off Roadway/Shoulder	0	1	2
Off Roadway/Median	5	4	4
Off Roadway/Other	140	145	167
Other/Unknown	0	1	0
A_INTSEC			
Intersection	12	26	18
Non-Intersection	140	139	165
A_ROADFC			
Interstate, Principal Arterial	13	7	17
Freeway & Expressway, Principal Arterial	4	3	6
Principal Arterial, Other	16	15	16
Minor Arterial	20	27	36
Collector	58	65	60
Local	37	46	40
Unknown	4	2	8
A_TOD			
Daytime	48	62	58
Nighttime	104	103	125
A_DOW			
Weekday	74	79	98

Weekend	78	86	85
A_MC			
Involved Motorcycle	29	40	56
Other Crash	123	125	127
A_POSBAC			
Driver with Positive BAC Testing Crash	76	87	85
All Drivers with ZERO BAC Testing Crash	54	49	64
Unknown BAC Crash	22	29	34
A_DIST			
Involving a Distracted Driver	4	8	7
Not Distracted	148	157	176
Month			
January	11	8	9
February	10	6	6
March	13	11	9
April	14	12	10
May	18	18	17
June	18	18	20
July	14	16	23
August	11	14	21
September	10	20	17
October	17	15	24
November	7	17	13
December	9	10	14
Hour			
0:00am-0:59am	7	14	16
1:00am-1:59am	16	13	11
2:00am-2:59am	13	14	10
3:00am-3:59am	3	6	6
4:00am-4:59am	6	4	10
5:00am-5:59am	7	0	4
6:00am-6:59am	2	2	1
7:00am-7:59am	6	4	3
8:00am-8:59am	2	3	3
9:00am-9:59am	1	2	2
10:00am-10:59am	3	3	4

11:00am-11:59am	5	2	5
12:00pm-12:59pm	4	8	2
1:00pm-1:59pm	2	4	5
2:00pm-2:59pm	3	7	8
3:00pm-3:59pm	4	8	7
4:00pm-4:59pm	10	10	10
5:00pm-5:59pm	6	8	8
6:00pm-6:59pm	3	5	12
7:00pm-7:59pm	8	9	11
8:00pm-8:59pm	7	11	9
9:00pm-9:59pm	11	8	10
10:00pm-10:59pm	7	10	13
11:00pm-11:59pm	16	9	13

Table 8: Driver Variables for Speed-Involved, Single-Vehicle, Male Driver Crashes for Section 3.3

Involved Speeding, Single-Vehicle, Male Driver (Drivers)			
Year	**2018**	**2019**	**2020**
Total Drivers	152	165	183
Driver Age			
15 Years	0	2	1
16 Years	3	2	3
17 Years	2	2	3
18 Years	4	1	2
19 Years	2	5	7
20 Years	2	4	5
21 Years	6	4	7
22 Years	7	4	0
23 Years	7	0	4
24 Years	3	4	5
25 Years	6	4	3
26 Years	3	1	2
27 Years	6	3	5
28 Years	1	6	6
29 Years	3	7	3
30 Years	3	4	4
31 Years	4	4	5
32 Years	2	6	8
33 Years	3	0	3

34 Years	5	4	6
35 Years	4	2	7
36 Years	0	3	2
37 Years	3	3	5
38 Years	2	2	4
39 Years	0	3	5
40 Years	1	2	7
41 Years	8	5	8
42 Years	4	6	3
43 Years	2	4	1
44 Years	2	4	2
45 Years	1	4	3
46 Years	7	1	2
47 Years	3	2	1
48 Years	1	3	3
49 Years	3	5	2
50 Years	2	3	1
51 Years	5	5	2
52 Years	2	3	1
53 Years	1	4	4
54 Years	2	3	0
55 Years	1	2	1
56 Years	3	2	3
57 Years	1	2	0
58 Years	0	0	3
59 Years	2	0	1
60 Years	0	5	4
61 Years	4	2	4
62 Years	0	4	2
63 Years	1	3	0
64 Years	3	1	2
65 Years	1	1	1
66 Years	0	0	1
67 Years	2	0	1
68 Years	2	0	5
69 Years	1	1	2
70 Years	0	0	2
71 Years	1	0	3
72 Years	0	1	1
73 Years	0	2	0
75 Years	1	1	0
76 Years	1	0	0

79 Years	0	0	1
81 Years	0	3	0
86 Years	1	0	0
89 Years	0	1	1
92 Years	1	0	0
97 Years	1	0	0
BAC			
0.00%	53	48	64
0.01% - 0.04%	1	4	3
0.041% - 0.079%	6	6	7
0.080% - 0.12%	7	10	8
0.121% - 0.16%	16	19	18
0.161% - 0.20%	15	22	18
0.201% - 0.24%	16	13	17
0.241% - 0.28%	7	9	9
0.281% - 0.32%	5	3	3
0.321% - 0.36%	3	1	2
0.361% - 0.40%	0	1	0
0.401% - 0.44%	0	0	0
0.441% - 0.48%	0	0	0
Unknown	0	6	5
Test Not Given	23	23	29
Ethnicity			
Hispanic, Origin Not Specified or Other Origin	1	0	1
Mexican	0	3	4
Non-Hispanic	127	132	146
Not A Fatality (not Applicable)	22	28	28
Puerto Rican	1	2	2
Unknown	1	0	2

Table 9: Vehicle Variables for Speed-Involved, Single-Vehicle, Male Driver Crashes for Section 3.3

Involved Speeding, Single-Vehicle, Male Driver (Vehicles)			
Year	**2018**	**2019**	**2020**
Total Vehicles	9	9	17
Vehicle Make			
Acura	1	3	4

Alfa Romeo	0	1	0
Audi	1	0	0
BMW	3	1	7
Buick / Opel	2	3	1
Cadillac	1	3	0
Chevrolet	24	28	26
Chrysler	3	2	1
Dodge	9	5	13
Ford	18	25	19
Freightliner	3	0	1
GMC	8	6	3
Harley-Davidson	14	20	27
Honda	13	20	19
Hyundai	3	5	1
International Harvester/Navistar	0	2	1
Jaguar	1	0	1
Jeep / Kaiser-Jeep / Willys- Jeep	3	2	4
Kawasaki	3	6	0
Kenworth	0	1	0
KIA	2	2	3
Lexus	3	1	3
Lincoln	1	3	0
Mack	0	0	1
Mazda	1	1	2
Mercedes-Benz	1	0	0
Mercury	0	1	0
Moto-Guzzi	0	0	1
Nissan/Datsun	3	2	2
Other Make	2	3	7
Peterbilt	1	0	2
Pontiac	3	1	2
Saab	1	0	0
Saturn	0	1	3
Scion	1	0	0
Subaru	0	2	2
Suzuki	4	4	9
Toyota	8	8	10
Triumph	0	0	1
Unknown Make	1	0	1
Victory	1	0	1
Volkswagen	3	0	1
Volvo	1	0	0

Yamaha	5	3	4
Vehicle Type			
2-door sedan, hardtop, coupe	2	6	16
3-door/2-door hatchback	4	3	1
4-door sedan, hardtop	53	41	45
5-door/4-door hatchback	4	1	2
ATV/ATC [All-Terrain Cycle]	2	6	2
Cab Chassis Based (includes Rescue Vehicle, Light Stake, Dump, and Tow Truck)	1	0	0
Compact Utility (Utility Vehicle Categories "Small" and "Midsize")	15	19	15
Convertible (excludes sun-roof, t-bar)	2	3	3
Farm equipment other than trucks	1	0	0
Large utility (ANSI D16.1 Utility Vehicle Categories and "Full Size" and "Large")	1	2	5
Large Van-Includes van-based buses (B150-B350, Sportsman, Royal Maxiwagon, Ram, Tradesman,...)	1	2	0
Light Pickup	24	33	21
Medium/heavy Pickup (GVWR greater than 10,000 lbs.)	0	2	0
Minivan (Chrysler Town and Country, Caravan, Grand Caravan, Voyager, Voyager, Honda-Odyssey, ...)	3	1	0
Motor Scooter	0	0	2
Off-road Motorcycle	0	0	2
Recreational Off-Highway Vehicle	0	1	4
Single-unit straight truck or Cab-Chassis (GVWR greater than 26,000 lbs.)	1	1	2
Single-unit straight truck or Cab-Chassis (GVWR range 19,501 to 26,000 lbs.)	0	1	1
Station Wagon (excluding van and truck based)	4	0	7
Truck-tractor (Cab only, or with any number of trailing unit; any weight)	3	2	2
Two Wheel Motorcycle (excluding motor scooters)	28	40	52
Unknown body type	0	0	1
Utility station wagon (includes suburban limousines, Suburban, Travellall, Grand Wagoneer)	2	1	0

Table 10: Extensive Overview of Variables from Speed-Involved, Single-Vehicle, Male Driver, Motorcycles Fatalities for Section 3.4

Involved Speeding, Single-Vehicle, Male Driver, Motorcycle			
Year	**2018**	**2019**	**2020**
Total Crashes	29	40	56

FATALS			
1	28	39	54
2	1	1	2
A_RU			
Rural	14	15	31
Urban	15	23	23
Unknown	0	2	2
A_ROADFC			
Interstate, Principal Arterial	2	0	5
Freeway & Expressway, Principal Arterial	0	1	1
Principal Arterial, Other	2	5	5
Minor Arterial	6	4	8
Collector	14	18	21
Local	5	10	14
Unknown	0	2	2
A_TOD			
Daytime	11	18	20
Nighttime	18	22	36
A_DOW			
Weekday	12	12	23
Weekend	17	28	33
A_POSBAC			
Driver with Positive BAC Testing Crash	14	19	31
All Drivers with ZERO BAC Testing Crash	10	12	18
Unknown BAC Crash	5	9	7
Month			
January	0	0	0
February	0	0	1
March	1	1	4
April	1	4	0
May	10	5	9
June	3	5	7
July	4	7	11

August	2	6	9
September	5	8	7
October	3	3	8
November	0	1	0
December	0	0	0
Hour			
0:00am-0:59am	1	2	6
1:00am-1:59am	2	4	5
2:00am-2:59am	2	4	3
3:00am-3:59am	0	0	1
4:00am-4:59am	2	0	0
5:00am-5:59am	1	0	0
6:00am-6:59am	0	0	0
7:00am-7:59am	0	0	0
8:00am-8:59am	0	0	0
9:00am-9:59am	0	0	0
10:00am-10:59am	0	2	1
11:00am-11:59am	1	0	0
12:00pm-12:59pm	2	3	2
1:00pm-1:59pm	0	2	1
2:00pm-2:59pm	0	4	3
3:00pm-3:59pm	2	2	3
4:00pm-4:59pm	4	1	7
5:00pm-5:59pm	2	4	3
6:00pm-6:59pm	1	0	5
7:00pm-7:59pm	3	2	4
8:00pm-8:59pm	3	3	3
9:00pm-9:59pm	1	3	1
10:00pm-10:59pm	1	2	4
11:00pm-11:59pm	1	2	4

Table 11: Driver Variables for Speed-Involved, Single-Vehicle, Male Driver, Motorcycle Crashes for Section 3.4

Involved Speeding, Single-Vehicle, Male Driver, Motorcycles (Drivers)			
Year	**2018**	**2019**	**2020**
Total Drivers	29	40	56
Driver Age			
20 Years	1	0	0

21 Years	1	1	0
22 Years	1	2	0
23 Years	3	0	0
24 Years	2	1	1
25 Years	2	0	2
26 Years	0	1	0
27 Years	1	0	1
28 Years	0	4	1
29 Years	0	0	3
30 Years	0	2	0
31 Years	0	0	1
32 Years	0	2	1
33 Years	0	0	1
34 Years	1	1	2
35 Years	0	0	4
36 Years	0	1	0
37 Years	0	0	4
38 Years	0	0	1
39 Years	0	0	2
40 Years	0	0	4
41 Years	3	1	3
42 Years	1	1	0
43 Years	0	1	1
44 Years	0	1	0
46 Years	1	0	0
47 Years	0	1	0
48 Years	0	1	2
49 Years	0	1	1
50 Years	1	2	1
51 Years	2	3	0
52 Years	2	2	0
53 Years	0	2	1
55 Years	0	0	1
56 Years	0	2	2
58 Years	0	0	2
59 Years	1	0	1
60 Years	0	3	2
61 Years	1	0	2
62 Years	0	2	1
63 Years	0	1	0
64 Years	1	0	0
65 Years	0	1	0

67 Years	2	0	0
68 Years	1	0	3
69 Years	0	0	2
70 Years	0	0	1
71 Years	1	0	2
BAC			
0.00%	10	12	18
0.01% - 0.04%	0	2	2
0.041% - 0.079%	2	3	2
0.080% - 0.12%	2	0	5
0.121% - 0.16%	2	5	5
0.161% - 0.20%	4	3	7
0.201% - 0.24%	1	4	8
0.241% - 0.28%	1	1	2
0.281% - 0.32%	0	0	0
0.321% - 0.36%	2	0	0
0.361% - 0.40%	0	1	0
Unknown	0	3	1
Test Not Given	5	6	6
Ethnicity (2019-2020)			
Mexican	NA	1	1
Non-Hispanic	NA	36	50
Not A Fatality (not Applicable)	NA	2	3
Puerto Rican	NA	1	1
Unknown	NA	0	1
Ethnicity (2018)			
Asian Indian	1	NA	NA
Black	1	NA	NA
Not a Fatality (not Applicable)	4	NA	NA
White	23	NA	NA
Helmet Use			
DOT-Compliant Motorcycle Helmet	6	10	10
Helmet, Unknown if DOT-Compliant	2	2	2
No Helmet	20	28	43
Not Reported	1	0	1

Table 12: Vehicle Variables for Speed-Involved, Single-Vehicle, Male Driver, Motorcycle Crashes for Section 3.4

Involved Speeding, Single-Vehicle, Male Driver, Motorcycle (Vehicles)			
Year	**2018**	**2019**	**2020**
Total Vehicles	29	40	56
Make of Motorcycle			
BMW	0	0	2
Harley-Davidson	14	20	27
Honda	2	7	10
Kawasaki	3	6	0
Moto-Guzzi	0	0	1
Other Make	0	1	1
Suzuki	3	4	8
Triumph	0	0	1
Unknown Make	1	0	1
Victory	1	0	1
Yamaha	5	2	4