Alcohol- and Drug-Involved Crashes in Michigan: 2014-2018

Patrick Bowman, Dawn Massie, Carol Flannagan
Center for the Management of Information for Safe and Sustainable Transportation,
University of Michigan Transportation Research Institute

Contents

1.0 Executive Summary

This report utilizes police-reported crash data in Michigan from 2014 through 2018 to study the impact of both alcohol and drug impaired driving on crash trends. Major findings include:

- The number of alcohol-involved crashes and drug-involved crashes increased each year from 2014 through 2017, but both decreased in 2018.
- The highest percentage of both alcohol and drug-involved crashes are single-vehicle crashes followed by rear-end crashes, and impaired drivers have a higher risk of head-on crashes and sideswipe crashes that occur when the vehicles are traveling in opposite directions.
- Alcohol-involved crashes have much higher rates on weekends, while drug-involved crashes occur from Monday through Wednesday, with somewhat higher counts Thursday through Sunday.
- Alcohol-involved crashes are more likely to occur at night, with a peak from 2 a.m. to 3 a.m., while drug-involved crashes peak between 5 p.m. and 6 p.m.
- Both alcohol-involved crashes and drug-involved crashes occur most frequently at the 55 miles per hour posted speed limit.
- Pedestrians account for 2.0% of parties drinking in crashes, while bicyclists account for 0.5%. Among the parties using drugs in crashes, 1.6% are pedestrians and 0.3% are bicyclists.
- Male impaired motor vehicle drivers appear at higher rates than female impaired drivers for both alcohol- and drug-involved crashes.
- Motor vehicle drivers age 21-25 years old have the highest frequencies for both alcohol-involved crashes and drug-involved crashes.
- Compared to no impairment crashes, alcohol only fatal crashes occur at a rate of 10.5 times higher, drugs only fatal crashes at 36 times higher, and alcohol and drugs fatal crashes at 41 times higher.

2.0 Introduction

This report analyzes police-reported motor vehicle crashes involving alcohol and/or drug impairment on public roadways in Michigan from 2014 through 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. This crash data was used to study the impact of both alcohol and drug impaired driving on crash severity and crash type, as well as the other factors that confound and influence impaired driving, including temporal elements, speed limit, and driver demographics. Blood alcohol content (BAC) and drug test results are explored to determine usage trends. A section on combined alcohol and drug involvement in crashes examines differences from single impairment crashes.

3.0 Crash Count Trends

Table 1 displays the number of alcohol-involved crashes and drug-involved crashes between 2014 and 2018, as well as fatal crashes for each category. Figure 1 and Figure 2 highlight the increasing trend of both alcohol-involved and drug-involved crashes between 2014 and 2017. While alcohol-involved and drug-involved crash counts both show an upward trend from 2014 through 2017, the increase in drug-involved crashes is higher. Between 2014 and 2017, drug-involved crashes increased by 48.1%, while alcohol-involved crashes increased by about 9.2%. Alcohol-involved crashes are much higher in number, so a small percentage increase can imply a substantial increase in the number of crashes.

The general crash trend from 2014 to 2017 for both drug and alcohol crashes is increasing, with a decrease in 2018 for both alcohol- and drug-involved crashes. The highest single-year increase occurred from 2016 to 2017 for alcohol-involved crashes and between 2015 and 2016 for drug-involved crashes. Alcohol-involved fatal crashes have fluctuated each year from 2014 to 2018, but drug-involved fatal crashes increased each year from 2014 through 2017, with a decrease of one in 2018. Both impairment types showed the highest number of fatal crashes in 2017 during the five-year period.

Table 1. Alcohol- and Drug-Involved Crashes, 2014-2018

	Year	All Crashes	Fatal Crashes
Alcohol-Involved Crashes	2014	9,396	222
	2015	9,537	271
	2016	9,769	254
	2017	10,265	320
	2018	9,786	287
	Total	48,753	1,354
Drug-Involved Crashes	2014	1,944	131
	2015	2,227	159
	2016	2,667	216
	2017	2,880	221
	2018	2,636	220
	Total	12,354	947

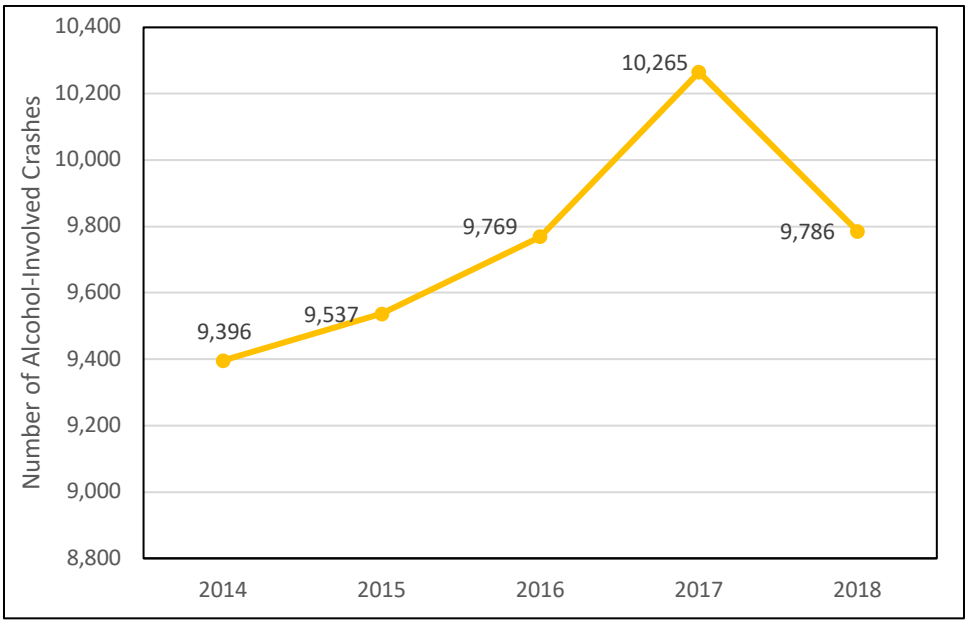

Figure 1 – Alcohol-Involved Crashes by Year

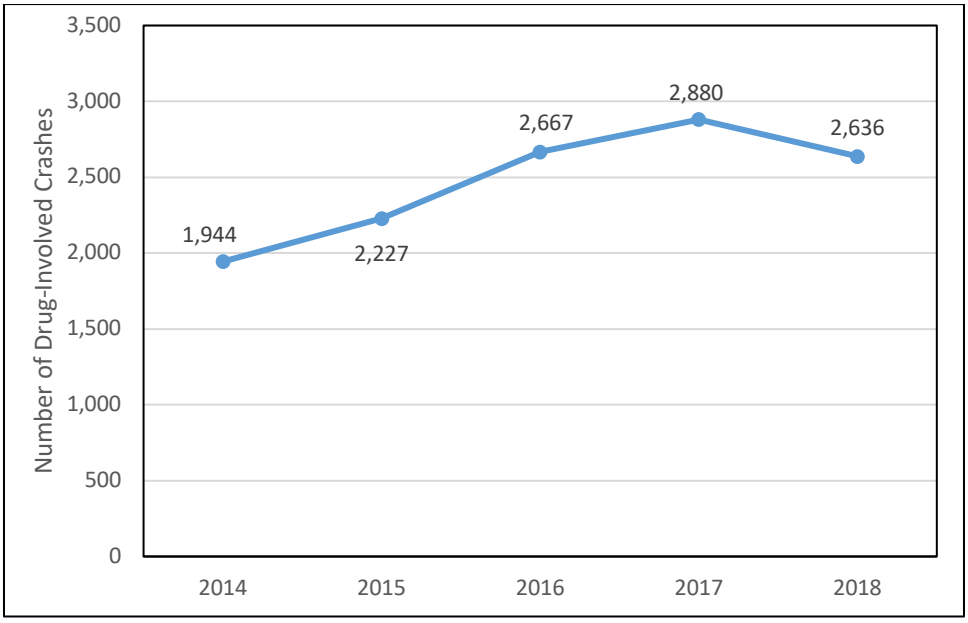

Figure 2 – Drug-Involved Crashes by Year

4.0 Crash and Injury Severity

Table 2 shows severity distributions for alcohol-involved, drug-involved, and all crashes, broken down by worst injury in the crash for the years of 2014 through 2018 combined. Fatal crashes occurred in 2.8% of

alcohol-involved crashes and 7.7% of drug-involved crashes, compared to 0.3% for all crashes from 2014 to 2018. Injury proportions for alcohol- and drug-involved crashes are also substantially higher than the crash injury rate when alcohol and drugs are not present.

Table 2. Crash Severity Distributions for Alcohol-Involved, Drug-Involved, and All Motor Vehicle Crashes, 2014-2018

Crash Severity	Alcohol-Involved	Drug-Involved	All
Fatal	2.8%	7.7%	0.3%
Suspected Serious Injury	7.7%	10.7%	1.4%
Suspected Minor Injury	14.9%	14.7%	4.8%
Possible Injury	16.9%	19.9%	11.8%
Property Damage Only (PDO)	57.8%	47.0%	81.7%
Total	100.0%	100.0%	100.0%

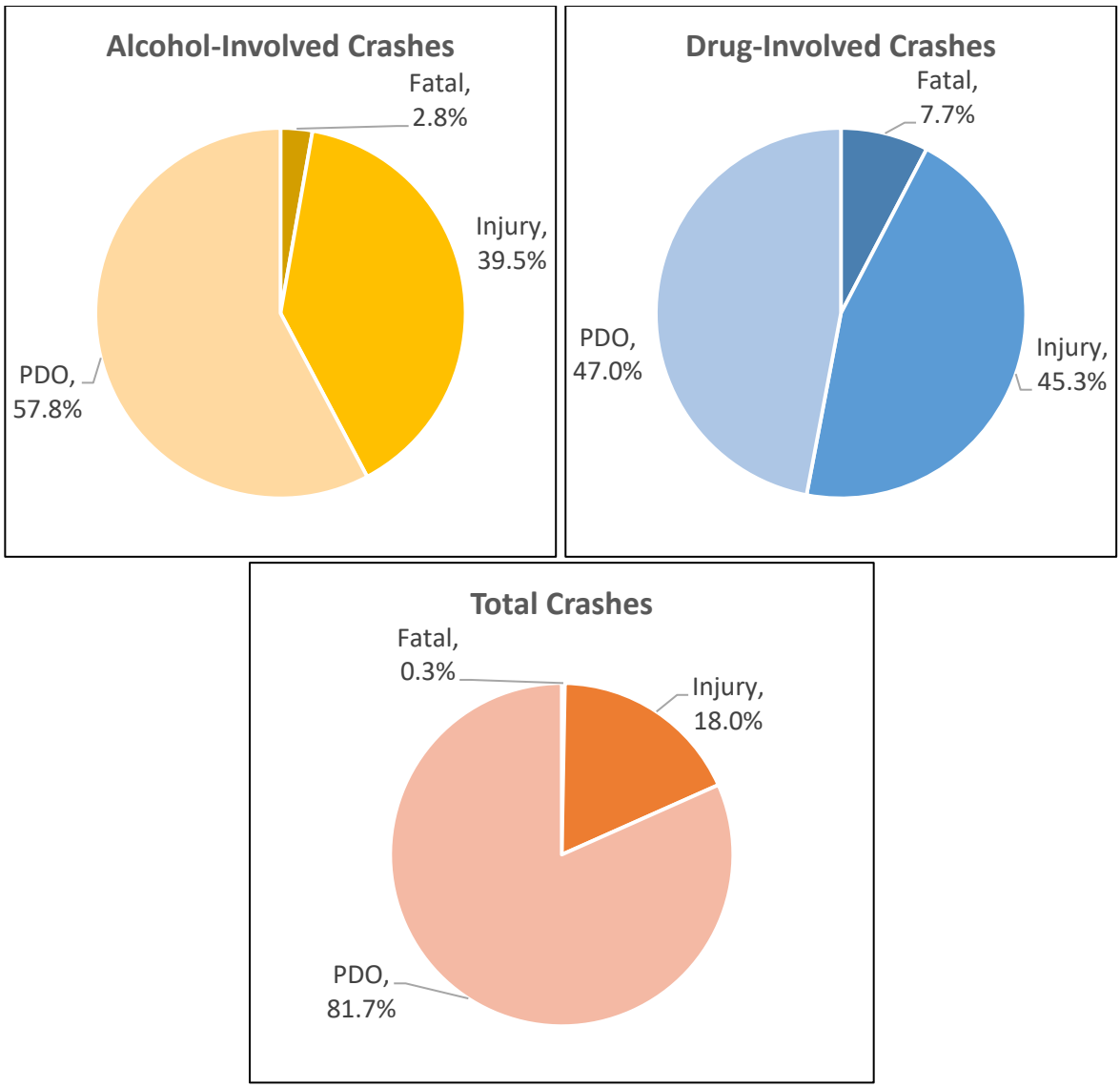

Figure 3 – Crash Severity Comparison

Figure 3 (above) shows the distribution of fatal crashes, injury crashes (suspected serious injury, suspected minor injury, and possible injury), and property damage only crashes. Alcohol impaired crashes have an injury rate of 39.5% and drug-involved crashes have an injury rate of 45.3%. The injury rate for all crashes within the five-year period is 18.0%. When looking at all crashes, the proportion of fatal crashes is approximately nine times higher when a driver tests positive for alcohol and almost 26 times higher when a driver tests positive for drugs.

Figures 4 and 5 show injury counts in crashes with an alcohol impaired and drug impaired driver, respectively. The injuries were reported for all people involved in each impaired crash type. Because the numbers of "no injury" are fairly high, they were excluded from the two graphs. Fatalities in alcohol-involved crashes have wavered each year, with the largest jump from 2016 to 2017. Both suspected serious and suspected minor injuries increased each year from 2014 to 2017. Possible injuries in alcohol-

involved crashes increased from 2014 through 2016, but decreased again in 2017 and had a slight increase in 2018. Drug-involved fatalities and injuries at all three levels increased each year from 2014 to 2017. While all three injury levels decreased in 2018, fatalities increased by a count of one. The highest jump in drug-involved fatalities occurred from 2015 (179) to 2016 (239).

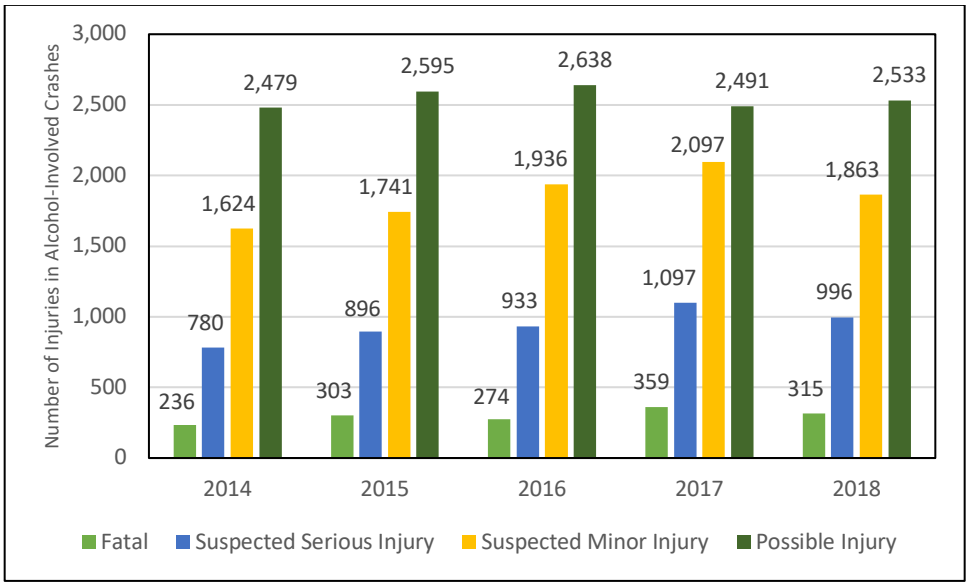

Figure 4 – Injuries in Alcohol-Involved Crashes by Year

Note: People coded as "no injury" or who were missing injury data are excluded from Figure 4.

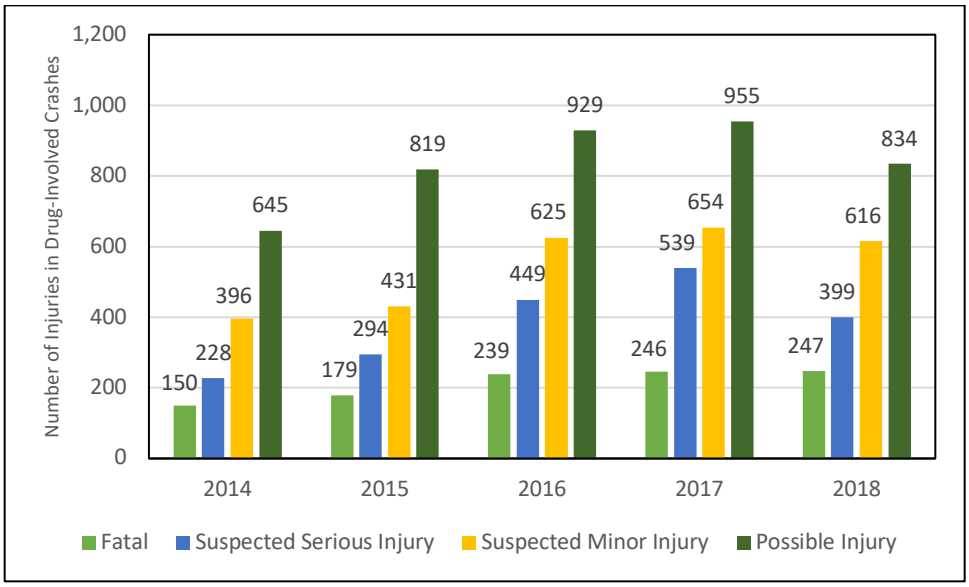

Figure 5 – Injuries in Drug-Involved Crashes by Year

Note: People coded as "no injury" or who were missing injury data are excluded from Figures 5.

5.0 BAC Test Results for Drivers

BAC for motor vehicle drivers in crashes who were coded as drinking is shown in Figure 6. The graph displays percentages for all valid BAC results within a given crash year to explore the proportion of drivers in four different BAC categories: 0.00, 0.01-0.07, 0.08-0.16, and 0.17 and higher. These cutoffs were determined appropriate based on the Michigan impaired driving law legal limit cutoff at 0.08 and the "super drunk" limit with more severe penalties at 0.17. Unknown BAC levels were excluded from the percentage calculations. All three BAC groups above 0.00 remained at relatively constant percentages over the period from 2014 to 2018. For example, from 2014 to 2018 the 0.08-0.16 group ranged from a high of 40.9% in 2014 to a low of 39.8% in 2018 and the 0.17 and higher group ranged from a low of 43.0% in 2016 to a high of 46.8% in 2018. This indicates that although the counts of drivers in crashes coded drinking varied each year, there was a generally consistent rate across the BAC groups. In 2018, the 0.00 BAC group decreased to 0.2%, while the lowest previous percent during the five-year period occurred in 2014 at 2.3%. This is presumably due to data quality checks implemented for both alcohol and drug elements in the Michigan crash data in recent years.

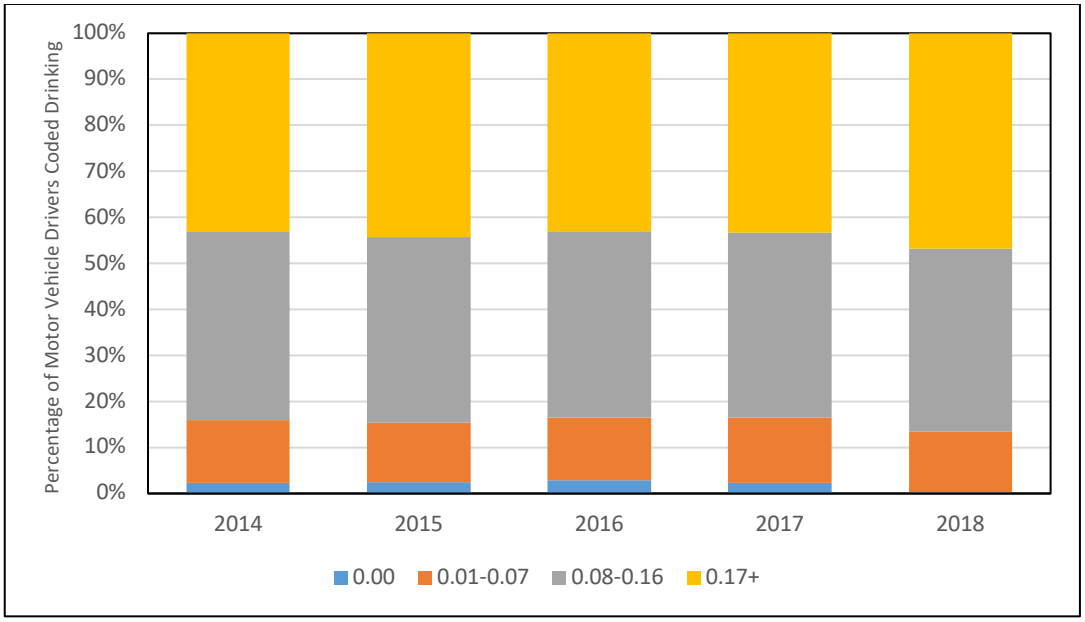

Figure 6 – Motor Vehicle Drivers in Crashes Coded as Drinking by BAC Level

Note: Drivers coded "unknown" or "not entered" for BAC are excluded from Figure 6.

Figures 7 and 8 show the contributions of crash-involved motor vehicle drivers coded as drinking and motor vehicle drivers coded as using drugs by BAC frequency. Drivers coded as having a BAC at 0.00 or above 0.40 are excluded from Figure 7. A cutoff of 0.40 was used for BAC to exclude small extreme values that may have been inadvertently created due to coding errors. Among drivers coded as drinking, the BAC distribution is generally smooth, with a peak at 0.16. In Figure 8 showing drivers using drugs in crashes, drivers coded as having a BAC at 0.00 or above 0.40 are again excluded. This eliminates the peak at 0.00, where drivers were thought to be drinking, but were instead using drugs. Of the total

drivers testing positive for drugs during the period from 2014-2018, 12.2% were coded as having a BAC of 0.00. BAC levels are generally lower, though the most common value shown is at 0.18, similar to drivers coded as drinking alcohol.

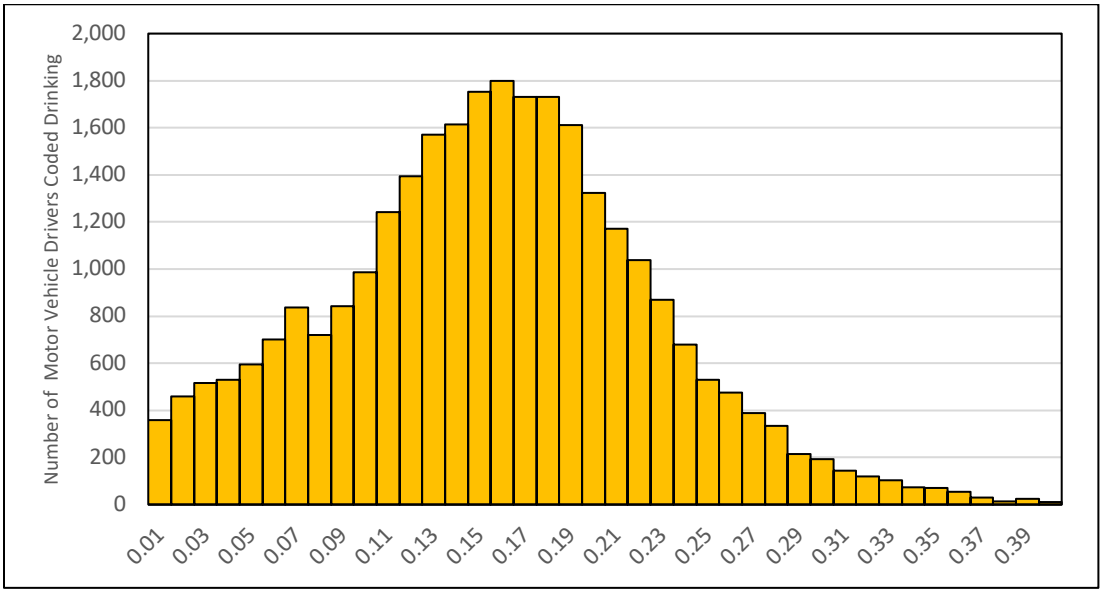

Figure 7 – Motor Vehicle Drivers in Crashes Coded as Drinking by BAC Frequency

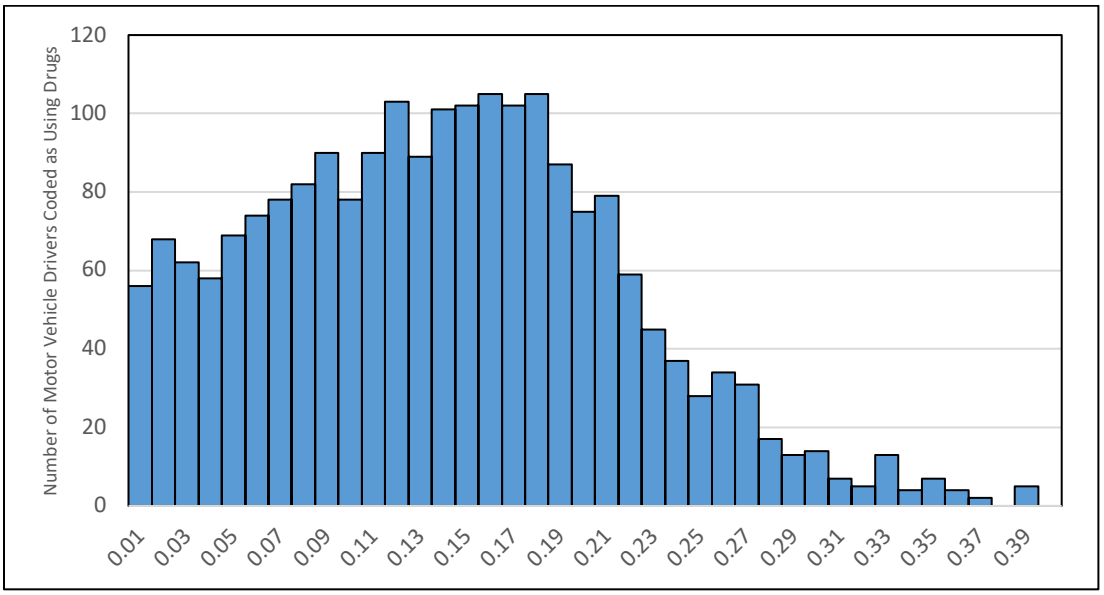

Figure 8 – Motor Vehicle Drivers in Crashes Coded as Using Drugs by BAC Frequency

Table 3 explores the drug status of motor vehicle drivers coded with a 0.00 BAC test result, indicating they were tested for alcohol and the test came back negative. The percentage of drivers coded as using drugs in crashes has increased among the 0.00 BAC test result group each year from a low of 11.8% in

2014 to a high of 20.1% in 2018. Drug testing may have also increased, contributing to the percentage increase in recent years.

Table 3. Motor Vehicle Drivers in Crashes with a 0.00 BAC Test Result by Drug Use

	Year	Drugs Suspected	No Drugs Suspected	Percentage
Motor Vehicle Drivers	2014	205	1,527	11.8%
	2015	232	1,617	12.5%
	2016	323	1,661	16.2%
	2017	359	1,474	19.6%
	2018	365	1,455	20.1%
	Total	1,484	7,734	16.1%

Note: Specific drug test results for drivers in crashes are not included in this report. At present, the crash dataset contains specific drug test results for only one drug. When a driver tests positive for more than one drug, the one with the highest priority (i.e., lowest code value) is listed, regardless of the relative levels of the different drugs. For example, since cannabinoids are relatively low priority (high code value), they will generally be undercounted for any drivers who test positive for multiple drugs. As a result, we cannot accurately measure the number of drivers testing positive for specific drugs. This issue is expected to be improved in the future.

6.0 Crash Type

As shown in Figure 9 and Figure 10, crash type differs when drivers are not impaired compared to when drivers are using alcohol or drugs. Crash type patterns are similar for the two impairment crash types, with single motor vehicle, rear-end, and angle crashes rounding out the top three most common crash types. However, single vehicle crashes occur at higher percentages than the counterpart crashes for both alcohol-involved and drug-involved crashes. Head-on crashes and sideswipe crashes with the vehicles traveling in opposite directions crashes also occur at higher rates for both impairment types.

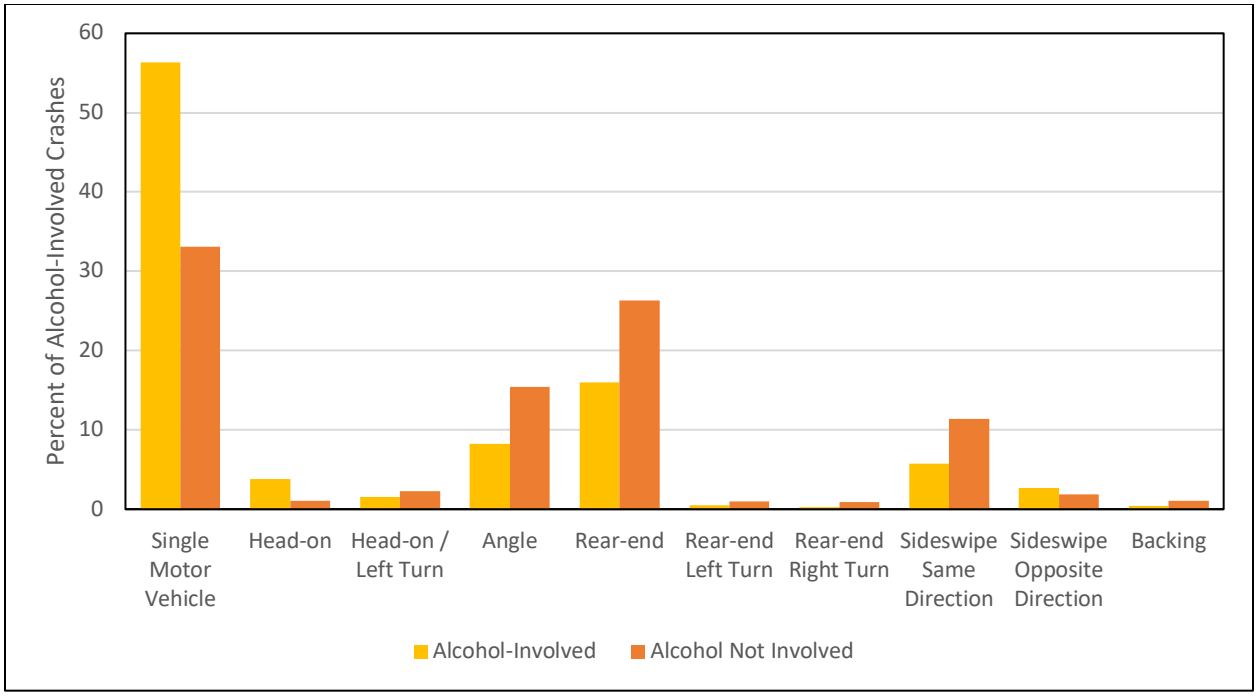

Figure 9 – Alcohol-Involved Crash Percentages by Crash Type, 2014-2018

Note: Crash types coded as "unknown," "other," or missing are excluded from Figure 9.

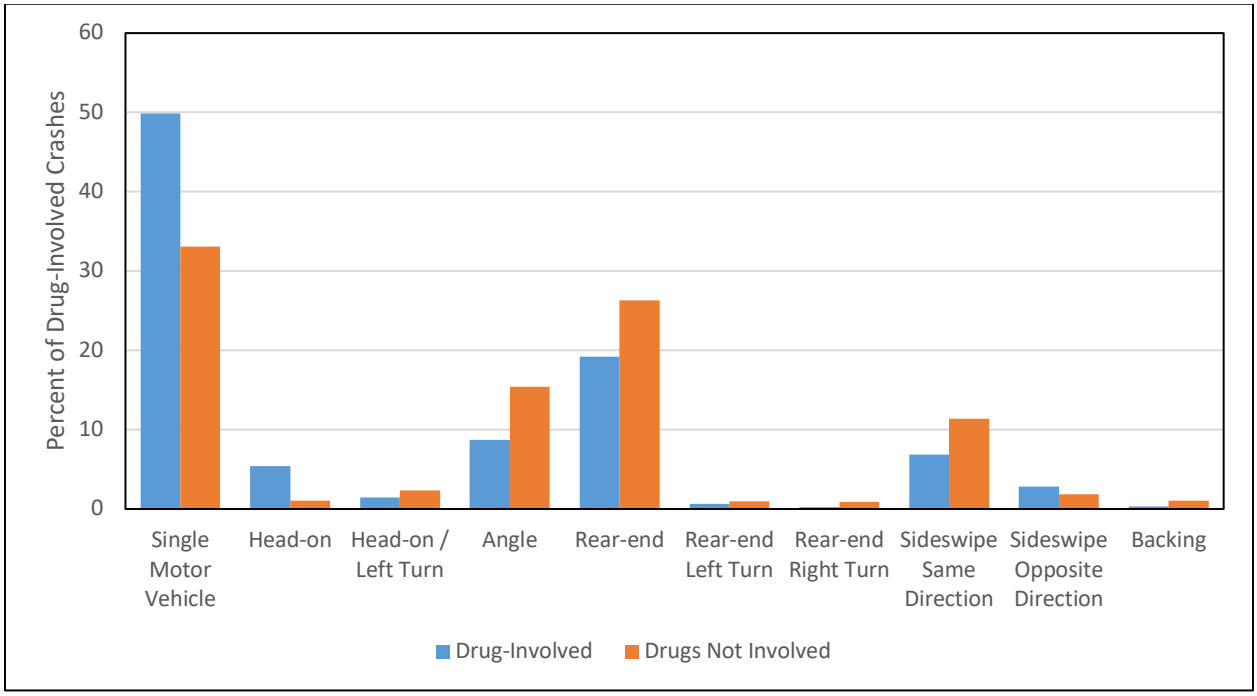

Figure 10 – Drug-Involved Crash Percentages by Crash Type, 2014-2018

Note: Crash types coded as "unknown," "other," or missing are excluded from Figure 10.

7.0 Temporal Variables

7.1 Month of Year

Figures 11 and 12 on the following page show the number of alcohol-involved crashes and drug-involved crashes across the months of the year. There is no clear trend, but alcohol-involved crashes appear to be slightly higher in the months from July through December than January through June. Drug-involved crashes appear to occur at slightly higher numbers during the warmer months of the year, from June through October and have lower counts in January and February.

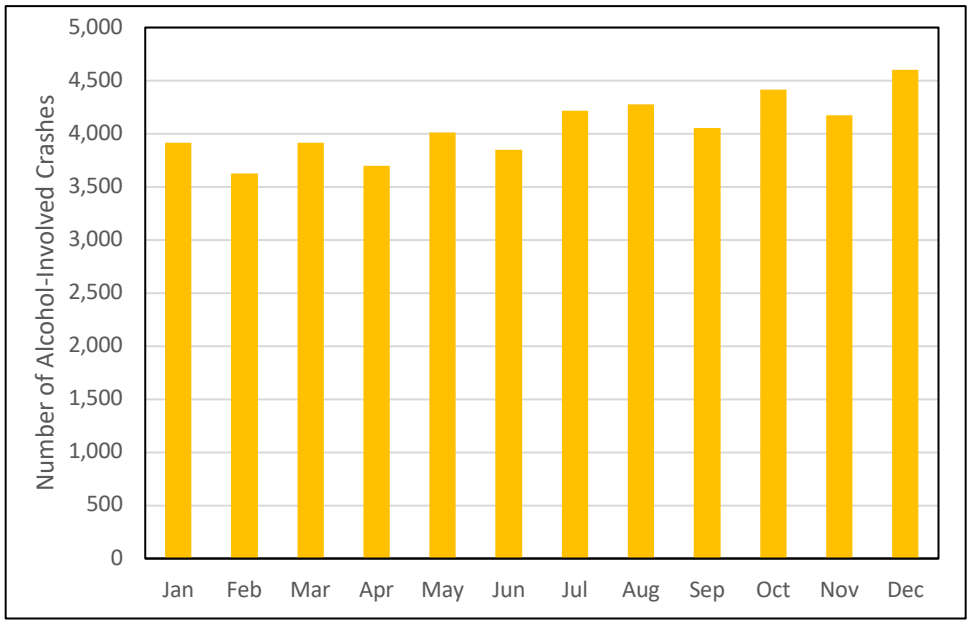

Figure 11 – Alcohol-Involved Crashes by Month, 2014-2018

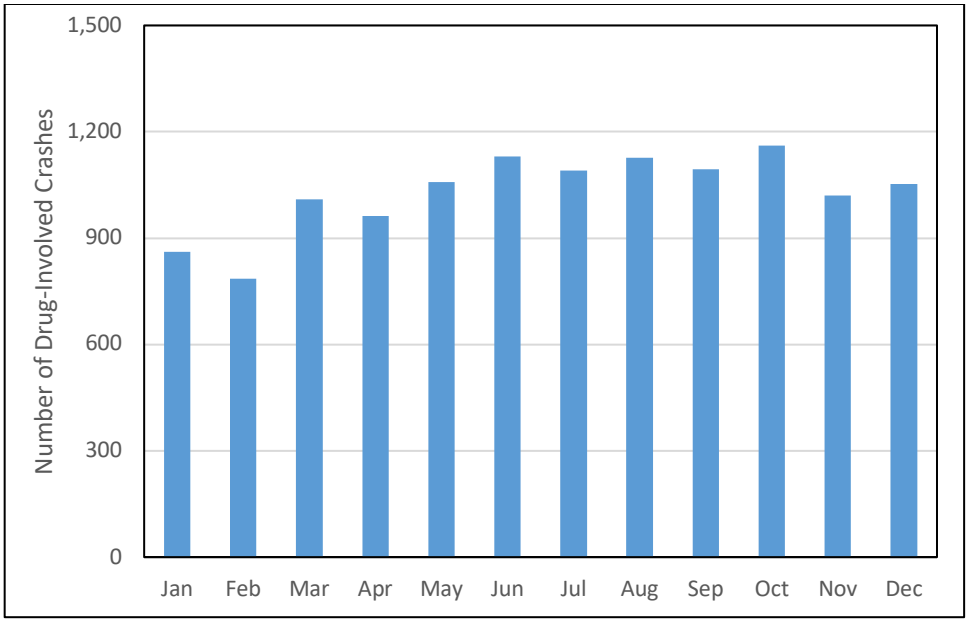

Figure 12 – Drug-Involved Crashes by Month, 2014-2018

7.2 Day of Week

The number of alcohol-involved crashes on each day of the week is shown in Figure 13 on the following page. Alcohol-involved crashes occur at much greater frequencies during the weekend with about 43.6% of crashes involving alcohol occurring during weekends.

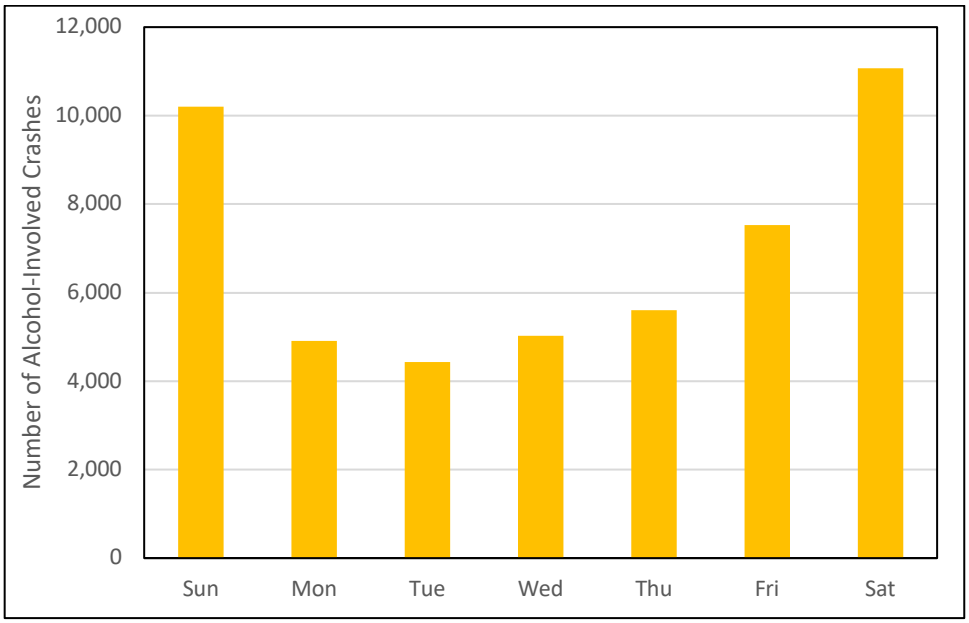

Figure 13 – Alcohol-Involved Crashes by Day of the Week, 2014-2018

Drug-involved crashes are displayed in Figure 14. Similar to alcohol-involved crashes, drug-involved crashes have higher counts during the weekend, but drug-involved crashes are higher Thursday through Sunday. Saturday accounted for 16.3% of drug-involved crashes during the week.

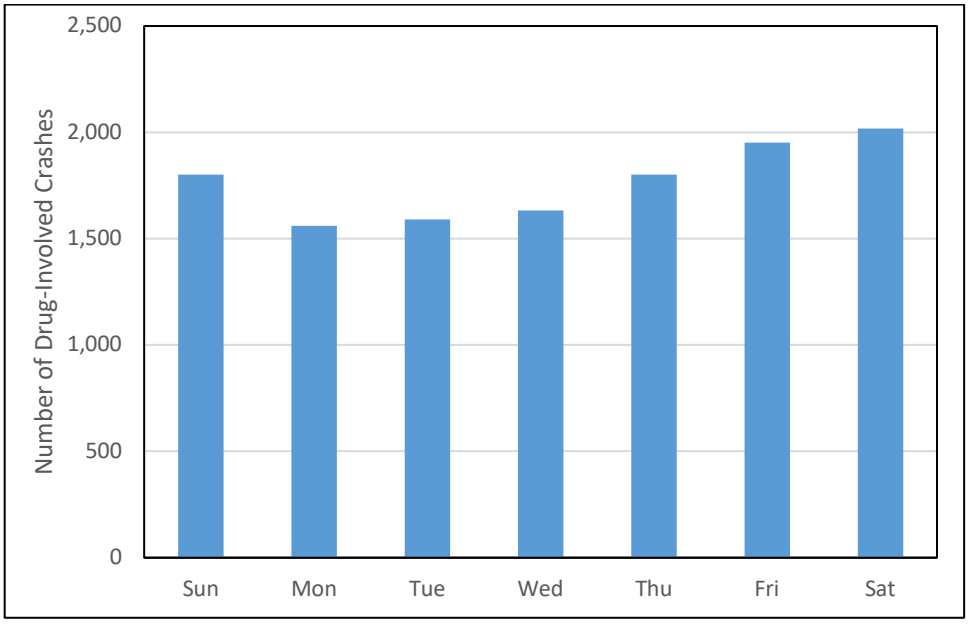

Figure 14 – Drug-Involved Crashes by Day of the Week, 2014-2018

7.3 Time of Day

Figure 15 shows the number of alcohol-involved crashes by hour of the day. The number of alcohol-involved crashes is greatest from midnight-3 a.m. However, the number of crashes increases steadily throughout the day from the low point at 10 a.m. About 10% of alcohol-involved crashes occur during the 2 a.m. hour.

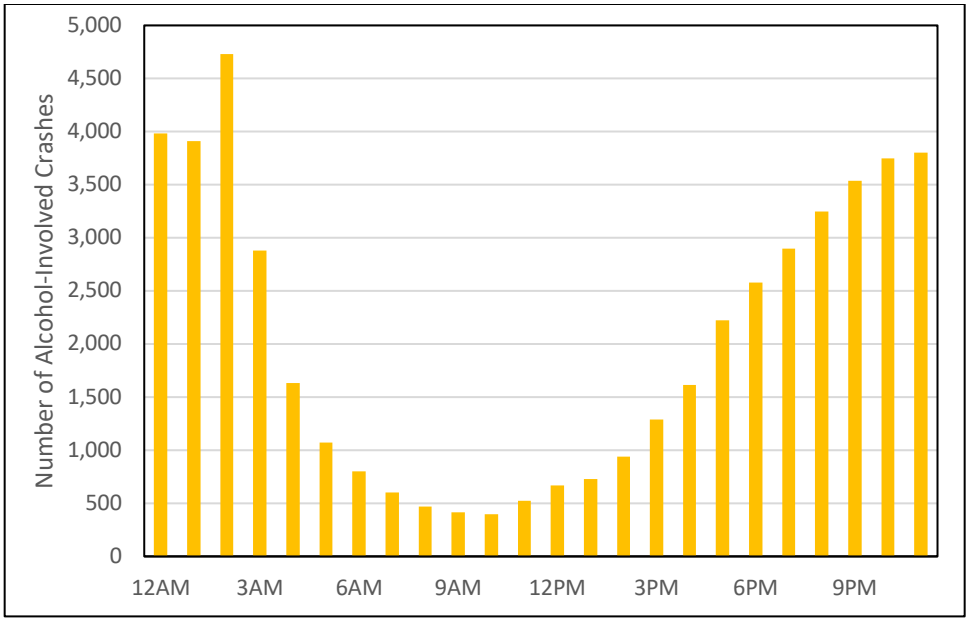

Figure 15 – Alcohol-Involved Crashes by Time of Day, 2014-2018

Figure 16 on the following page shows a different crash pattern. The number of drug-involved crashes peaks in the 5 p.m. hour, when 6.3% of drug-involved crashes occur. Drug-involved crashes begin increasing at 5 a.m. and increase through 5 p.m. Although drug-involved crashes peak at 5 p.m., they are still elevated throughout the night until 3 a.m.

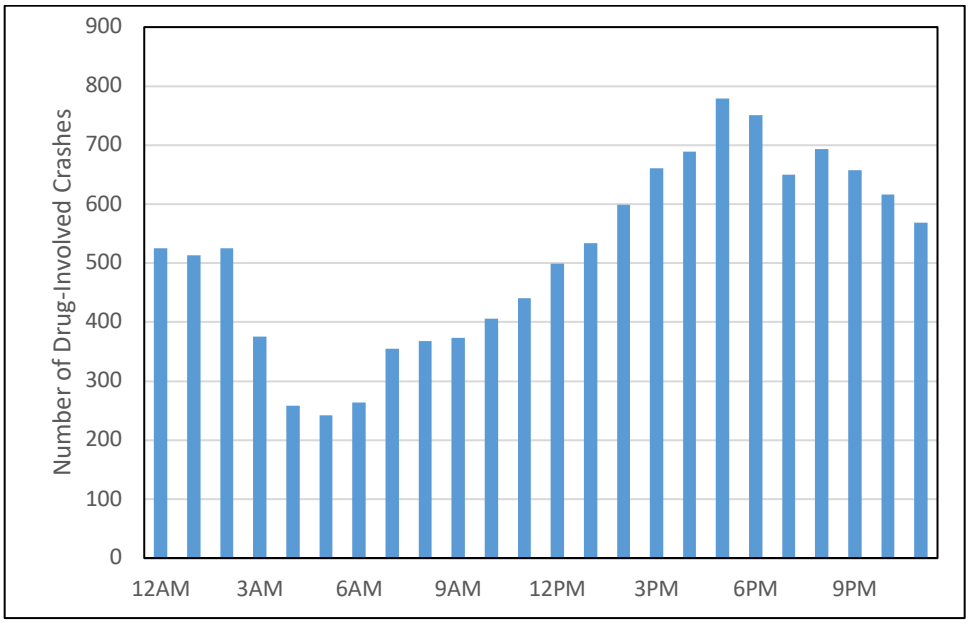

Figure 16 – Drug-Involved Crashes by Time of Day, 2014-2018

8.0 Speed Limit

Figures 17 and 18 show counts of alcohol-involved and drug-involved crashes according to the posted speed limit at the crash site. For both alcohol- and drug-involved crashes, 55 mile per hour speed limits had the highest crash counts, followed by speed limits of 25 and 45 mph. For alcohol-involved crashes, the percent of crashes occurring in those three speed limit zones were 31.2%, 19.4%, and 14.4%, respectively. For drug-involved crashes, the percentages were 28.4%, 16.0%, and 15.5%, respectively.

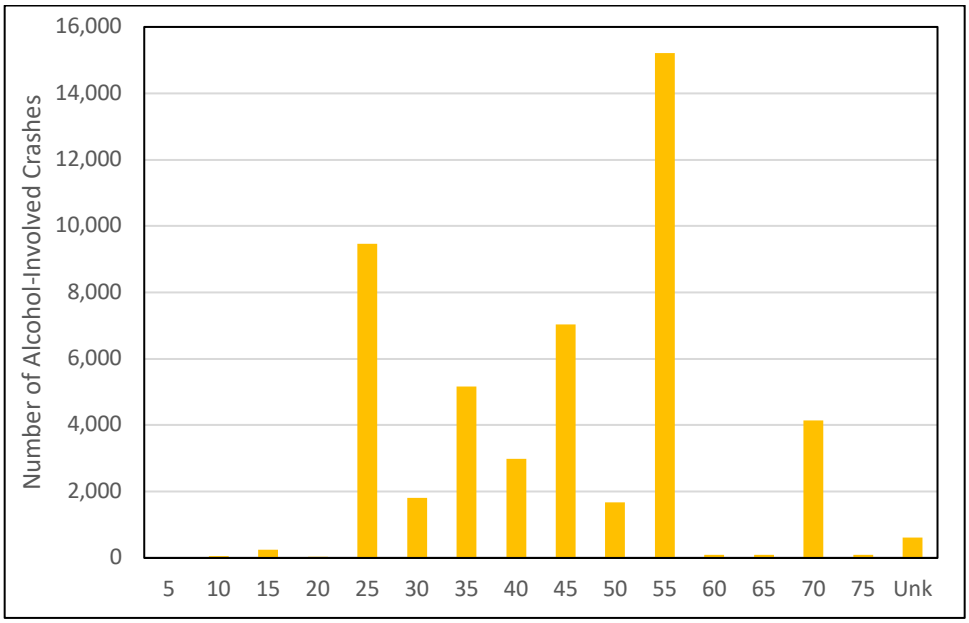

Figure 17 – Alcohol-Involved Crashes by Posted Speed Limit at Crash Site, 2014-2018

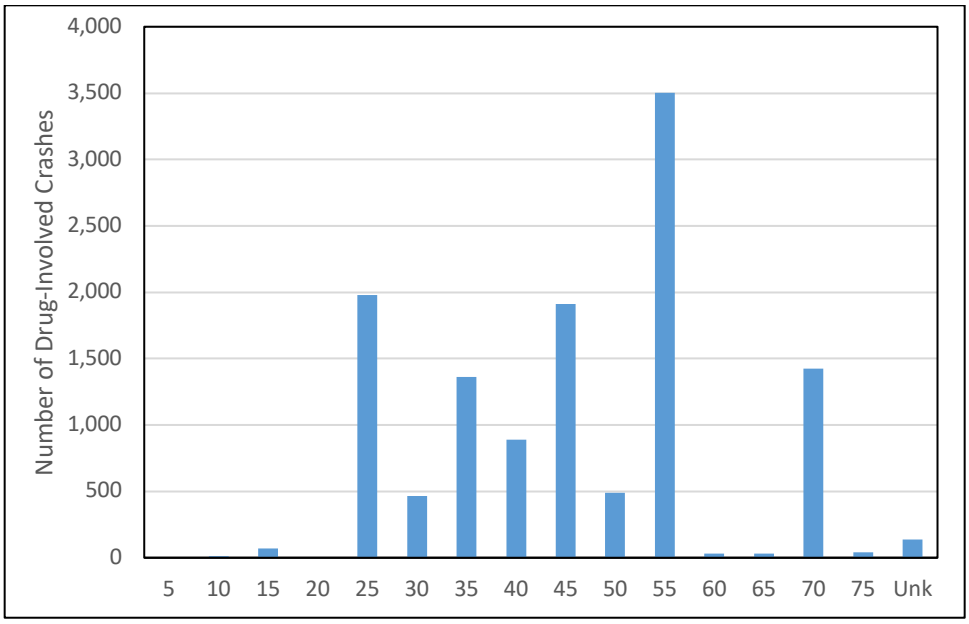

Figure 18 – Drug-Involved Crashes by Posted Speed Limit at Crash Site, 2014-2018

9.0 Demographics

9.1 Party Type

Table 4 shows the party drinking or using drugs each impairment crash type. Motor vehicle drivers understandably account for the highest percentage of crashes for both drinking and drug use. Pedestrians are the party drinking in 2.0% of all units drinking in crashes and are the party using drugs in 1.6% of the total units on drugs in crashes. Bicyclists have rates of drinking at 0.5% and using drugs at 0.3%. Table 5 shows the impairment distributions for pedestrian crashes, bicycle crashes, and crashes involving only motor vehicles. In pedestrian crashes, 9.4% involved alcohol only, 1.2% involved drugs only, and 1.5% involved both alcohol and drugs. In bicycle crashes, 3.5% involved alcohol only, 0.5% involved drugs only, and 0.4% involved alcohol and drugs. With the exception of alcohol and drug bicycle crashes, each non-motorist impairment distribution percentage was higher than crashes involving only motor vehicles.

Table 4. Party Type Drinking or Using Drugs in Crashes, 2014-2018

	Party Type	Count	Percentage
Party Drinking	Motor Vehicle Driver	47,922	97.5%
	Pedestrian	990	2.0%
	Bicyclist	255	0.5%
	Train Engineer	1	0.0%
	Total	49,168	100.0%
Party Using Drugs	Motor Vehicle Driver	12,204	98.2%
	Pedestrian	193	1.6%
	Bicyclist	33	0.3%
	Train Engineer	0	0.0%
	Total	12,430	100.0%

Table 5. Impairment Distributions for Pedestrian, Bicycle, and Motor Vehicle Crashes, 2014-2018

Impairment Type	Pedestrian	Bicycle	Motor Vehicle
Alcohol Only	9.4%	3.5%	2.8%
Drugs Only	1.2%	0.5%	0.4%
Alcohol and Drugs	1.5%	0.4%	0.4%
None	87.9%	95.6%	96.5%
Total	100.0%	100.0%	100.0%

9.2 Gender

Figure 19 shows the proportion of gender for motor vehicle drivers who are drinking and motor vehicle drivers who are using drugs in crashes. Males are represented at higher rates than females for both drinking drivers and drivers using drugs. The percentage of male drivers drinking in crashes is 72.7% and the percentage of females is 27.3%. Females using drugs in crashes occur at 31.1% and males at 68.9%.

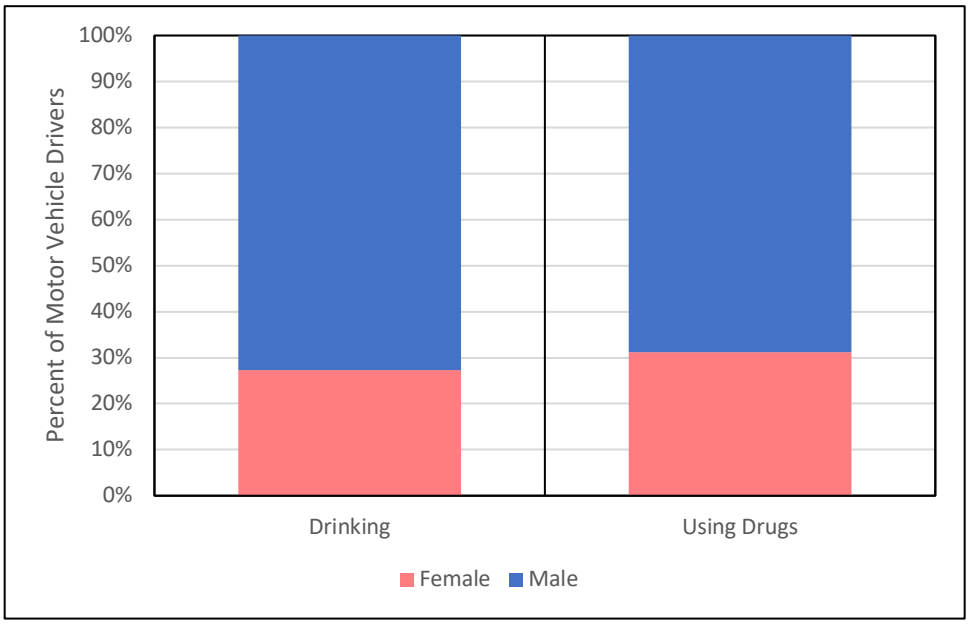

Figure 19 – Impaired Motor Vehicle Drivers in Crashes by Gender, 2014-2018

9.3 Age Group

Figures 20 and 21 on the following page show motor vehicle drivers drinking (Figure 20) and using drugs (Figure 21) by age group. Drivers with an invalid date of birth have been excluded. Both graphs show the same general pattern in which the 21-25-year-old age group has the highest number of drinking drivers and drivers using drugs. Of drivers drinking in crashes, 21.4% are age 21-25 and 19.0% of drivers using drugs in crashes are in the same age group. As the age groups increase, the count of drivers in each group decreases. Among the age groups of drivers using drugs in crashes, drivers age 16-20 appear at a higher proportion than they do among drinking drivers, with 6.0% of drinking drivers age 16-20 and 11.0% of drivers using drugs age 16-20.

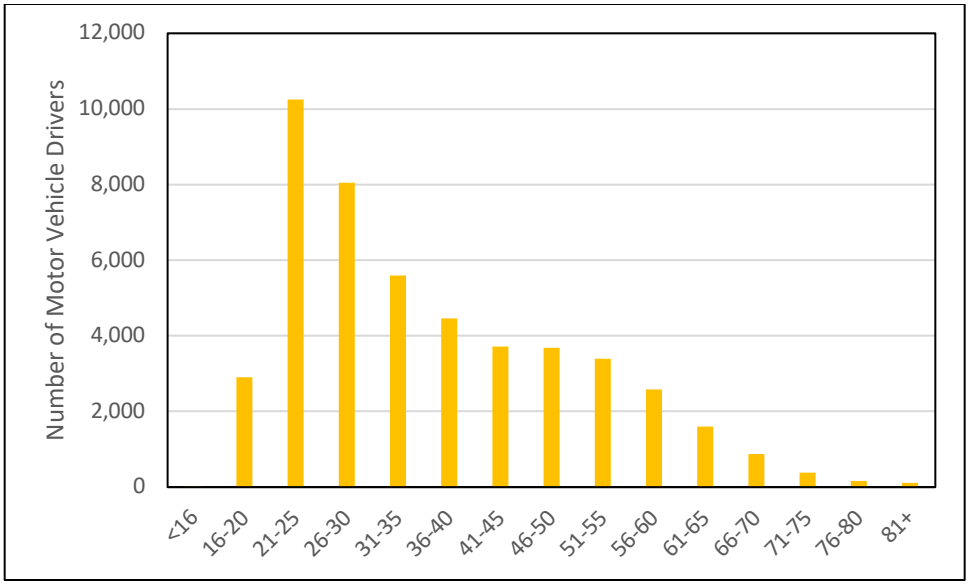

Figure 20 – Motor Vehicle Drivers Drinking in Crashes by Age Group, 2014-2018

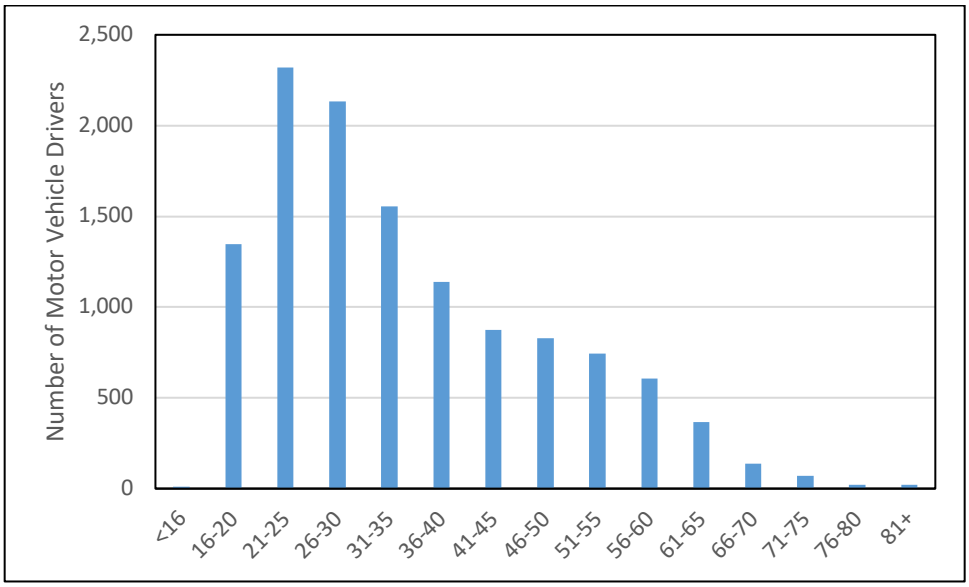

Figure 21 – Motor Vehicle Drivers Using Drugs in Crashes by Age Group, 2014-2018

10.0 Alcohol and Drugs Combined

It is important to look at drinking and drug use combined in crashes. There are different characteristics associated with crashes where drivers who are under the influence of more than one impairing substance, a condition referred to as "polydrug impairment." Similar to alcohol-involved crashes (Figure 1) and drug-involved crashes (Figure 2), alcohol-and-drug-involved crashes increased each year from 2014 through 2017 and decreased in 2018. During this period of four years, there was a 45.6% increase in the number of alcohol and drug combined crashes. This increase is illustrated in Figure 22.

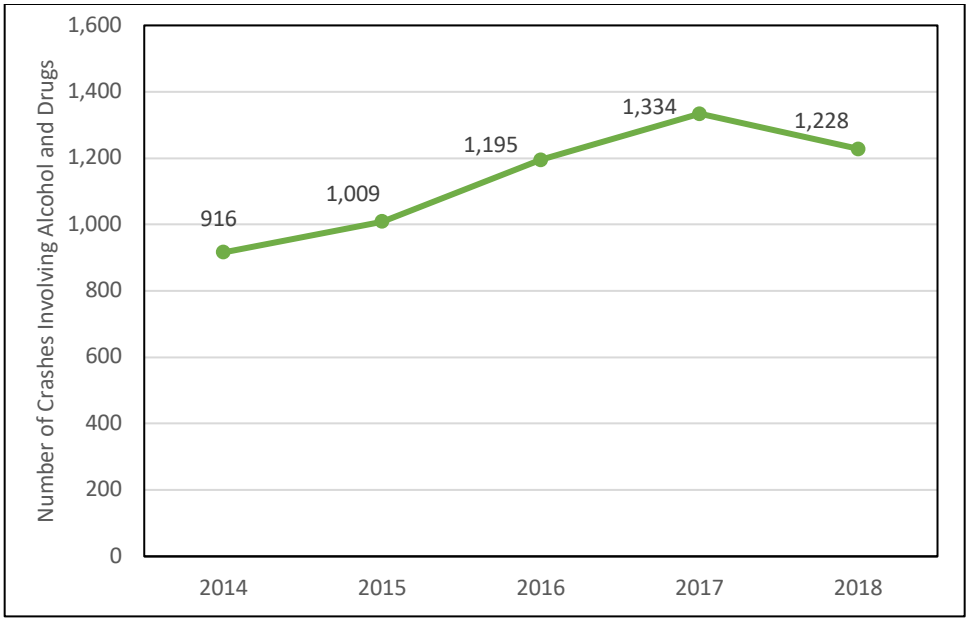

Figure 22 – Crashes Involving Alcohol and Drugs by Year

Table 6 below shows the counts and percentages of alcohol only, drugs only, alcohol and drugs combined, and non-impairment crashes and fatal crashes. Among all crashes, alcohol-only crashes make up 2.8% and drugs-only and alcohol-and-drug crashes each make up 0.4%. However, among fatal crashes, alcohol-only crashes make up almost 20% of crashes and the drug and drug-and-alcohol categories each make up over 10% of these crashes. The combination of drugs and alcohol is far more common than expected by chance.

Table 6. Impairment Distributions in Crashes, 2014-2018

Impairment Type	All Crashes	Percentage	Fatal Crashes	Percentage
Alcohol Only	43,071	2.8%	887	19.6%
Drugs Only	6,672	0.4%	480	10.6%
Alcohol and Drugs	5,682	0.4%	467	10.3%
None	1,480,188	97.9%	2,687	59.4%
Total	1,535,613	100.0%	4,521	100.0%

Table 7 shows more detail on crash severity (worst injury in crash) across the same four groups. Fatal and all three injury level crashes occur at higher percentages in the three impaired groups than in the non-impaired crash group. For fatal and suspected serious injury crashes, the alcohol and drug combined crashes have the highest rates at 8.2% and 11.2%, respectively, followed by the drugs only crash group with 7.2% and 10.3%, and the alcohol only crash group with 2.1% and 7.2%. In comparison, fatal crashes with no impairment occur at a rate of 0.2% and suspected serious injury crashes appear at 1.2%.

Table 7. Crash Severity Distributions for Alcohol Only, Drugs Only, Alcohol and Drugs, and None Impaired in Crashes, 2014-2018

Crash Severity	Alcohol Only	Drugs Only	Alcohol and Drugs	None
Fatal	2.1%	7.2%	8.2%	0.2%
Suspected Serious Injury	7.2%	10.3%	11.2%	1.2%
Suspected Minor Injury	14.7%	13.6%	16.0%	4.4%
Possible Injury	16.9%	22.0%	17.4%	11.6%
Property Damage Only (PDO)	59.2%	47.0%	47.1%	82.6%
Total	100.0%	100.0%	100.0%	100.0%

Figure 23 on the following page shows pie charts for the four impairment levels and groups the three injury levels into one category. Overall, drugs only crashes have the highest percentage of injury crashes at 45.8%, followed by alcohol- and drug-involved crashes at 44.7%, alcohol only crashes at 38.8%, and non-impairment crashes at 17.2%.

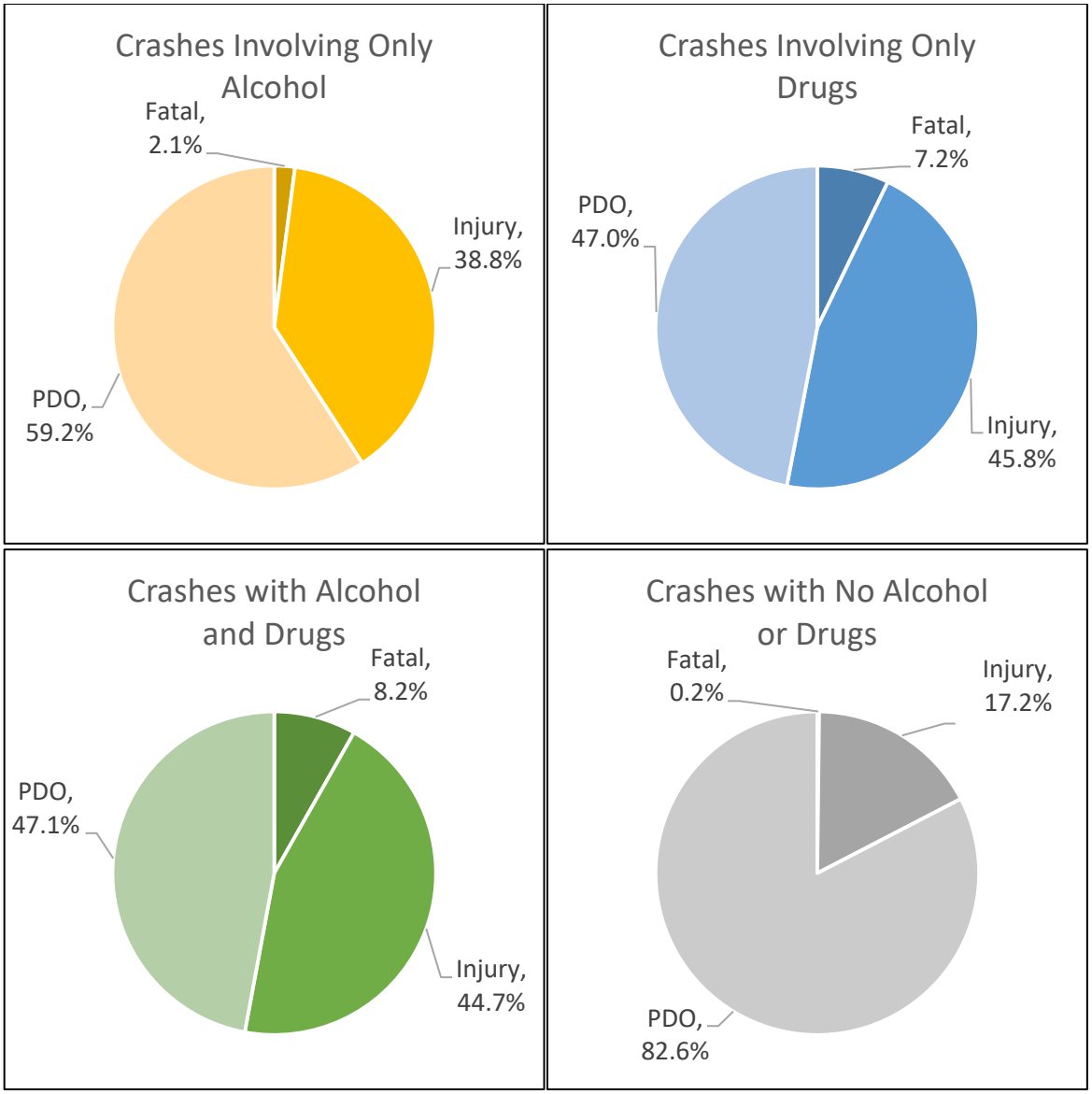

Figure 23 – Crash Severity Comparison

Figure 24 on the following page shows the number of alcohol and drug-involved crashes by month. This crash distribution most closely matches that of the drug-involved crash distribution by month, with higher counts during warmer months. June has the highest percentage of crashes, with 9.5% of the total crashes for the five-year period.

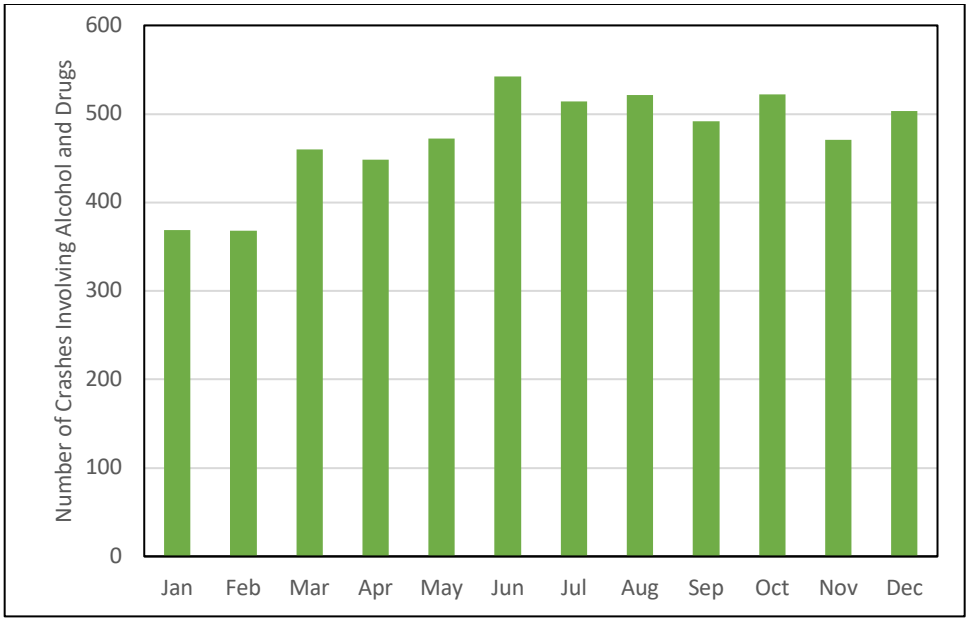

Figure 24 – Crashes Involving Alcohol and Drugs by Month, 2014-2018

Crashes involving both alcohol and drugs by day of the week are shown in Figure 25. Similar to alcohol-involved crashes (compare to Figure 13), weekends have higher counts of alcohol-and-drug-involved crashes than weekdays. A total of 19.2% of these crashes involving both alcohol and drugs took place on Saturdays.

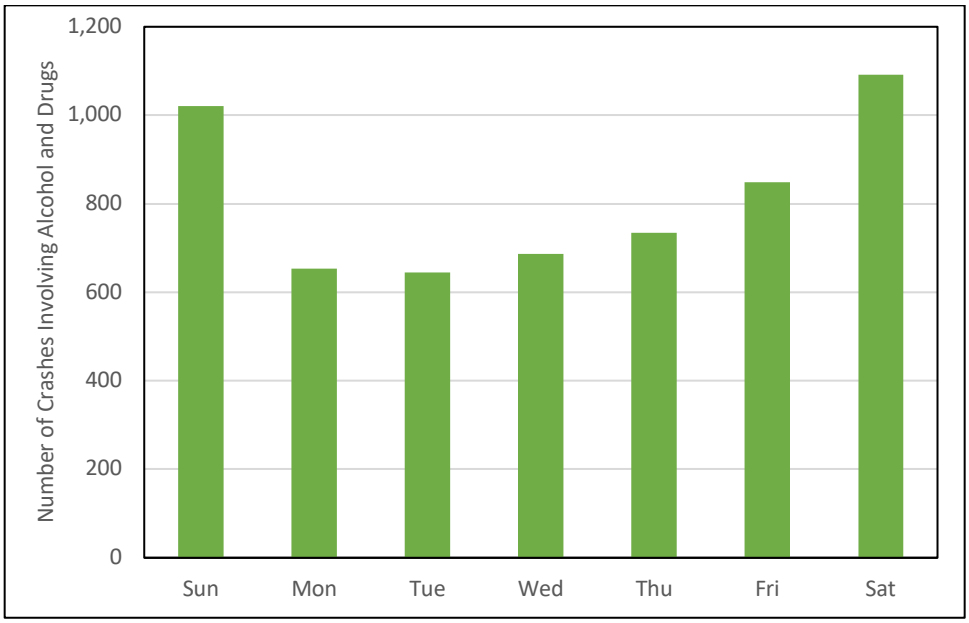

Figure 25 – Crashes Involving Alcohol and Drugs by Day of the Week, 2014-2018

Figure 26 shows crashes involving alcohol and drugs by time of day. This trend appears to be a combination of the patterns for alcohol crashes (Figure 15) and drug crashes (Figure 16). The large peak from 2 a.m. to 3 a.m. is similar to alcohol crashes, but there is also a smaller peak around 5 p.m. and 6 p.m. that corresponds to the peak shown for drug-involved crashes. Of the total, the 2 a.m. to 3 a.m. time period comprised about 6.9% of the crashes.

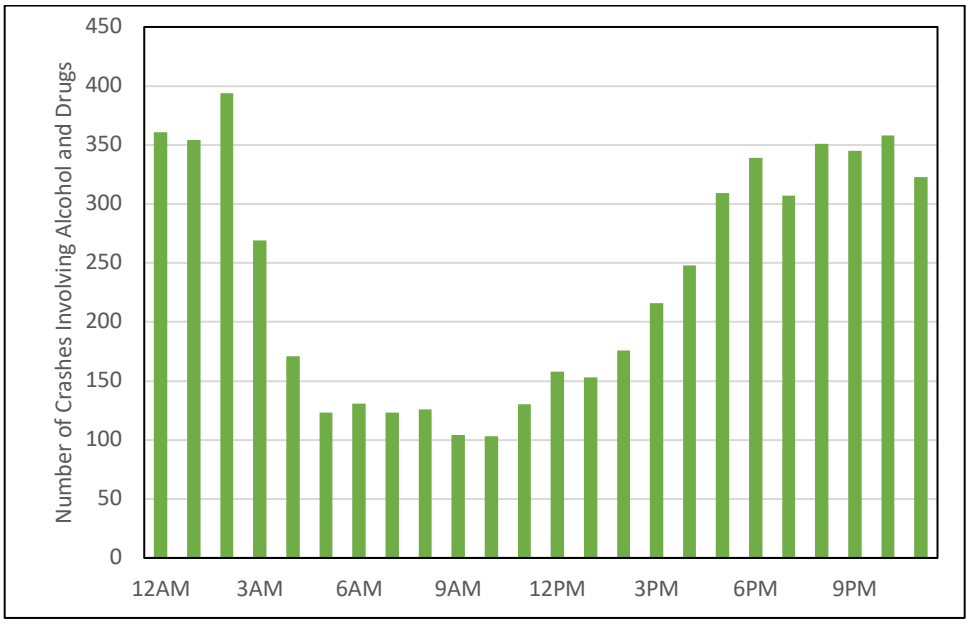

Figure 26 – Crashes Involving Alcohol and Drugs by Time of Day, 2014-2018

11.0 Summary

Alcohol- and/or drug-related impairment greatly increases the risk of fatal injury in a crash. Drivers between the ages of 21-25 appear in impaired crashes more often than other age groups. In addition, drug-involved crashes have some of the same patterns, but many unique patterns, including differing peak times of the day, and can be targeted separately from alcohol-involved crashes. A growing concern is combined alcohol and drug use, which has even higher fatal crash rates. In order to decrease the risk of impaired crashes and injuries associated with those crashes, proper intervention and awareness campaigns should be focused on those high-risk groups containing individuals who are more likely to drink and drive or partake in drugged driving. Future policies and safety campaigns can be designed to address such needs based on the data that is currently available. Data that examines multiple drugs in a driver's system at the time of a crash is necessary in order to convey a more complete analysis of the overall drugged driver issue.