WASHINGTON Traffic Safety COMMISSION

Driver Toxicology Testing and the Involvement of Marijuana in Fatal Crashes, 2010-2014

A Descriptive Report

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October 2015
Revised February 2016

Publication and Contact Information

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http://wtsc.wa.gov/research-data/traffic-safety-studies/

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Revision History:

February 2016 (impact=low): Table 31 on page 44 had incorrect ‘Marijuana Result’ table labels. The labels have been corrected. This labeling error did not affect numbers or text.

Table of Contents

Table of Tables

Table of Figures

Glossary

THC – Acronym for Tetrahydrocannabinols. For purposes of this report, the use of THC specifically refers to delta-9-THC, the psychoactive chemical entering the blood and brain immediately after marijuana smoking/consumption.

Carboxy-THC – The metabolite of delta-9-THC; this metabolite may be detected for up to 30 days after consumption.

Cannabinoids – A class of chemical compounds contained in marijuana. For purposes of this report, cannabinoids are an encompassing term to include any toxicology outcome related to marijuana (THC or carboxy-THC undistinguished).

Marijuana ng/ml of Blood – The unit of measurement used to describe the level of THC and/or carboxy-THC contained in a person's blood.

Other Drugs – Other drugs found in drivers involved in fatal crashes are from discrete drug families including narcotic analgesics, hallucinogens, depressants, stimulants, inhalants, and PCP. This report does not include alcohol when referring to other drugs. Detailed THC and carboxy-THC information were derived from toxicology reports. Descriptions of other drugs in this report relied on existing FARS drug coding. A complete list of detailed FARS drug information found in drivers reviewed in this report is included in Appendix C.

Blood Alcohol Concentration (BAC), alcohol greater than/equal to BAC .08 – The unit of measurement used to describe the level of alcohol contained in a person's blood; the measurement describes the percent of a person's blood that is alcohol. Alcohol greater than/equal to BAC .08 refers to a driver at or in excess of the per se limit.

Fatality Analysis Reporting System (FARS) – A national database funded by the National Highway Traffic Safety Administration containing a census of all fatal traffic crashes occurring in the U.S. Washington State FARS is supplemented with information from toxicology reports, death records, coroner reports, EMS information, vehicle registration, and driver licensing information.

Units in Fatal Crashes – Fatal crashes involve bodies other than just vehicles. The term unit refers to other vehicles, vehicles without drivers (i.e. parked vehicles), and non-motorists. A multiple unit fatal crash would describe a vehicle-vehicle crash, a vehicle-parked car crash, and a vehicle-pedestrian crash.

Non-Motorists – These persons involved in fatal crashes refer to non-vehicle occupants, covering pedestrians (persons on foot, wheelchairs, skateboards, etc.) and bicyclists.

Report Summary

The Fatality Analysis Reporting System (FARS) contains significant limitations in analyzing drug positive drivers involved in fatal crashes. Most notable to Washington, this data does not offer a cannabinoid code set that distinguishes between delta-9-THC and the metabolite, carboxy-THC. The levels of drugs present in blood are also not recorded in the FARS system, although they are provided in toxicology reports. In response to this limitation, Washington FARS Analysts, in collaboration with the State Toxicologist, manually abstracted cannabinoid drug results for deceased and surviving drivers involved in fatal crashes when toxicology analysis was performed.

This report is a description of this newly compiled data. The following is a summary of key observations gleaned from this more detailed fatal crash information with a focus on cannabinoid-positive drivers:

- From 2010-2014 there were 3,027 drivers involved in fatal crashes, of which 1,773 (58.6 percent) were tested for both alcohol and drugs with known results. Of the 1,773 drivers analyzed 1,061 (59.8 percent) were positive for alcohol and/or drugs.

- In 2014, 84.3 percent of drivers positive for cannabinoids were positive for THC, compared to only 44.4 percent of cannabinoid-positive drivers in 2010. In 2014, among the 75 drivers involved in fatal crashes positive for THC, approximately half (38) exceeded the 5 ng/ml THC per se limit.

- The frequency of drivers in fatal crashes that tested positive for THC, alone or in combination with alcohol or other drugs, was highest in 2014 (75 drivers) compared to the previous four-year average (36 drivers). The frequency of drivers with alcohol greater than/equal to BAC .08 and no other drugs was lowest in 2014 (51 drivers) compared to the previous four-year average (98 drivers).

- From the 1,061 drivers who tested positive for alcohol and/or drugs, mutually exclusive driver categories were established. This report focuses on a subset of these driver comparison groups (547 total drivers):
    - Only THC (56, 5.3 percent)
    - Only carboxy-THC (37, 3.5 percent)
    - THC and alcohol greater than/equal to BAC .08 (83, 7.8 percent)
    - THC, alcohol greater than/equal to BAC. 08, and drugs (18, 1.7 percent)
    - THC and other drugs (39, 3.7 percent)
    - Only alcohol greater than/equal to BAC .08 (314, 29.6 percent)

- Among drivers in fatal crashes that tested positive for only THC or only carboxy-THC, the largest proportion are ages 16-25. This age group also had the highest proportion of drivers with alcohol greater than/equal to BAC .08. Of drivers that tested positive for the combination of THC and alcohol greater than/equal to BAC 0.08, 39.8 percent were ages 16-25.

- Similar to drivers with only alcohol greater than/equal to BAC .08, drivers with the combination of THC and alcohol greater than/equal to BAC .08 were involved in fatal crashes that occurred most frequently on the weekends. Drivers with only THC were involved in fatal crashes that occurred equally between weekends (48.2 percent) and weekdays (51.8 percent).

- Drivers with alcohol greater than/equal to BAC .08, alone or in combination with other drugs, were involved in fatal crashes that occurred most often during the nighttime hours (6 p.m. – 5 a.m.). Drivers with only THC or only carboxy-THC were involved in fatal crashes that occurred most often during the daytime hours, similar to drivers with no drugs or alcohol.

- Drivers with only alcohol greater than/equal to BAC .08 were involved in fatal crashes that occurred most frequently on rural roads (58.6 percent), whereas the majority of drivers with only THC were involved in fatal crashes that occurred most frequently on urban roads (58.9 percent).

- Drivers with alcohol greater than/equal to BAC .08, alone or in combination with other drugs, were most frequently the only unit (no other vehicles or non-motorists) involved in the fatal crash. In contrast, over 70 percent of drivers with only THC or only carboxy-THC were involved in multiple unit fatal crashes, similar to the frequency of drivers with no drugs or alcohol.

- Drivers involved in fatal crashes with no drugs or alcohol and drivers with only carboxy-THC had the highest frequency of no reported crash contributing circumstances (approximately 44 percent). Among drivers with only THC, 28.6 percent had no other crash contributing circumstances reported, compared to 17.5 percent of drivers with only alcohol greater than/equal to BAC .08.

- The most frequently reported driver error among drivers in fatal crashes with only THC was lane deviation (12.5 percent), followed by overcorrecting (8.9 percent).

- More than half of drivers with only alcohol greater than/equal to BAC .08 involved in fatal crashes were speeding. Over 60 percent of drivers with alcohol greater than/equal to BAC .08 and THC combined were speeding.

The observations described in this report are insufficient for determining the link between THC and crash risk. The full limitations of this information as it is presented in this report are detailed in the following section.

Limitations of This Report

The purpose and scope of this report is to simply describe trends and characteristics of drivers involved in fatal crashes. The Washington Traffic Safety Commission continuously monitors trends and outcomes, including drug involvement in fatal crashes. In 2014, the state experienced an increase in the number of drivers involved in fatal crashes who tested positive for THC. This report provides a look inside that trend and provides comparisons for consideration and discussion. More information is still needed before any conclusions can be made relating to the impact of legalized recreational marijuana on traffic safety in Washington State.

It is not the purpose or within the scope of this report to establish crash risk due to marijuana. Therefore, the information in this report cannot be used to determine if marijuana is or is not causing fatal crashes. Washington State crash data does not include the assignment of an 'at-fault' driver. The information in this report was not designed to provide a link between marijuana use and levels of impairment.

Limitations of Descriptive Reports

Descriptive reports alone cannot determine if characteristic differences or changes observed over time are significant or simply due to chance. The purpose of a descriptive report, including this report, is to describe observed characteristics of a population or subject. A descriptive report does not attempt to explain why characteristics within the population vary, merely that they do. Descriptive reports provide simple summaries about the population or subject of interest and describe what the data shows, but are not sufficient for reaching conclusions. However, describing available data is a necessary first step before inference from the data can be determined.

Limitations of Fatal Crash Data

Fatal crash data is not a population-based dataset, meaning that the observations derived from persons involved in fatal crashes are not indicative of the population at large. For example, we know from the annual seat belt observation study that the population-based seat belt use rate is approximately 95 percent; however the seat belt use rate of all vehicle occupants involved in fatal crashes is only 80 percent. Drivers under the influence of drugs and/or alcohol involved in fatal crashes are generally a group of higher risk drivers who engage in other high risk behaviors not typical of the driving population at large.

Fatal crash events involve many factors beyond the behavioral characteristics of the drivers involved. Analysis of any crash data must account for factors present in the culture, environment, engineered roadways, and enforcement activities. Description of fatal crash data may not describe the general population, but it does describe a subset of persons at a higher risk for fatal crash involvement due to specific high risk characteristics and behaviors, such as impaired driving.

Background

Effects of THC on Motor Vehicle Crash Risk and Human Performance

Marijuana is the 'most commonly used illicit drug' in the U.S., consumed by 7.5 percent of Americans ages 12 and older in 2013.[13] Likewise, it is also the most commonly detected non-alcohol drug found in drivers who died within one hour of a motor vehicle crash in the U.S.[3] As with many other drugs used for non-medical (i.e., 'recreational') purposes, at least part of the allure of marijuana lies in its stimulation of elevated dopamine levels in the *nucleus accumbens* (NA), resulting in intense feelings of 'euphoria '.[9]

In Washington State, among drivers in fatal crashes that were tested for drugs, cannabinoids were detected more frequently than any other psychoactive substance, except alcohol. In 2014, the Washington Young Adult Health Survey, a collaborative effort between the University of Washington and state agencies, found that 43 percent of 18-25 year-old respondents had 'used marijuana for recreational purposes' within the previous year, and 47 percent of these reported doing so at least once a month. During the previous 30 days, nearly half of the at least once-a-month users (49 percent) had driven a motor vehicle within three hours of marijuana use.[4] The Behavioral Risk Factor Surveillance Survey, a telephone-based weighted sample survey funded by the Centers for Disease Control, found that 10 percent of Washington adults age 18 and over reported using marijuana in the past 30 days, and 39 percent of these adults reported driving within three hours of consumption.[16] It has become critically important for public officials to accurately assess all potential threats to health and safety posed by the apparent increases in marijuana use.

The search for clear and compelling evidence about the nature of marijuana's impairing effects has been complicated by a number of factors. Until fairly recently not much was known about the neurobiology of how cannabinoids affect the human body. The major psychoactive compound in marijuana, delta-9-tetrahydrocannabinol (delta-9 THC), was not identified and isolated until 1964, and the human endocannabinoid system was not firmly established until the late 1990s. A potent psychoactive metabolite of THC, i.e., 11-OH-THC, is oxidized directly to carboxy-THC. This fairly late development of knowledge about marijuana is likely the result of both political (DEA-related) and technical (development of more sensitive technologies and techniques) obstacles.[11]

Numerous earlier studies investigating the relationship between marijuana impairment and driving found no additional crash risk posed by driving under the influence of marijuana (for example, see Lowenstein and McLain [10]). However, these studies did not distinguish between THC and the inactive metabolite carboxy-THC therefore recent analysts have observed that these earlier crash-risk estimates for marijuana were bias. In part this was caused by 'the difficulty of collecting specimens quickly enough to capture rapidly decreasing active THC concentrations' [5,7]. In effect, then, many earlier studies purporting to show motor vehicle crash risk instead demonstrate marijuana use prevalence among crash involved drivers.

Other problems have also contributed to the ambiguous results of marijuana and driving studies. Erratic rates of blood THC testing of drivers in crashes have almost certainly introduced selection bias into studies of associated motor vehicle crash risk, and the failure of some studies to include comparisons with drug-positive drivers who are not involved in crashes has probably resulted in overstating the role of drugs alone. Thus, generally inadequate controls for these and other potential confounders (e.g., age, gender, seat belt use, alcohol use) have flawed many earlier studies. [5,7]

Two Systematic Reviews

Two recent (2012) meta-studies were able to control more carefully for these confounders. They also reached remarkably similar conclusions regarding the motor vehicle crash risk posed by THC-positive drivers. Both studies included two of the same studies in their final study samples.[3,16] Li et al. systematically winnowed an initial collection of nearly 3,000 studies down to a final sample of nine (from six different countries) based on their 'high quality and credibility'. Five of these were case-control studies, two were cross-sectional surveys, and two were cohort studies. All but one of the studies found increases in crash risk following driver use of marijuana, and seven of them independently concluded that THC-positive drivers are more than twice as likely to crash as THC-free drivers. Two of the studies offered data enabling analysis of a dose-response relationship between THC and crash risk. Using unadjusted odds-ratios for each study, the authors pooled and weighted the results to obtain an overall odds ratio of 2.66 (2.07-3.41), meaning that drivers under the influence of THC were 2.66 times more likely to crash than drivers not under the influence of THC.[8]

In the other meta-analysis, Asbridge et al. followed a systematic review process like that advocated by the Cochrane Collaboration [6] to reach a final sample of nine studies, also from an initial pool of nearly 3,000 entries. The nine studies included three case-control studies but also six 'culpability' studies, a specific type of case-control design in which driver factors contributing to each crash are analyzed independently of drug or alcohol results, as a result of which each driver is classified as 'culpable,' 'contributory,' or 'not culpable.' A culpability ratio was then calculated for all drivers relative to each drug result (including alcohol) included in the study. The authors found that a 'pooled risk of a motor vehicle collision while driving under the influence of THC was almost twice the risk while driving uninfluenced (odds ratio 1.92 [95 percent confidence interval 1.35 to 2.73]).'[2]

Asbridge et al. performed further meta-analyses on the study groups, i.e., case-control studies and culpability studies, and found that the case-control studies estimated a higher crash risk posed by THC than the culpability studies, which may partly account for the odds-ratio differences between the two meta-studies. The study by Li et al. differed from that of Asbridge et al. in another important respect as well: the latter 'included data only if the presence of the active THC was also confirmed by a blood sample' (eight of the nine studies included cases showing minimum 'cut-off' levels of 1 or 2 ng/ml), whereas the former included data from studies that relied either on urine or blood samples confirming the presence of carboxy-THC alone.

Psychomotor and Neurocognitive Evidence: How Marijuana Impairs Driving

Driving is a complex task requiring smooth interactions among a variety of perceptual, cognitive, and psychomotor processes. Given that all human beings are subject to limitations of these perceptual, cognitive, and motor resources at any one time, additional demands placed on them will further diminish driver performance. Abundant evidence from laboratory and simulator studies has shown that THC generates a variety of deficits that diminish driving performance and require additional driver effort to overcome. In addition, after consuming marijuana drivers are aware of their impairment and appear 'to compensate by driving more slowly and taking fewer risks,' though recent observers have concluded that such driver compensation is limited in duration and effectiveness. The effort of compensating also adds to further cognitive loading and potential distraction.[5]

Simply 'converting' the findings from laboratory and simulator studies to on-road driving performance effects has resulted in unwarranted conclusions. Nonetheless, these studies have given researchers the chance to understand the effects of both smoking and ingesting marijuana in a careful, dose-related manner, and also to predict how driving performance is likely to be altered (smoking results in elevated plasma-THC levels within seconds and maximum values within 15 minutes, whereas ingestion results in lower maximum values that peak in around 1 hour). The use of critical tracking (CT) tests, for instance (where the human subject might use a joy-stick or other control to maintain the position of a cursor or icon on a computer screen), translates fairly well to simulator testing of standard deviation of lateral position (SDLP) experiments, which in turn is highly similar to on-road tests measuring the lane position variability among subject drivers. [5,7]

Driving-related human capacities that are diminished by the use of marijuana and include:

Critical Tracking – Degraded between 2 and 25 ng/ml THC for up to 7 hours.

Standard Deviation of Lateral Position (i.e. 'weaving') – Increases in dose-dependent fashion as THC level rises, indicating reduced vehicle control.

Steering Wheel Variability – Steering control is degraded by consumption of marijuana.

Concentrated Attention – Serious and prolonged (8-10 hours) degradation by consumption of marijuana.

Divided-Attention Tasks – Strong linear correlation between THC concentration and degraded performance at 5-25 ng/ml.

Reaction Time –Increased both simple and complex reaction time (braking, steering) after marijuana use.

Headway Variability (i.e. variation in distance between vehicles traveling in the same direction) – Increases following marijuana use.

Speed Variability – Increased speed variance following marijuana smoking.

Balance and Coordination – Standing balance and stability impaired by THC in a dose-related fashion; 'body-sway.'

Memory and Recall – Immediate recall and also short-term and working memory seriously impaired by THC.

Visual Processing – THC degrades visual searching processing speed.

Complex Tasks – Particularly sensitive to THC's impairing effects.

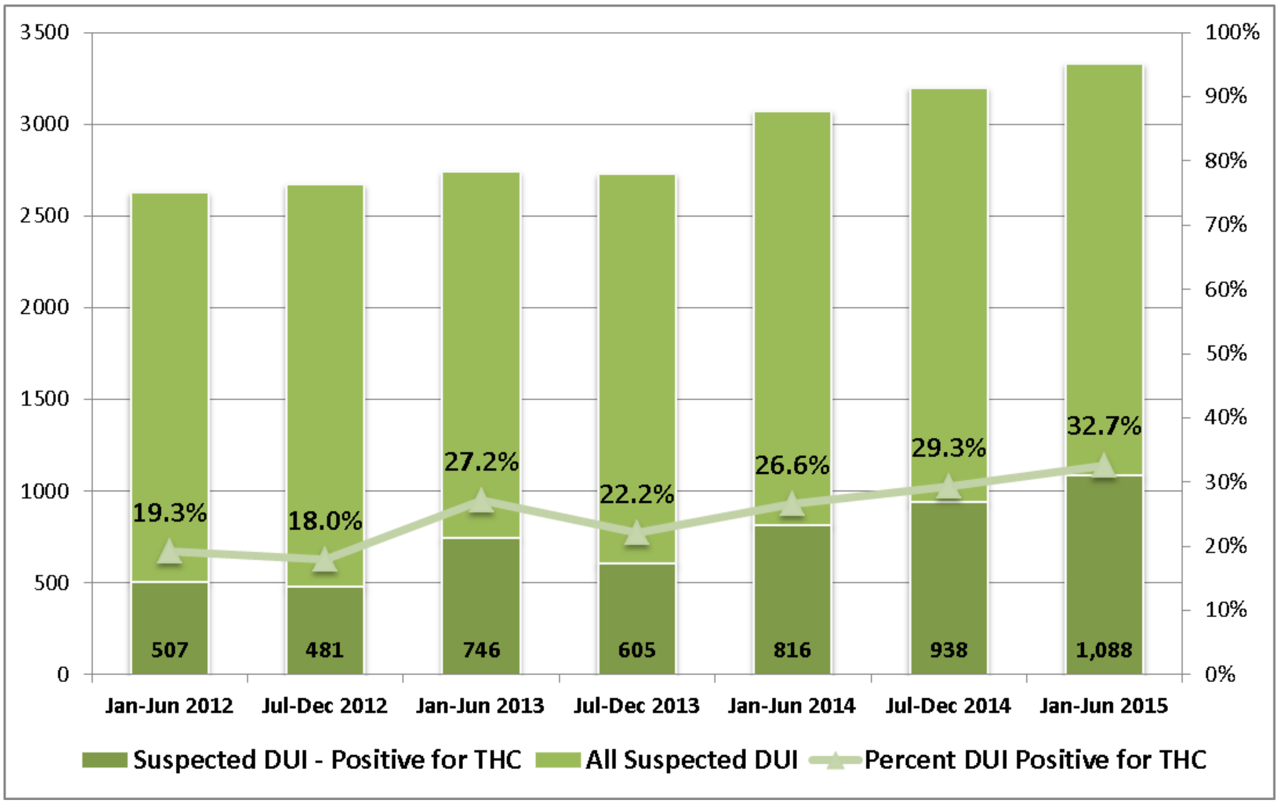
All of these capabilities are even more strongly compromised by the added presence of alcohol. Even low doses of THC in combination 'with a 0.04% BAC produced road-tracking impairment to a degree similar to BACs of 0.09%.'[5] Likewise, chronic and heavy users of marijuana, who often show reduced performance deficits owing to drug-tolerance, become seriously degraded after drinking alcohol. In part this reversal occurs because alcohol erases the ability of even strongly-habituated marijuana users to compensate for their performance decrements.

A link between THC blood levels and impairment may never be developed comparable to the relationship that exists for alcohol. Alcohol and marijuana are very distinct in terms of chemical makeup, body metabolism, and psychomotor impairment and therefore should not be compared. Strategies implemented to reduce alcohol-impaired driving are not likely to have the same impact on reducing drugged drivers. More research and information is needed before a definitive link between marijuana use and increased crash risk can be established. However, significant limitations to this type of research still exist, including lack of complete and reliable data, differences in toxicological blood testing methods and sensitivity, and the vast variety of marijuana potency and consumption methods.

Description of Toxicology Testing Among Drivers in Fatal Crashes

Washington State has a centralized toxicology lab. This means that all drivers suspected of driving under the influence (DUI), either in traffic or as part of a crash investigation where a blood/specimen was collected, are tested by the Washington State Patrol (WSP) Toxicology Lab. Centralized toxicology testing also means statewide DUI toxicology outcomes may be regularly monitored. According to information from the Lab, the proportion of drivers suspected of DUI who tested positive for THC reached its highest point during the first half of 2015.

Figure 1: Proportion of DUI Toxicology Outcomes Positive for THC



The WSP Toxicology Lab's reporting thresholds for THC have varied in the past from one to two nanograms per milliliter of blood (ng/mL). On January 1, 2013, the WSP Toxicology Lab reset the THC reporting threshold to one ng/mL and began conducting full panel (alcohol and drug) tests on all traffic crash blood sample submissions. Prior to this date, the Lab tested blood for the presence of alcohol first. Only if blood alcohol concentrations were under .10, the Lab then conducted drug testing. In addition, full panel alcohol and drug testing was only performed when a driver was involved in vehicular homicide/assault and/or underwent a Drug Recognition Expert examination. The Lab change to full panel testing after 2013 had a minor impact on the data used in this report (drivers with only alcohol screening were excluded). Table 2 on the following page describes the frequency of full panel testing.

Toxicology Testing of Drivers in Fatal Crashes

Data was abstracted from reports obtained from the Washington State Patrol (WSP) Toxicology Lab, collected for Fatality Analysis Reporting System (FARS) purposes. A complete description of the method for abstracting complete toxicology from FARS records is detailed in Appendix B.

Revised Code of Washington 46.52.065 requires that 'a blood sample be taken from all drivers and all pedestrians who are killed in any traffic accident where the death occurred within four hours' for analysis by the state toxicologist 'to determine the concentration of alcohol and, where feasible, the presence of drugs or other toxic substances.' This statute has led to statewide testing rates for deceased drivers of almost 90 percent. Failure to test a deceased driver most often results from either a long time-lag between crash and death or from some other barrier to obtaining a viable sample for testing. Unfortunately, a similar law does not exist for surviving drivers involved in fatal crashes. Therefore testing rates among this group are much lower and rely on the reasonable suspicion of impairment by the investigating law enforcement parties.

Table 1: Toxicology Testing of Surviving and Deceased Drivers, 2010-2014

2010-2014	Any Toxicology Testing	No Toxicology Testing	% Tested	Total
Surviving Drivers	610	1,003	37.8%	1,613
Deceased Drivers	1,264	150	89.4%	1,414
Total Drivers	1,874	1,153	61.9%	3,027

Drivers in Fatal Crashes Excluded From This Report

In Washington State between 2010 and 2014, a total of 3,027 drivers were involved in fatal crashes. Overall testing rates of drivers involved in fatal crashes remained stable during this time period. The table on the following page describes the type and frequency of toxicology tests.

Table 2: Toxicology Testing of Drivers by Year

	Alcohol Test ONLY	Drug Test ONLY	Alcohol and Drug Test	Not Tested	% Tested	Total
2010	22	1	377	219	**64.6%**	**619**
2011	36	0	344	226	**62.7%**	**606**
2012	21	1	345	224	**62.1%**	**591**
2013	7	0	373	212	**64.2%**	**592**
2014[1]	5	0	342	272	**56.1%**	**619**
Total	**91**	**2**	**1,781**	**1,153**	**61.9%**	**3,027**

[1] At the time of this report, data for 2014 is still preliminary. Data remains preliminary until January 1, 2016. Additional toxicology outcomes may still be received.

For purposes of this report, the results from the 91 drivers that were tested for only alcohol were excluded from further analysis. The two drivers tested only for drugs is likely due to FARS not receiving alcohol information, therefore these two drivers were also excluded from further analysis. Of the 1,781 drivers tested for both alcohol and drugs, eight had either an unknown alcohol or drug type result; these eight drivers were also excluded from further analysis. The resulting final sample of 1,773 drivers was tested for both alcohol and drugs with known drug type results.

Figure 2: Drivers in Fatal Crashes by Toxicology Testing Status

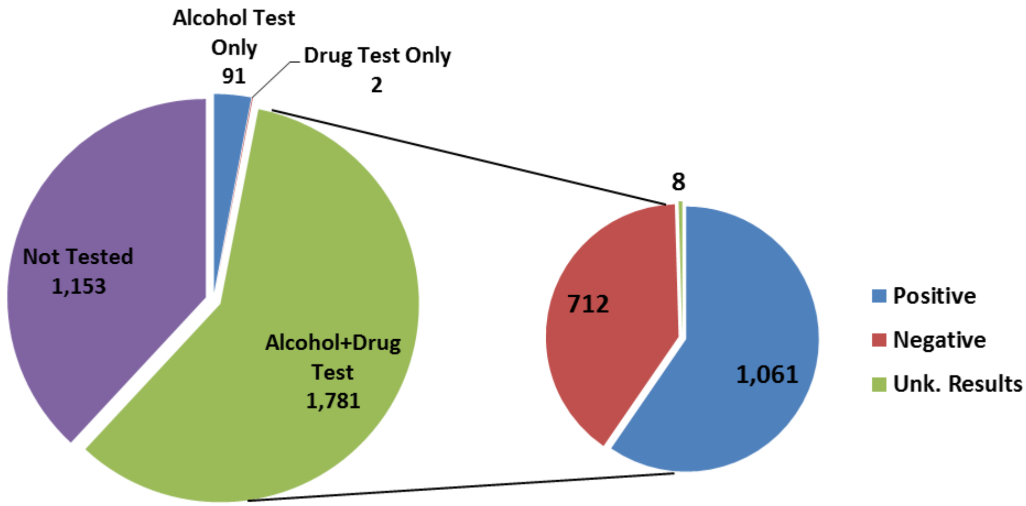


Figure 1 displays that of the 1,781 drivers tested for both alcohol and drugs, 1,061 or 59.6 percent tested positive for drugs and/or alcohol. Eight of these drivers were tested but the results regarding the alcohol result or type of drug were unknown.

Description of Tested Drivers and Non- Tested Drivers

This section describes the drivers who were tested, regardless of the injury outcome for those drivers.

Table 3: Toxicology Testing of Drivers by Gender

Gender	Alcohol and Drug Test	No Test	% Tested	Total
Male	1,394	765	64.6%	2,159
Female	379	355	51.6%	734
Unknown	0	33	0.0%	33
Total	1,773	1,153	60.6%	2,926

Male drivers are generally involved in fatal crashes more frequently than female drivers. Even so, a higher proportion of male drivers were tested for alcohol and drugs; 64.6 percent compared to only 51.6 percent of female drivers.

Table 4: Toxicology Testing of Drivers by Age Group

Age Group	Alcohol and Drug Test	No Test	% Tested	Total
Age $\leq$ 15	5	3	62.5%	8
16-25	457	207	68.8%	664
26-35	329	203	61.8%	532
36-45	277	189	59.4%	466
46-55	271	202	57.3%	473
56-65	226	182	55.4%	408
66-75	115	71	61.8%	186
Age 76+	92	61	60.1%	153
Unknown	1	35	2.8%	36

Drivers ages 16-25 are generally involved in fatal crashes more frequently than any other age group. This age group also has the highest proportion of drivers tested for alcohol and drugs at 68.8 percent.

Table 5: Toxicology Testing of Drivers by Gender and Age Group

Gender / Age Group	Alcohol and Drug Test	No Test	% Tested	Total
Male	**1,394**	**765**	**64.6%**	**2,159**
Age ≤ 15	4	1	80.0%	5
16-25	356	139	71.9%	495
26-35	260	131	66.5%	391
36-45	221	131	62.8%	352
46-55	207	139	59.8%	346
56-65	191	134	58.8%	325
66-75	95	51	65.1%	146
Age 76+	59	37	61.5%	96
Unknown	1	2	33.3%	3
Female	**379**	**355**	**51.6%**	**734**
Age ≤ 15	1	2	33.3%	3
16-25	101	68	59.8%	169
26-35	69	72	48.9%	141
36-45	56	58	49.1%	114
46-55	64	63	50.4%	127
56-65	35	48	42.2%	83
66-75	20	20	50.0%	40
Age 76+	33	24	57.9%	57
Unknown	0	0	0.0%	0
Unknown	0	33	0.0%	33

Males ages 16-25 were the most frequent drivers involved in fatal crashes between 2010 and 2014. Among this driver group, 71.9 percent were tested for alcohol and drugs. Among females of the same age group, 59.8 percent were tested for alcohol and drugs.

Table 6: Toxicology Testing of Drivers by Investigating Jurisdiction

Investigating Jurisdiction	Alcohol and Drug Test	No Test	% Tested	Total
State	973	615	61.3%	1,588
City	367	310	54.2%	677
County	419	216	66.0%	635
Other	3	2	60.0%	5
Unknown	11	10	52.4%	21

Among all jurisdiction levels investigating fatal crashes, city jurisdictions showed the lowest testing proportions, testing only 54.2 percent of drivers involved in fatal crashes. County jurisdictions had the highest testing proportion at 66 percent.

Table 7: Toxicology Testing of Drivers by County of Crash

County	Alcohol and Drug Test	No Test	% Tested	Total
Adams	20	20	50.0%	40
Asotin	1	2	33.3%	3
Benton	54	31	63.5%	85
Chelan	27	21	56.3%	48
Clallam	26	12	68.4%	38
Clark	98	52	65.3%	150
Columbia	0	0	0.0%	0
Cowlitz	39	18	68.4%	57
Douglas	13	8	61.9%	21
Ferry	3	3	50.0%	6
Franklin	22	12	64.7%	34
Garfield	3	4	42.9%	7
Grant	59	44	57.3%	103
Grays Harbor	24	17	58.5%	41
Island	23	9	71.9%	32
Jefferson	12	8	60.0%	20
King	298	272	52.3%	570
Kitsap	64	26	71.1%	90
Kittitas	29	23	55.8%	52
Klickitat	19	7	73.1%	26
Lewis	24	16	60.0%	40
Lincoln	11	4	73.3%	15
Mason	31	16	66.0%	47
Okanogan	36	19	65.5%	55
Pacific	9	6	60.0%	15
Pend Oreille	12	7	63.2%	19
Pierce	166	123	57.4%	289
San Juan	3	0	100.0%	3
Skagit	33	23	58.9%	56
Skamania	8	11	42.1%	19
Snohomish	148	105	58.5%	253
Spokane	122	69	63.9%	191
Stevens	31	16	66.0%	47
Thurston	75	41	64.7%	116
Wahkiakum	0	2	0.0%	2
Walla Walla	21	17	55.3%	38
Whatcom	60	27	69.0%	87
Whitman	17	11	60.7%	28
Yakima	132	51	72.1%	183

Alcohol and drug testing of drivers involved in fatal crashes varies by county. However, several counties experience few fatal crash events, contributing to the extreme variability seen between counties.

Description of Tested Drivers: Positive and Negative for Drugs or Alcohol

Table 8: Toxicology Outcomes of Drivers by Gender

Gender	Negative	Positive	% Positive	Total
Male	538	856	61.4%	1,394
Female	174	205	54.1%	379
Unknown	0	0	0.0%	0
Total	712	1,061	59.8%	1,773

A higher proportion of male drivers than female drivers involved in fatal crashes are tested for alcohol and drugs. Of these tested male drivers, 61.4 percent were positive for alcohol and/or drugs, compared to 54.1 percent of female drivers.

Table 9: Toxicology Outcomes of Drivers by Age Group

Age Group	Negative	Positive	% Positive	Total
Age < 15	1	4	80.0%	5
16-25	171	286	62.6%	457
26-35	84	245	74.5%	329
36-45	98	179	64.6%	277
46-55	113	158	58.3%	271
56-65	112	114	50.4%	226
66-75	67	48	41.7%	115
Age 76+	65	27	29.3%	92
Unknown	1	0	0.0%	1

Drivers aged 16-25 involved in fatal crashes had the highest proportion of alcohol and drug testing, but this was not the age group with the highest proportion of drivers testing positive. Drivers aged 26-35[2] had the highest proportion of positive alcohol and drug testing at 74.5 percent, compared to 62.6 percent of drivers aged 16-25.

[2] For this comparison, drivers age 15 or younger were excluded due to the small sample size.

Table 10: Toxicology Outcomes of Drivers by Gender and Age Group

Gender / Age Group	Negative	Positive	% Positive	Total
Male	**538**	**856**	**61.4%**	**1,394**
Age ≤ 15	1	3	75.0%	4
16-25	118	238	66.9%	356
26-35	66	194	74.6%	260
36-45	76	145	65.6%	221
46-55	85	122	58.9%	207
56-65	91	100	52.4%	191
66-75	56	39	41.1%	95
Age 76+	44	15	25.4%	59
Unknown	1	0	0.0%	1
Female	**174**	**205**	**54.1%**	**379**
Age ≤ 15	0	1	100.0%	1
16-25	53	48	47.5%	101
26-35	18	51	73.9%	69
36-45	22	34	60.7%	56
46-55	28	36	56.3%	64
56-65	21	14	40.0%	35
66-75	11	9	45.0%	20
Age 76+	21	12	36.4%	33
Unknown	0	0	0.0%	0
Unknown	0	0	0.0%	0

Among drivers ages 26-35, little variation existed between male and female drivers in terms of testing positive for alcohol and/or drugs. Nearly 75 percent of both male and female drivers in this age group who were tested for alcohol and drugs tested positive.

Table 11: Toxicology Outcomes of Drivers by Investigating Jurisdiction

Investigating Jurisdiction	Negative	Positive	% Positive	Total
State	436	537	55.2%	973
City	144	223	60.8%	367
County	131	288	68.7%	419
Other	1	2	66.7%	3
Unknown	0	11	100%	11

As shown earlier, county jurisdictions had the highest driver testing rates. This jurisdiction also had the highest proportion of drivers testing positive for alcohol and/or drugs (68.7 percent).

Table 12: Toxicology Outcomes of Drivers by County of Crash

County	Negative	Positive	% Positive	Total
Adams	12	8	40.0%	20
Asotin	1	0	0.0%	1
Benton	28	26	48.1%	54
Chelan	13	14	51.9%	27
Clallam	8	18	69.2%	26
Clark	42	56	57.1%	98
Columbia	0	0	0.0%	0
Cowlitz	15	24	61.5%	39
Douglas	3	10	76.9%	13
Ferry	1	2	66.7%	3
Franklin	7	15	68.2%	22
Garfield	3	0	0.0%	3
Grant	30	29	49.2%	59
Grays Harbor	8	16	66.7%	24
Island	13	10	43.5%	23
Jefferson	6	6	50.0%	12
King	113	185	62.1%	298
Kitsap	22	42	65.6%	64
Kittitas	12	17	58.6%	29
Klickitat	9	10	52.6%	19
Lewis	11	13	54.2%	24
Lincoln	5	6	54.5%	11
Mason	13	18	58.1%	31
Okanogan	10	26	72.2%	36
Pacific	2	7	77.8%	9
Pend Oreille	3	9	75.0%	12
Pierce	56	110	66.3%	166
San Juan	0	3	100.0%	3
Skagit	16	17	51.5%	33
Skamania	2	6	75.0%	8
Snohomish	60	88	59.5%	148
Spokane	49	73	59.8%	122
Stevens	12	19	61.3%	31
Thurston	27	48	64.0%	75
Wahkiakum	0	0	0.0%	0
Walla Walla	9	12	57.1%	21
Whatcom	27	33	55.0%	60
Whitman	9	8	47.1%	17
Yakima	55	77	58.3%	132

Testing outcomes of drivers involved in fatal crashes varied by county. However, several counties experience few fatal crash events, contributing to the extreme variability seen between counties.

Categorization of Drivers Testing Positive for Alcohol or Drugs

Drivers involved in fatal crashes who were tested for alcohol and drugs were assigned into mutually exclusive categories (represented only once) based on toxicology outcomes.

Table 13: Categorization of Drivers Testing Positive for Alcohol or Drugs

TEST STATUS	Driver Category 1	Sample	Driver Category 2	Sample	Driver Category 3	Sample
Not Tested	Not Tested	1,153	Not Tested	1,153	Not Tested	1,153
Tested - Negative	No Drugs, No Alcohol	712	No Drugs, No Alcohol	712	No Drugs, No Alcohol	712
Tested – Positive (1,773) Excluding Alcohol Test Only (91), Drug Test Only (2), Tested with Unknown Results (8)	Alcohol Only	360	Alcohol Only <.079	46	Alcohol Only <.079	46
			Alcohol Only ≥.08	314	Alcohol Only ≥.08	314
	Cannabinoids Only	93	THC Only	56	THC Only	56
			Carboxy-THC Only	37	Carboxy-THC Only	37
	Cannabinoids + Alcohol Only	137	THC + Alcohol	96	THC + Alcohol <.079	13
					THC + Alcohol ≥.08	83
			Carboxy-THC + Alcohol	41	Carboxy-THC + Alcohol	41
	Cannabinoids + Drugs + Alcohol	43	THC + Drugs + Alcohol	24	THC + Drugs + Alcohol <.079	6
					THC + Drugs + Alcohol ≥.08	18
			Carboxy-THC + Drugs + Alcohol	19	Carboxy-THC + Drugs + Alcohol	19
	Cannabinoids + Drugs Only	69	THC + Drugs	39	THC + Drugs	39
			Carboxy-THC + Drugs	30	Carboxy-THC + Drugs	30
	Other Drugs Only	258	Other Drugs Only	258	Other Drugs Only	258
	Other Drugs + Alcohol Only	101	Other Drugs + Alcohol Only	101	Other Drugs + Alcohol Only	101
Total Driver Sample, 2010-2014						2,926

Some categories could have been separated further but the remainder of this report focuses on descriptive comparisons of drivers with negative test results, drivers with alcohol greater than/equal to BAC .08, drivers with only carboxy-THC, and drivers with combinations of THC (THC alone, THC with alcohol greater than/equal to BAC .08, THC with other drugs, and THC with alcohol greater than/equal to BAC .08 and drugs). Driver Category One from the table is presented in Figure 3 on the following page.

Figure 3: Categorization of Driver Positive Alcohol and Drug Results

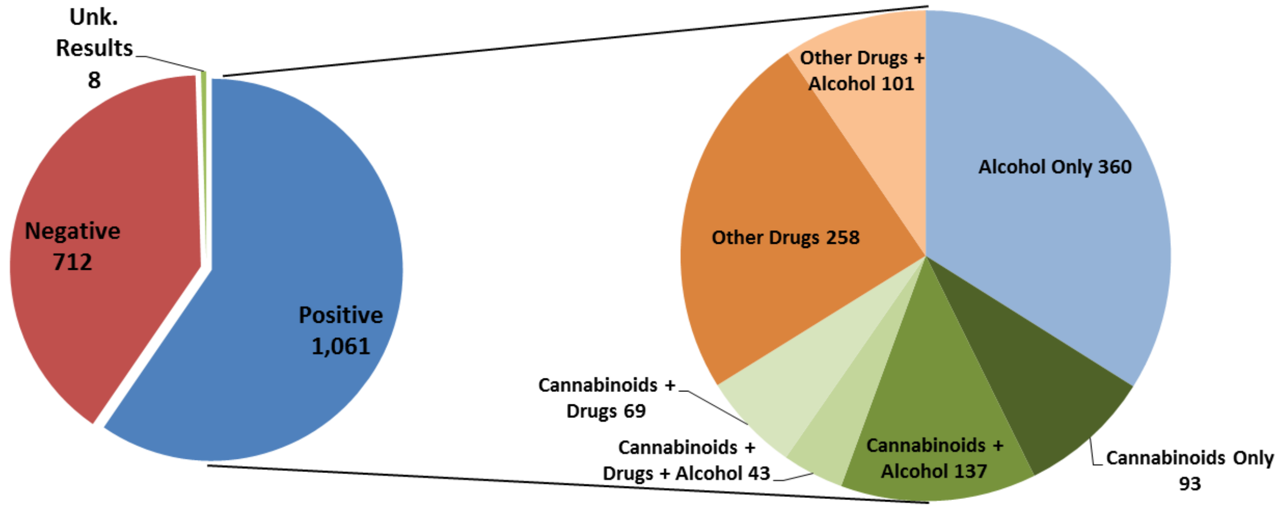


Figure 3 shows the testing results of drivers in fatal crashes that tested for alcohol and drugs 2010 through 2014. Alcohol without other drugs was the most frequent substance found in drivers involved in fatal crashes. All other drugs combined (excluding any cannabinoids and not in combination with alcohol) also represented a high proportion of drivers testing positive (for a complete list of 'other drugs,' refer to Appendix C). Compared with singular drug families (such as depressants, stimulants, and opioids) cannabinoids was the most frequently occurring drug family among drivers in fatal crashes testing positive for drugs.

Frequency of Driver Toxicology Outcomes by Year

The following table describes the frequency of mutually exclusive driver alcohol/drug categorization.

Table 14: Categorization of Drivers Testing Positive for Alcohol or Drugs by Year[3]

Driver Category 3	2010	2011	%Change 2010 - 2011	2012	%Change 2011 - 2012	2013	%Change 2012 - 2013	2014	%Change 2013 - 2014	TOTAL 2010-2014	Percent Change 2010-2014
Not Tested	219	226	3.2%	224	-0.9%	212	-5.4%	272	28.3%	1,153	**24.2%**
No Drugs, No Alcohol	147	151	2.7%	151	0.0%	147	-2.6%	116	-21.1%	712	**-21.1%**
Alcohol Only <.079	15	8	-46.7%	6	-25.0%	7	16.7%	10	42.9%	46	**-33.3%**
Alcohol Only ≥.08	67	67	0.0%	60	-10.4%	69	15.0%	51	-26.1%	314	**-23.9%**
THC Only	9	7	-22.2%	13	85.7%	7	-46.2%	20	185.7%	56	**122.2%**
Carboxy-THC Only	11	10	-9.1%	7	-30.0%	3	-57.1%	6	100.0%	37	**-45.5%**
THC + Alcohol <.079	3	1	-66.7%	0	-100.0%	3	300.0%	6	100.0%	13	**100%**
THC + Alcohol ≥.08	16	16	0.0%	12	-25.0%	16	33.3%	23	37.5%	83	**43.8%**
Carboxy-THC + Alcohol	12	6	-50.0%	11	83.3%	9	-18.2%	3	-66.7%	41	**-75.0%**
THC + Drugs + Alcohol <.079	0	0	0.0%	1	100.0%	2	100.0%	3	50.0%	6	**300%**
THC + Drugs + Alcohol ≥.08	2	5	150.0%	2	-60.0%	3	50.0%	6	100.0%	18	**200%**
Carboxy-THC + Drugs + Alcohol	10	2	-80.0%	5	150.0%	2	-60.0%	0	-100.0%	19	**-100%**
THC + Drugs	6	3	-50.0%	8	166.7%	5	-37.5%	17	240.0%	39	**183.3%**
Carboxy-THC + Drugs	10	5	-50.0%	3	-40.0%	7	133.3%	5	-28.6%	30	**-50.0%**
Other Drugs Only	47	42	-10.6%	46	9.5%	71	54.3%	52	-26.8%	258	**10.6%**
Other Drugs + Alcohol Only	20	18	-10.0%	19	5.6%	20	5.3%	24	20.0%	101	**20.0%**
Total Drivers	**594**	**567**	**-4.5%**	**568**	**0.2%**	**583**	**2.6%**	**614**	**5.3%**	**2,926**	**3.4%**

[3] Driver categories displayed in shaded rows were selected for further comparisons and are described throughout the remainder of this report.

The frequency of drivers that tested positive for THC, alone or combined with any other drug including alcohol, increased since 2010. The frequency of drivers that tested positive for alcohol, including alcohol combined with carboxy-THC, declined since 2010. The occurrences of other drugs, alone or in combination with alcohol, have increased slightly since 2010.

Comparative Description of Drivers Testing Positive for Cannabinoids

The remainder of this report will focus on the comparison of the selected driver groups based on toxicology outcomes. These selected comparison groups are presented in the table below.

Table 15: Driver Comparison Groups by Year

	2010	2011	2012	2013	2014	TOTAL 2010-2014	Percent Change 2010-2014
No Drugs, No Alcohol	147	151	151	147	116	712	**-21.1%**
Alcohol Only ≥.08	67	67	60	69	51	314	**-23.9%**
THC Only	9	7	13	7	20	56	**122.2%**
Carboxy-THC Only	11	10	7	3	6	37	**-45.5%**
THC + Alcohol ≥.08	16	16	12	16	23	83	**43.8%**
THC + Drugs	6	3	8	5	17	39	**183.3%**
THC + Drugs + Alcohol ≥.08	2	5	2	3	6	18	**200.0%**

Although sample sizes are small, the frequency of drivers in fatal crashes who tested positive for THC, alone or in combination with other drugs and alcohol, reached its highest point in 2014 compared to the previous four years. The number of drivers in fatal crashes who were only impaired by alcohol (BAC greater than/equal to .08) has been steadily declining. Figures 4 and 5 on the following page demonstrate this trend.

Figure 4: Percent Change in Frequency of Driver Comparison Groups, 2010-2014

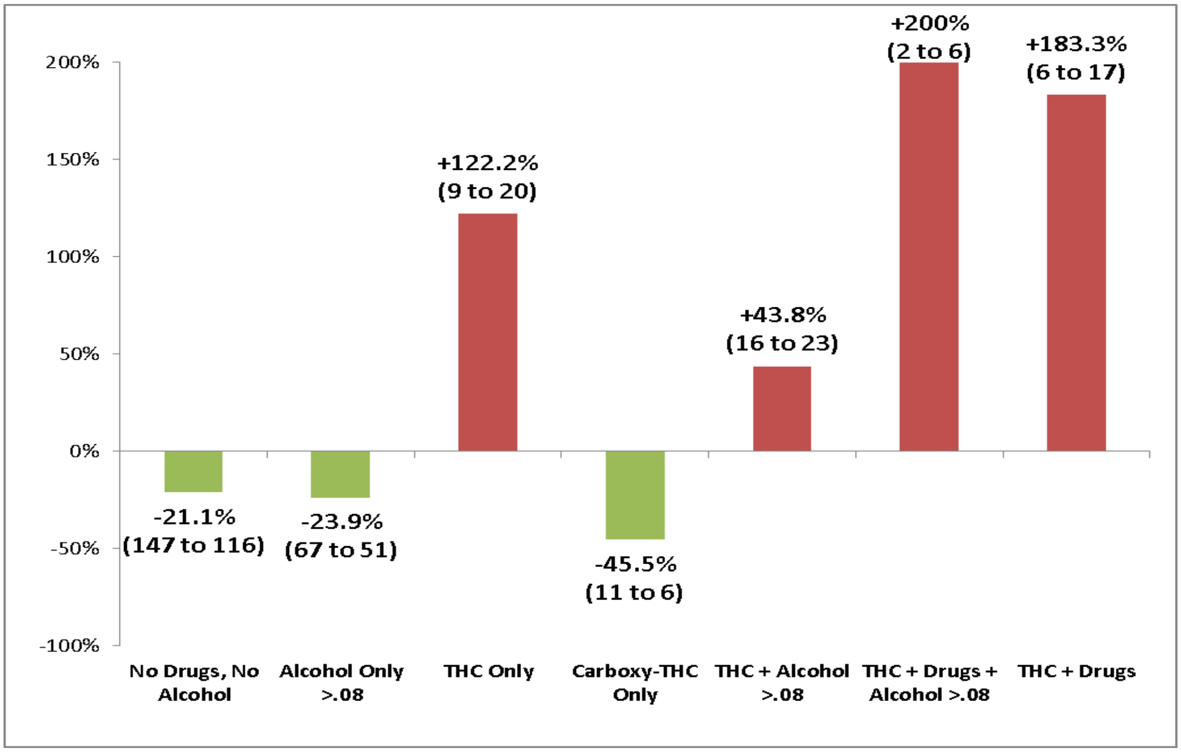
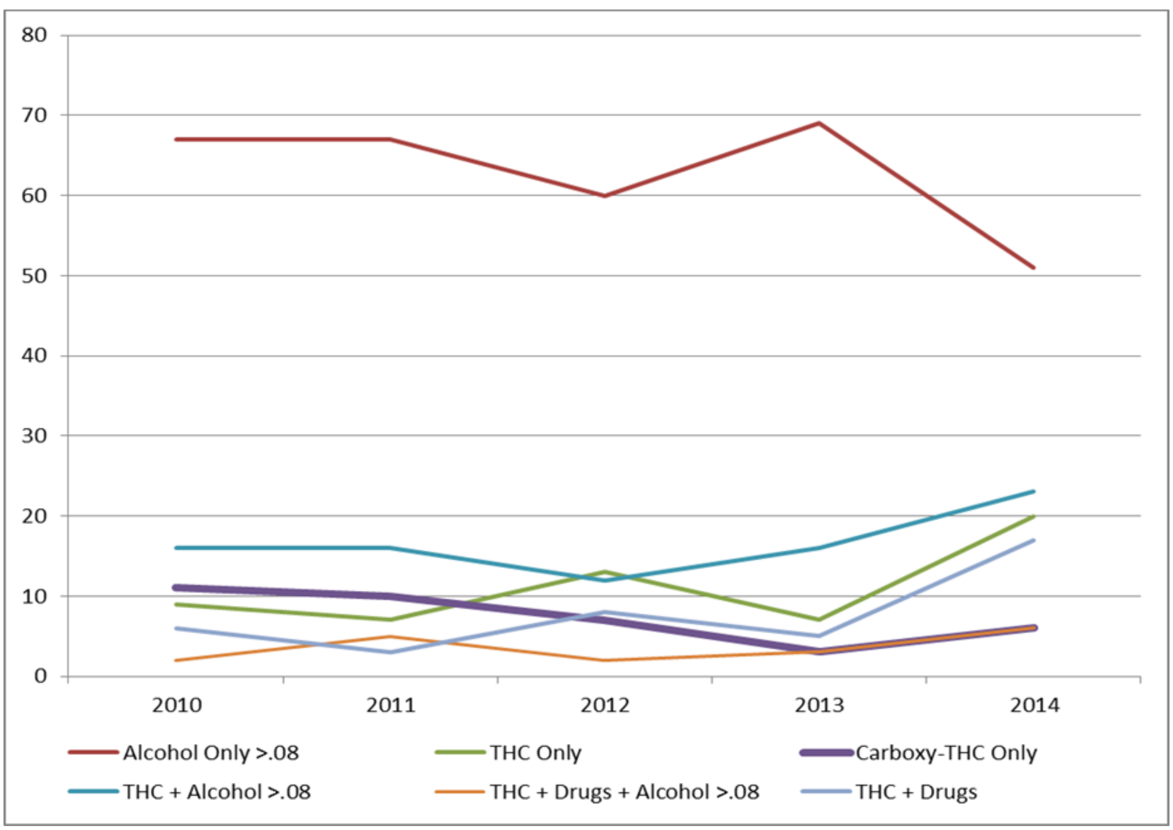


Figure 5: Frequency of Drivers Testing Positive for Cannabinoids by Year



The remainder of the report will describe the select driver comparison groups by demographics and crash characteristics. Due to small sample sizes, the following comparisons are made using the five years of aggregate data.

Driver Demographics

Demographics of drivers include age and gender. The following tables describe demographic differences between the driver comparison groups. Due to small sample sizes, gender and age are presented separately.

Table 16: Driver Comparison Groups by Gender

	MALE	FEMALE	% of ALL MALE Tested Drivers (n=1,394)	% of ALL FEMALE Tested Drivers (n=379)	TOTAL 2010-2014
No Drugs, No Alcohol	538	174	38.6%	45.9%	712
Alcohol Only ≥.08	276	38	19.8%	10.0%	314
THC Only	49	7	3.5%	1.8%	56
Carboxy-THC Only	31	6	2.2%	1.6%	37
THC + Alcohol ≥.08	70	13	5.0%	3.4%	83
THC + Drugs	32	7	2.3%	1.8%	39
THC + Drugs + Alcohol ≥.08	17	1	1.2%	0.3%	18

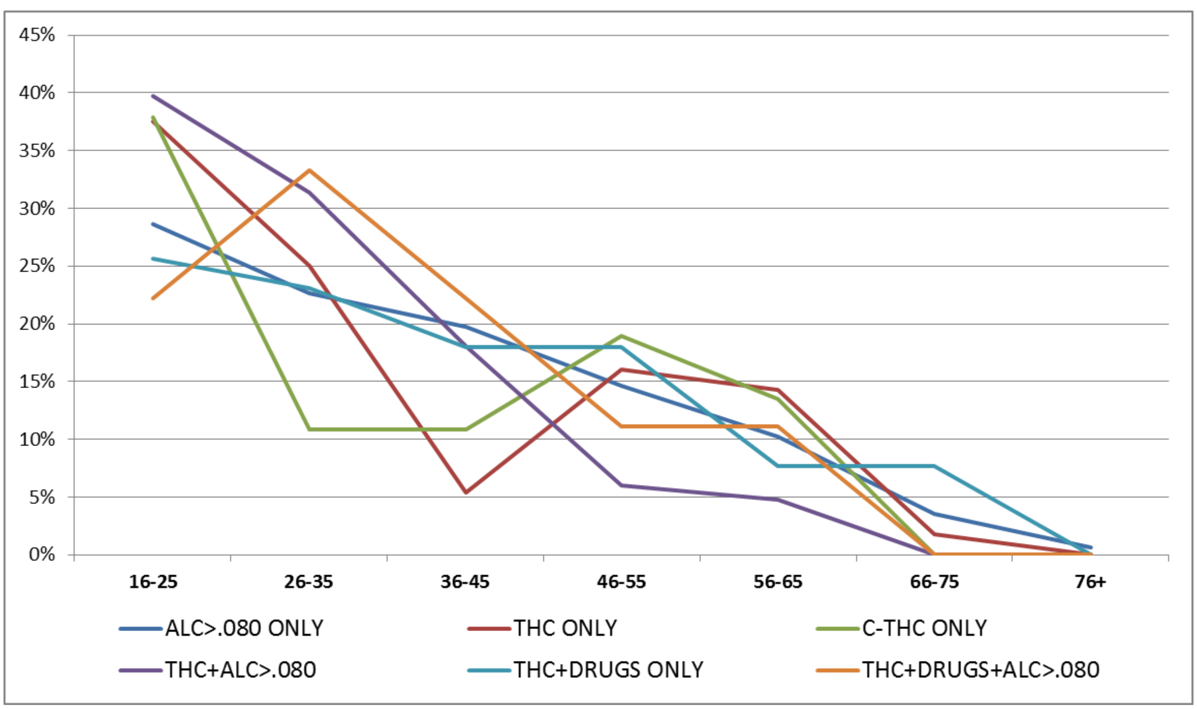
Table 16 shows the gender of drivers involved in fatal crashes by toxicology outcomes. Of all female drivers tested, 45.9 percent were negative for alcohol and drugs, compared to only 38.6 percent of males. Twelve percent of tested male drivers were positive for THC, alone or in combination with other drugs and/or alcohol, compared to 7.3 percent of tested female drivers. The frequency of drivers with alcohol greater than/equal to BAC .08 remained highest for both genders at nearly one-fifth of tested male drivers and one-tenth of tested female drivers.

Table 17: Driver Comparison Groups by Age

	0-15	16-25	26-35	36-45	46-55	56-65	66-75	76+	Unk
No Drugs, No Alcohol	1	171	84	98	113	112	67	65	1
	0.1%	24.0%	11.8%	13.8%	15.9%	15.7%	9.4%	9.1%	0.1%
Alcohol Only ≥.08	0	90	71	62	46	32	11	2	0
	0.0%	28.7%	22.6%	19.7%	14.6%	10.2%	3.5%	0.6%	0.0%
THC Only	0	21	14	3	9	8	1	0	0
	0.0%	37.5%	25.0%	5.4%	16.1%	14.3%	1.8%	0.0%	0.0%
Carboxy-THC Only	3	14	4	4	7	5	0	0	0
	8.1%	37.8%	10.8%	10.8%	18.9%	13.5%	0.0%	0.0%	0.0%
THC + Alcohol ≥.08	0	33	26	15	5	4	0	0	0
	0.0%	39.8%	31.3%	18.1%	6.0%	4.8%	0.0%	0.0%	0.0%
THC + Drugs	0	10	9	7	7	3	3	0	0
	0.0%	25.6%	23.1%	17.9%	17.9%	7.7%	7.7%	0.0%	0.0%
THC + Drugs + Alcohol ≥.08	0	4	6	4	2	2	0	0	0
	0.0%	22.2%	33.3%	22.2%	11.1%	11.1%	0.0%	0.0%	0.0%

Among drivers in fatal crashes testing positive for THC, the largest proportion of them were ages 16-25. This age group also had the highest proportion of drivers with alcohol greater than/equal to BAC .08. Of drivers testing positive for the combination of THC and alcohol greater than/equal to BAC .08, 39.8 percent were ages 16-25.

Figure 6: Driver Comparison Groups by Age



Crash Time [4]

Analyzing the timing of crash events is used in predicting and directing enforcement efforts. The timing of fatal crash events involving alcohol differ from fatal crash events involving THC and are described further in this section.

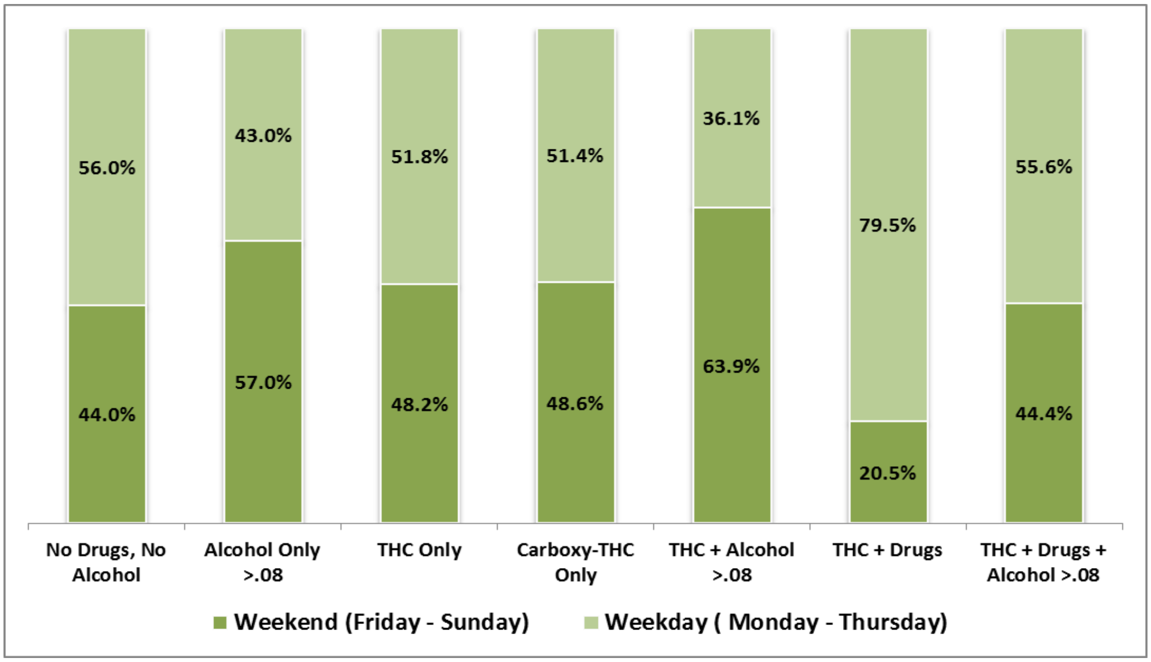
Table 18: Driver Comparison Groups by Crash Day of Week

	FRI	SAT	SUN	MON	TUE	WED	THU
No Drugs, No Alcohol	115	123	75	118	96	92	93
	16.2%	17.3%	10.5%	16.6%	13.5%	12.9%	13.1%
Alcohol Only ≥.08	59	68	52	34	29	33	39
	18.8%	21.7%	16.6%	10.8%	9.2%	10.5%	12.4%
THC Only	12	9	6	7	10	4	8
	21.4%	16.1%	10.7%	12.5%	17.9%	7.1%	14.3%
Carboxy-THC Only	6	7	5	5	5	3	6
	16.2%	18.9%	13.5%	13.5%	13.5%	8.1%	16.2%
THC + Alcohol ≥.08	12	23	18	6	8	7	9
	14.5%	27.7%	21.7%	7.2%	9.6%	8.4%	10.8%
THC + Drugs	2	4	2	9	9	9	4
	5.1%	10.3%	5.1%	23.1%	23.1%	23.1%	10.3%
THC + Drugs + Alcohol ≥.08	5	1	2	2	2	4	2
	27.8%	5.6%	11.1%	11.1%	11.1%	22.2%	11.1%
Total Drivers	211	235	160	181	159	152	161
Total Crashes	187	220	147	164	136	133	146

Among drivers with only alcohol greater than/equal to BAC .08, 57 percent were involved in fatal crashes that occurred Friday-Sunday, compared to 48.2 percent of drivers with only THC. Among drivers with alcohol greater than/equal to BAC .08 and THC combined, 63.9 percent of them were involved in fatal crashes that occurred on weekends. Driver sample sizes were small when divided by day of the week so for meaningful comparison, days were grouped into week days (Monday – Thursday) and weekend days (Friday – Sunday). These differences are displayed in Figure 7 on the next page.

[4] Crash variables are represented at the driver level to compare the driver groups. For reference, the total number of crashes is provided. All percent values are derived from total number of drivers in the comparison groups.

Figure 7: Driver Comparison Groups by Weekend/Weekday Crashes



Fatal crashes that involved drivers with no alcohol or drugs were more evenly split between weekdays and weekends than were crashes that involved alcohol. Fatal crashes involving drivers with alcohol greater than/equal to BAC .08 occurred most frequently on weekend days.

Table 19: Driver Comparison Groups by Crash Month

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
No Drugs, No Alcohol	41	60	44	45	58	65	65	75	78	68	48	65
	5.8%	8.4%	6.2%	6.3%	8.1%	9.1%	9.1%	10.5%	11.0%	9.6%	6.7%	9.1%
Alcohol Only ≥.08	20	18	22	29	35	30	31	33	27	20	28	21
	6.4%	5.7%	7.0%	9.2%	11.1%	9.6%	9.9%	10.5%	8.6%	6.4%	8.9%	6.7%
THC Only	3	2	3	3	7	4	9	6	3	5	4	7
	5.4%	3.6%	5.4%	5.4%	12.5%	7.1%	16.1%	10.7%	5.4%	8.9%	7.1%	12.5%
Carboxy-THC Only	2	3	4	0	1	4	7	3	6	1	3	3
	5.4%	8.1%	10.8%	0.0%	2.7%	10.8%	18.9%	8.1%	16.2%	2.7%	8.1%	8.1%
THC + Alcohol ≥.08	8	6	12	6	11	7	2	3	7	7	3	11
	9.6%	7.2%	14.5%	7.2%	13.3%	8.4%	2.4%	3.6%	8.4%	8.4%	3.6%	13.3%
THC + Drugs	4	4	5	4	4	4	2	1	2	4	1	4
	10.3%	10.3%	12.8%	10.3%	10.3%	10.3%	5.1%	2.6%	5.1%	10.3%	2.6%	10.3%
THC + Drugs + Alcohol ≥.08	0	0	3	1	4	0	1	4	2	0	3	0
	0.0%	0.0%	16.7%	5.6%	22.2%	0.0%	5.6%	22.2%	11.1%	0.0%	16.7%	0.0%
Total Drivers	**78**	**93**	**93**	**88**	**120**	**114**	**117**	**125**	**125**	**105**	**90**	**111**
Total Crashes	**73**	**80**	**83**	**79**	**111**	**103**	**102**	**117**	**112**	**93**	**79**	**101**

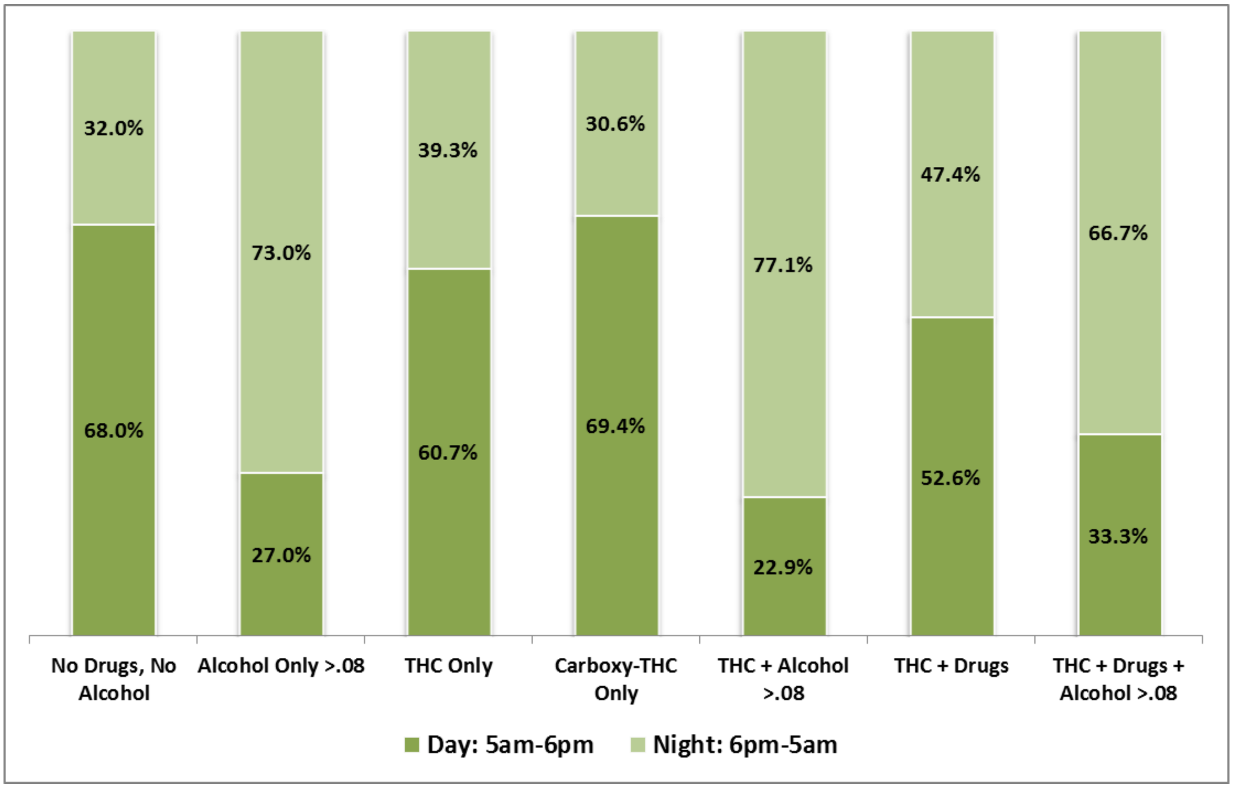
Similar to day of week, driver sample sizes were small when divided by month. No clear descriptive patterns by month were observed.

Table 20: Driver Comparison Groups by Crash Time

	Day: 5:01am – 6:00pm	Night: 6:01pm – 5:00am	Unknown Crash Time
No Drugs, No Alcohol	483	227	2
	68.0%	32.0%	0.3%
Alcohol Only >.08	82	222	10
	27.0%	73.0%	3.3%
THC Only	34	22	0
	60.7%	39.3%	0.0%
Carboxy-THC Only	25	11	1
	69.4%	30.6%	2.8%
THC + Alcohol >.08	19	64	0
	22.9%	77.1%	0.0%
THC + Drugs	20	18	1
	52.6%	47.4%	2.6%
THC + Drugs + Alcohol >.08	6	12	0
	33.3%	66.7%	0.0%
Total Drivers	**668**	**576**	**14**
Total Crashes	**579**	**540**	**14**

The times of day for fatal crashes that involved a driver with the combination of THC and alcohol are similar to crashes involving a driver impaired by only alcohol. The majority of these crashes occurred in the nighttime hours between 6 p.m. and 5 a.m. The majority of fatal crashes involving a driver with only THC, or even THC combined with other drugs, occurred during the daytime hours. Figure 8 on the following page displays these differences.

Figure 8: Driver Comparison Groups by Day/Night Crashes



The majority of fatal crashes that involved a driver with alcohol greater than/equal to BAC .08, alone or in combination with any other drugs, occurred in the nighttime hours. The majority of fatal crashes involving drivers with THC, alone or in combination with other drugs, occurred during the daytime hours.

Crash Characteristics and Location[5]

This section describes the location and characteristics of fatal crashes. Crash characteristics include the number and type of units involved in the crash.

[5] Crash variables are represented at the driver level to compare the driver groups. For reference, the total number of crashes is provided. All percent values are derived from total number of drivers in the comparison groups.

Table 21: Driver Comparison Groups by County of Crash

County	No Drugs, No Alcohol	Alcohol Only ≥.08	THC Only	Carboxy-THC Only	THC + Alcohol ≥.08	THC + Drugs	THC + Drugs + Alcohol ≥.08
Adams	12	2	2	0	0	0	0
Asotin	1	0	0	0	0	0	0
Benton	28	6	3	1	3	0	0
Chelan	13	2	1	1	0	2	0
Clallam	8	7	2	1	2	0	0
Clark	42	16	3	1	5	3	1
Columbia	0	0	0	0	0	0	0
Cowlitz	15	6	2	1	1	1	0
Douglas	3	3	0	0	0	0	0
Ferry	1	1	0	0	0	1	0
Franklin	7	2	3	1	0	0	0
Garfield	3	0	0	0	0	0	0
Grant	30	8	1	2	0	1	0
Grays Harbor	8	5	0	0	2	1	0
Island	13	2	1	0	0	0	0
Jefferson	6	1	0	0	1	0	0
King	113	55	5	9	16	8	2
Kitsap	22	10	3	2	4	2	2
Kittitas	12	3	0	2	1	2	0
Klickitat	9	1	0	0	1	0	0
Lewis	11	8	1	0	0	1	1
Lincoln	5	3	1	0	0	0	0
Mason	13	6	1	0	0	0	0
Okanogan	10	10	0	1	1	0	1
Pacific	2	2	0	0	0	1	0
Pend Oreille	3	2	0	0	2	0	0
Pierce	56	39	7	4	12	4	4
San Juan	0	2	0	0	0	0	0
Skagit	16	3	1	1	0	1	1
Skamania	2	1	0	1	0	1	0
Snohomish	60	21	5	4	6	1	0
Spokane	49	26	5	1	6	2	3
Stevens	12	5	1	0	3	2	0
Thurston	27	12	1	1	3	4	1
Wahkiakum	0	0	0	0	0	0	0
Walla Walla	9	3	0	2	0	0	0
Whatcom	27	8	4	0	4	1	0
Whitman	9	2	1	0	0	0	0
Yakima	55	31	2	1	10	0	2

The frequency of drivers involved in fatal crashes varies by county. However, several counties experience few fatal crash events, contributing to the extreme variability seen between counties.

Table 22: Driver Comparison Groups by Roadway Classification

		Rural	Urban	Unknown
No Drugs, No Alcohol		427	284	1
		60.0%	39.9%	0.1%
Alcohol Only ≥.08		184	129	1
		58.6%	41.1%	0.3%
THC Only		23	33	0
		41.1%	58.9%	0.0%
Carboxy-THC Only		19	17	1
		51.4%	45.9%	2.7%
THC + Alcohol ≥.08		38	44	1
		45.8%	53.0%	1.2%
THC + Drugs		25	14	0
		64.1%	35.9%	0.0%
THC + Drugs + Alcohol ≥.08		10	8	0
		55.6%	44.4%	0.0%
Total Drivers		**726**	**528**	**4**
Total Crashes		**642**	**487**	**4**

Nearly 60 percent of drivers with only alcohol greater than/equal to BAC .08 crashed on rural roadways, whereas nearly 60 percent of drivers with THC only crashed on urban roadways. Drivers with THC combined with alcohol greater than/equal to BAC .08 crashed most frequently on urban roadways (53 percent); however, drivers with THC and other drugs combined crashed most frequently on rural roadways (64.1 percent). Figure 9 on the following page displays these differences.

Figure 9: Driver Comparison Groups by Rural/Urban Crashes

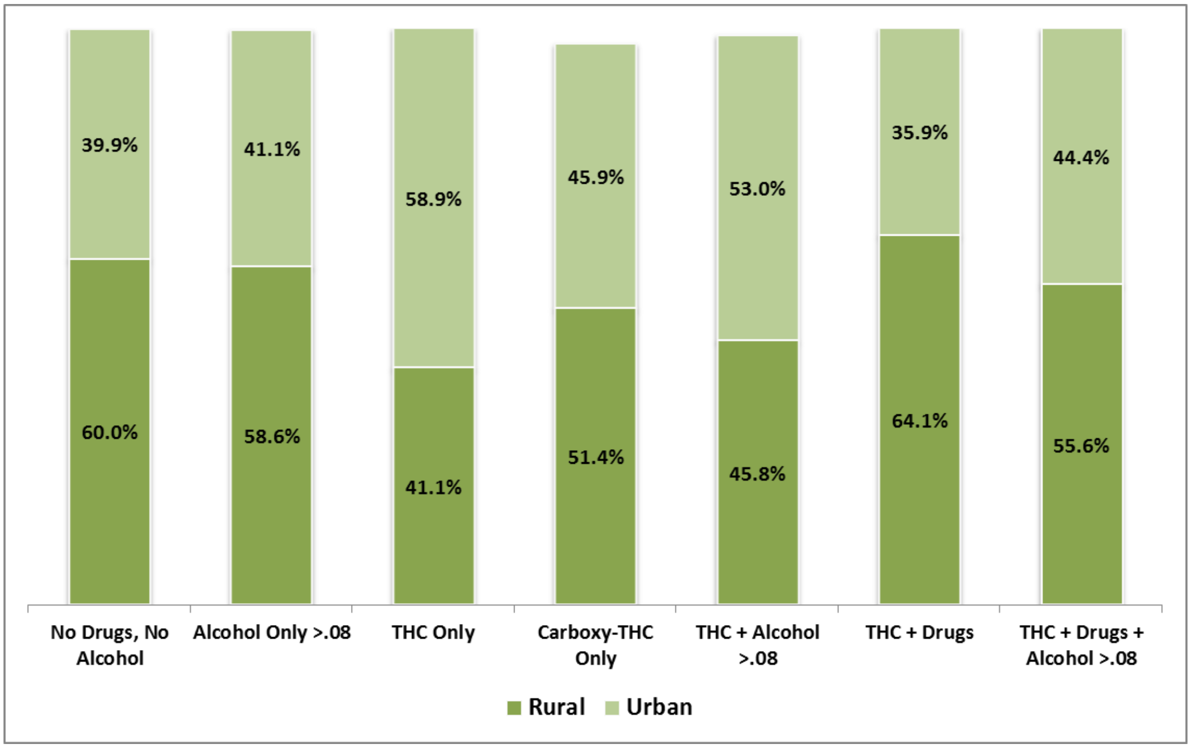


Table 23: Driver Comparison Groups by Road Type Route Signing

	Interstate	US Highway	State Route	City Street	County Road	Other / Unknown
No Drugs, No Alcohol	82	96	226	128	174	6
	11.5%	13.5%	31.7%	18.0%	24.4%	0.8%
Alcohol Only >.08	30	17	71	62	129	5
	9.6%	5.4%	22.6%	19.7%	41.1%	1.6%
THC Only	6	3	15	18	14	0
	10.7%	5.4%	26.8%	32.1%	25.0%	0.0%
Carboxy-THC Only	6	2	8	7	12	2
	16.2%	5.4%	21.6%	18.9%	32.4%	5.4%
THC + Alcohol >.08	5	6	17	23	31	1
	6.0%	7.2%	20.5%	27.7%	37.3%	1.2%
THC + Drugs	3	2	12	7	14	1
	7.7%	5.1%	30.8%	17.9%	35.9%	2.6%
THC + Drugs + Alcohol >.08	1	1	5	4	7	0
	5.6%	5.6%	27.8%	22.2%	38.9%	0.0%
Total Drivers	**133**	**127**	**354**	**249**	**381**	**15**
Total Crashes	**117**	**109**	**309**	**229**	**355**	**14**

Generally, the majority of fatal crash events occur on state routes and county roads. However, drivers with only THC were most frequently involved in fatal crashes that occurred on city streets.

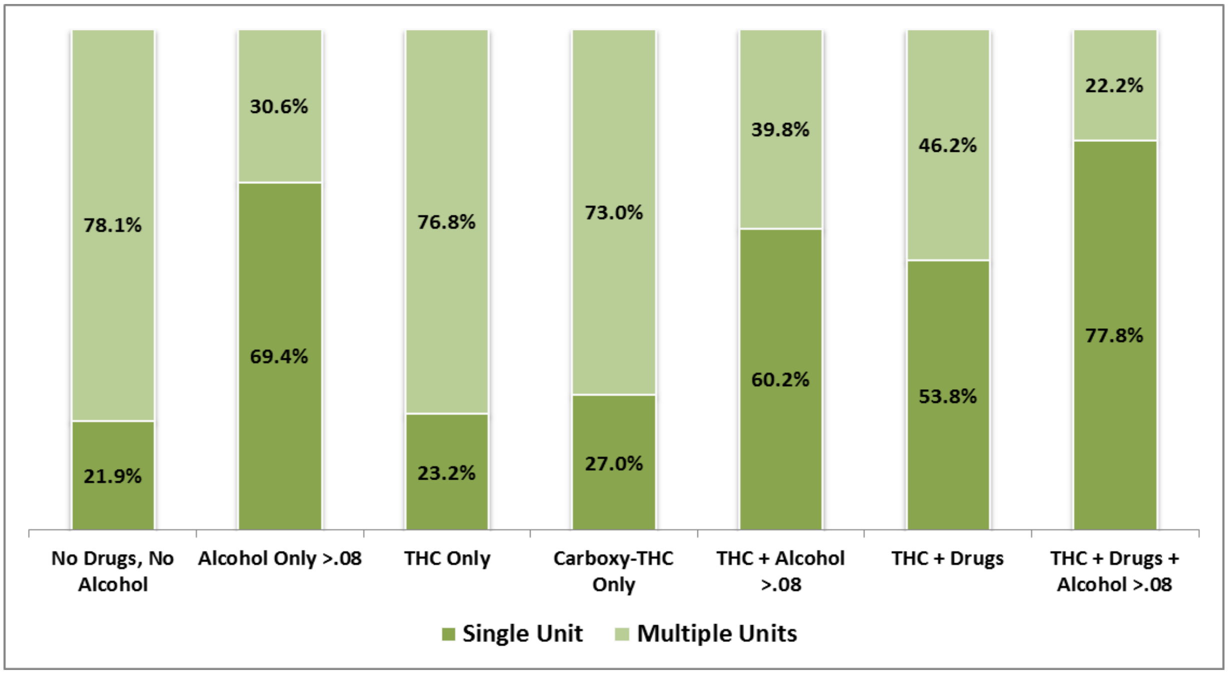
Table 24: Driver Comparison Groups by Number of Units Involved

	Single Unit	Multiple Units[6]
No Drugs, No Alcohol	156	556
	21.9%	78.1%
Alcohol Only >.08	218	96
	69.4%	30.6%
THC Only	13	43
	23.2%	76.8%
Carboxy-THC Only	10	27
	27.0%	73.0%
THC + Alcohol >.08	50	33
	60.2%	39.8%
THC + Drugs	21	18
	53.8%	46.2%
THC + Drugs + Alcohol >.08	14	4
	77.8%	22.2%
Total Drivers	**482**	**777**
Total Crashes	**482**	**651**

Drivers with alcohol greater than/equal to BAC .08, alone or in combination with other drugs, are most frequently the only unit involved in fatal crashes. In comparison, over 70 percent of drivers with only THC or only carboxy-THC were involved in multiple unit fatal crashes, similar to the frequency of drivers with no drugs or alcohol. Figure 10 on the following page displays these differences.

[6] In addition to other vehicles, non-motorists and driverless vehicles are considered units.

Figure 10: Driver Comparison Groups by Number of Units Involved



Units include other vehicles, parked (or driverless) vehicles, and non-motorists including pedestrians and bicyclists. A driver with any combination of alcohol greater than/equal to BAC .08 was most often the only unit involved in the crash. Drivers with no drugs or alcohol, only THC, or only carboxy-THC appeared similar in terms of being most frequently involved in multiple unit crashes.

Table 25: Driver Comparison Groups by Types of Multiple Unit Crashes

	Single Vehicle + Non-Motorist(s)	Multiple Vehicles[7] + Non-Motorist(s)	Vehicle-Vehicle[7]	Three or More Vehicles[7]
No Drugs, No Alcohol	81	10	376	89
	14.6%	1.8%	67.6%	16.0%
Alcohol Only $\geq$.08	11	2	73	10
	11.5%	2.1%	76.0%	10.4%
THC Only	8	2	26	7
	18.6%	4.7%	60.5%	16.3%
Carboxy-THC Only	3	1	18	5
	11.1%	3.7%	66.7%	18.5%
THC + Alcohol $\geq$.08	2	0	25	6
	6.1%	0.0%	75.8%	18.2%
THC + Drugs	2	0	12	4
	11.1%	0.0%	66.7%	22.2%
THC + Drugs + Alcohol $\geq$.08	1	0	3	0
	25.0%	0.0%	75.0%	0.0%
Total Drivers	**108**	**15**	**533**	**121**
Total Crashes	**108**	**13**	**433**	**97**

Multiple vehicles are the most common type of multiple unit fatal crashes. In non-motorist fatal crashes, a higher proportion of drivers with THC only (23.3 percent) were involved compared to the proportion of drivers with alcohol greater than/equal to BAC .08 only (13.6 percent).

[7] Includes driverless vehicles.

Table 26: Driver Comparison Groups by Vehicle Type

	Passenger Vehicles	Motorcycles	Medium/Heavy Trucks	Other Vehicle Type
No Drugs, No Alcohol	504	129	68	11
	70.8%	18.1%	9.6%	1.5%
Alcohol Only >.08	245	63	1	5
	78.0%	20.1%	0.3%	1.6%
THC Only	43	12	1	0
	76.8%	21.4%	1.8%	0.0%
Carboxy-THC Only	27	6	3	1
	73.0%	16.2%	8.1%	2.7%
THC + Alcohol >.08	72	8	0	3
	86.7%	9.6%	0.0%	3.6%
THC + Drugs	33	6	0	0
	84.6%	15.4%	0.0%	0.0%
THC + Drugs + Alcohol >.08	15	3	0	0
	83.3%	16.7%	0.0%	0.0%

Passenger vehicles are the most common type of vehicle involved in fatal crashes. Among the driver comparison groups, a slightly higher proportion of drivers with only alcohol greater than/equal to BAC .08 or drivers with only THC were motorcyclists. However, motorcyclists made up the smallest proportion of drivers that had combined alcohol greater than/equal to BAC .08 and THC.

***Driver Contributing Circumstances*[8]**

Driving under the influence of any alcohol or drugs is high-risk behavior. This high risk behavior is often also accompanied by other high risk behaviors, especially when the outcome is a fatal crash. This section describes the frequency of crash contributing circumstances and other co-occurring high risk behaviors.

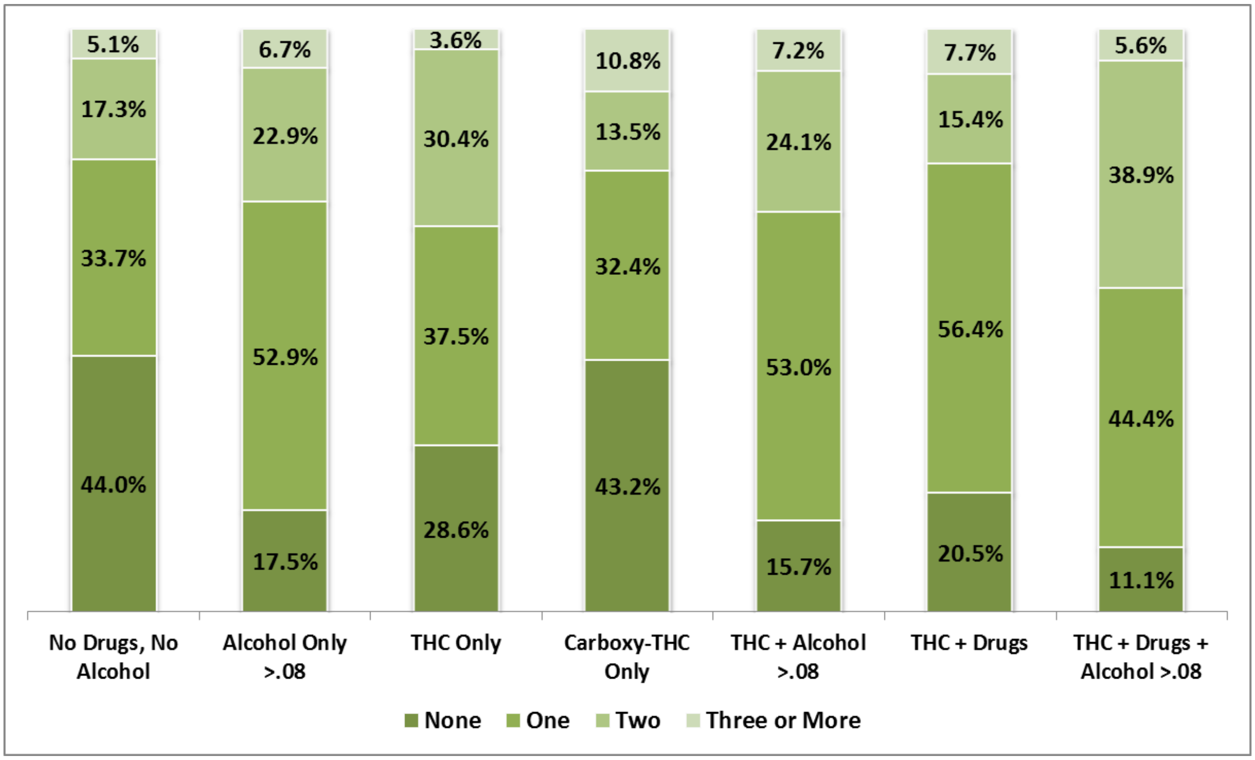
Table 27: Frequency of Driver Contributing Circumstances (CC)

	No Other CC Reported[9]	One CC	Two CC	Three or More CC
No Drugs, No Alcohol	313	240	123	36
	44.0%	33.7%	17.3%	5.1%
Alcohol Only ≥.08	55	166	72	21
	17.5%	52.9%	22.9%	6.7%
THC Only	16	21	17	2
	28.6%	37.5%	30.4%	3.6%
Carboxy-THC Only	16	12	5	4
	43.2%	32.4%	13.5%	10.8%
THC + Alcohol ≥.08	13	44	20	6
	15.7%	53.0%	24.1%	7.2%
THC + Drugs	8	22	6	3
	20.5%	56.4%	15.4%	7.7%
THC + Drugs + Alcohol ≥.08	2	8	7	1
	11.1%	44.4%	38.9%	5.6%

Drivers with no alcohol or drugs, followed closely by drivers with only carboxy-THC, were most frequently reported by investigating officers as having no crash contributing circumstances. Drivers with alcohol greater than/equal to BAC .08 and THC combined had the highest frequency of crash contributing circumstances. Figure 11 on the following page displays these differences.

[8] The Fatality Analysis Reporting System allows for coding of up to six driver related factors, with separate coding for select contributing circumstances such as speeding and distraction. As such, each driver may have several contributing circumstances and may be represented in multiple categories.
[9] Besides the noted alcohol or drug involvement, no other driver contributing circumstances were reported.

Figure 11: Driver Comparison Groups by Number of Other Contributing Circumstances



Drivers involved in fatal crashes with no drugs or alcohol and drivers with only carboxy-THC had the highest proportion of no reported driver errors. Drivers with only THC and drivers with the combination of THC, alcohol greater than/equal to BAC .08, and drugs had the highest proportion of having two or more reported driver contributing circumstances.

Table 28: Driver Comparison Groups by Frequency of Driver Errors

	Fail to Obey Signs/Signals	Fail to Yield	Over-correcting	Lane Deviation	Driving on Wrong Side of Road	Improper Passing
No Drugs, No Alcohol	27	67	18	58	16	11
	3.8%	9.4%	2.5%	8.1%	2.2%	1.5%
Alcohol Only ≥.08	12	15	17	17	15	6
	3.8%	4.8%	5.4%	5.4%	4.8%	1.9%
THC Only	2	4	5	7	3	2
	3.6%	7.1%	8.9%	12.5%	5.4%	3.6%
Carboxy-THC Only	2	0	1	4	0	1
	5.4%	0.0%	2.7%	10.8%	0.0%	2.7%
THC + Alcohol ≥.08	3	1	7	8	5	2
	3.6%	1.2%	8.4%	9.6%	6.0%	2.4%
THC + Drugs	0	2	1	2	1	2
	0.0%	5.1%	2.6%	5.1%	2.6%	5.1%
THC + Drugs + Alcohol ≥.08	1	0	2	0	1	0
	5.6%	0.0%	11.1%	0.0%	5.6%	0.0%

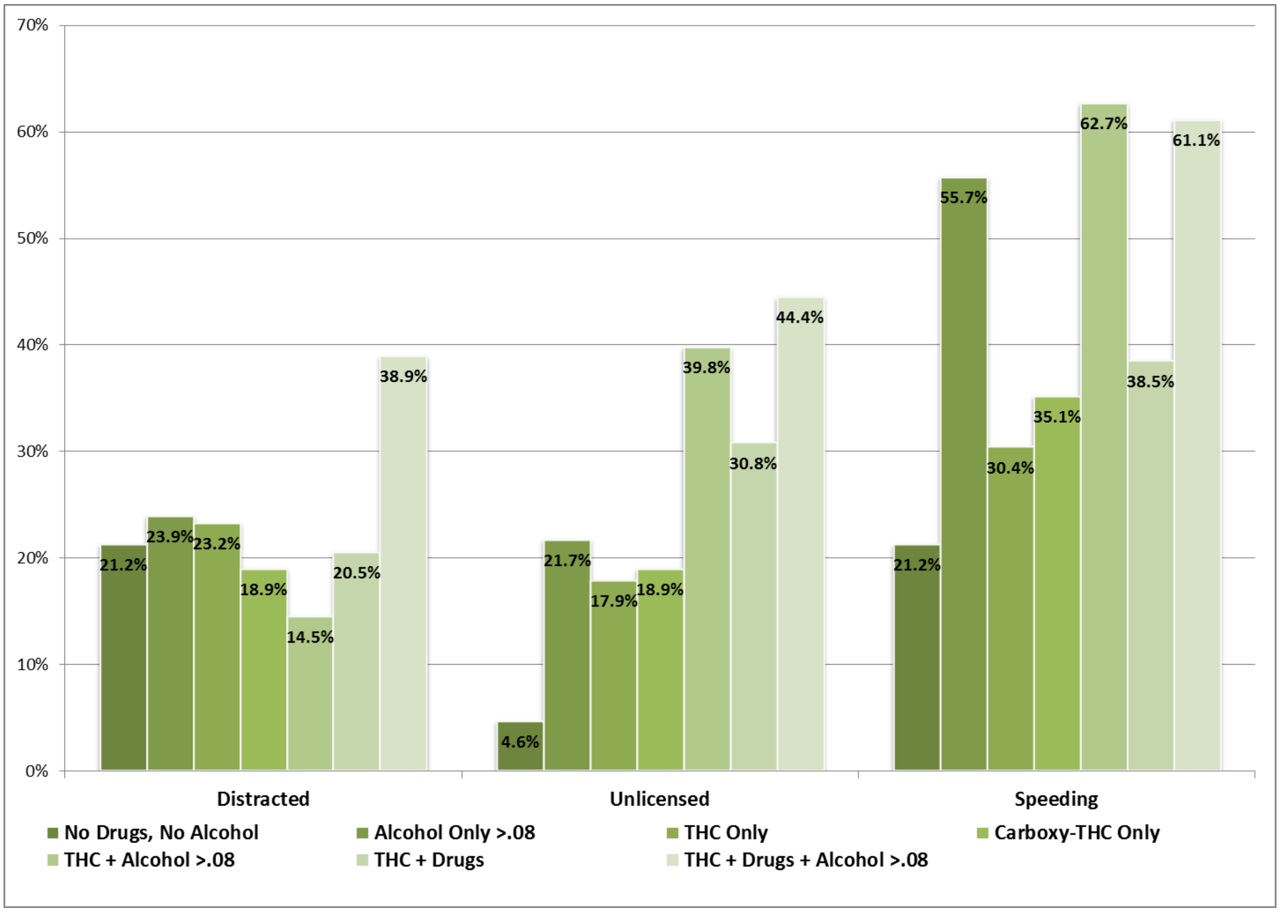
The most frequently reported fatal crash error among drivers with only THC was lane deviation (12.5 percent), followed by overcorrecting (8.9 percent). Lane deviation and overcorrecting were also the most frequently reported driver errors for drivers with alcohol greater than/equal to BAC .08 and drivers with alcohol greater than/equal to BAC .08 and THC combined. However, the proportion of drivers that committed these errors in the latter two groups was slightly lower than drivers with only THC.

Table 29: Driver Comparison Groups by Frequency of High Risk Driver Behavior

	Distracted	Unlicensed	Speeding
No Drugs, No Alcohol	151	33	151
	21.2%	4.6%	21.2%
Alcohol Only >.08	75	68	175
	23.9%	21.7%	55.7%
THC Only	13	10	17
	23.2%	17.9%	30.4%
Carboxy-THC Only	7	7	13
	18.9%	18.9%	35.1%
THC + Alcohol >.08	12	33	52
	14.5%	39.8%	62.7%
THC + Drugs	8	12	15
	20.5%	30.8%	38.5%
THC + Drugs + Alcohol >.08	7	8	11
	38.9%	44.4%	61.1%

The majority of drivers with alcohol greater than/equal to BAC .08, alone or in combination with THC or other drugs, were speeding. All driver comparison groups with any alcohol or drugs had higher frequencies of being unlicensed when compared to drivers with no alcohol or drugs. No clear patterns emerged for distraction between driver comparisons groups. Drivers with alcohol greater than/equal to BAC .08 and THC combined had the lowest frequency of reported distraction while drivers with THC, alcohol, and other drugs had the highest frequency of distraction, but the numbers are small. Figure 12 on the following page displays these differences.

Figure 12: Other High Risk Behaviors by Driver Comparison Groups



More than half of drivers involved in fatal crashes with only alcohol greater than/equal to BAC .08 were speeding. Over 60 percent of drivers with alcohol greater than/equal to BAC .08 and THC combined were speeding. The proportions of speeding drivers are much greater in drivers with alcohol greater than/equal to BAC .08, with or without other drug combinations, than the other driver comparison groups. Drivers involved in fatal crashes with alcohol greater than/equal to .08 and THC combined, with or without other drugs, had the highest proportion of being unlicensed. The proportion of drivers involved in fatal crashes who were distracted was similar for drivers with only alcohol greater than/equal to BAC .08 and drivers with only THC, approximately 23 percent, which is also similar to drivers with no alcohol or drugs at 21.2 percent.

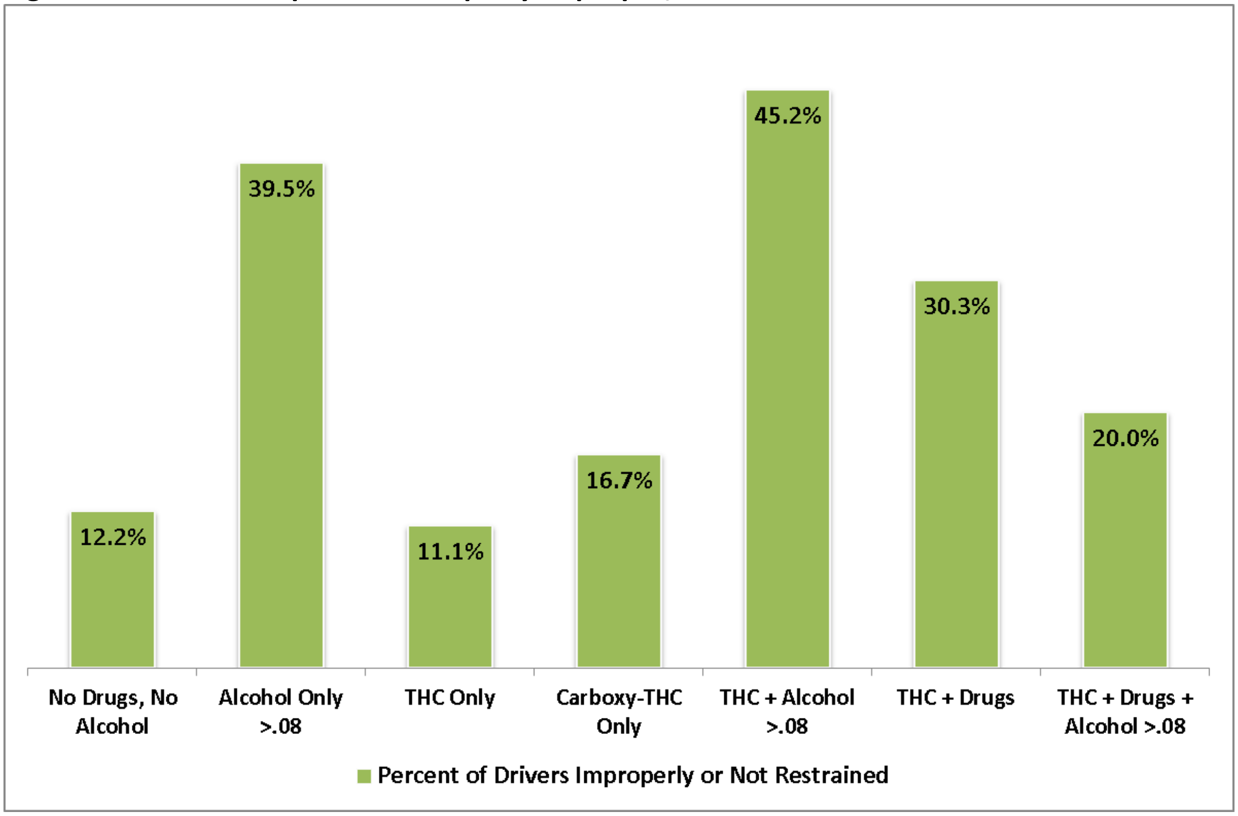
Table 30: Driver Comparison Groups by Restraint Use

	Seat Belt Used	Seat Belt Not Used/Improper Use	Unknown Seat Belt Use	Not Applicable[10]
No Drugs, No Alcohol	468	71	41	132
	80.7%	12.2%	7.1%	
Alcohol Only >.08	120	98	30	66
	48.4%	39.5%	12.1%	
THC Only	33	5	7	11
	73.3%	11.1%	15.6%	
Carboxy-THC Only	24	5	1	7
	80.0%	16.7%	3.3%	
THC + Alcohol >.08	30	33	10	10
	41.1%	45.2%	13.7%	
THC + Drugs	17	10	6	6
	51.5%	30.3%	18.2%	
THC + Drugs + Alcohol >.08	8	3	4	3
	53.3%	20.0%	26.7%	

Drivers with alcohol greater than/equal to BAC .08 and THC combined involved in fatal crashes had the lowest level of restraint use; 45.2 percent of these drivers were unrestrained at the time of the crash. Drivers with only THC involved in fatal crashes had the highest frequency of restraint use, even higher than drivers with no alcohol or drugs. Figure 13 on the following page displays these differences.

[10] Belt Use is not applicable to vehicles not equipped with restraint systems, such as motorcycles.

Figure 13: Driver Comparison Groups by Improper/Non Restraint Use



Drivers with THC combined with alcohol greater than/equal to BAC .08 had the highest percent of being unrestrained (45.2 percent). Nearly 40 percent of drivers with only alcohol greater than/equal to BAC .08 were unrestrained. Drivers with only THC involved in fatal crashes had the highest seatbelt use rate among all the driver comparison groups; only 11.1 percent were unrestrained.

Blood Levels: Alcohol Concentration and Cannabinoids

Table 31: Drivers Positive for Any Cannabinoids

Marijuana Result	2010	2011	2012	2013	2014	Total
Any Cannabinoids	**81**	**56**	**63**	**59**	**89**	**348**
Carboxy-THC	**45** **55.6%**	**24** **42.9%**	**27** **42.9%**	**21** **35.6%**	**14** **15.7%**	**131** **37.6%**
Any THC	**36** **44.4%**	**32** **57.1%**	**36** **57.1%**	**38** **64.4%**	**75** **84.3%**	**217** **62.4%**
THC ≥5 ng/ml	24 66.7%	19 59.4%	23 63.9%	19 50.0%	38 50.7%	123 56.7%
THC <5 ng/ml	12 33.3%	13 40.6%	12 33.3%	18 47.4%	37 49.3%	92 42.4%
THC Result Unk	0	0	1	1	0	2

The number of drivers testing positive for any cannabinoids (THC or carboxy-THC) increased to 89 in 2014, a 37 percent increase over the previous four-year (2010-2013) average. The percentage of these drivers who tested positive for any level of THC, alone or in combination with alcohol or other drugs, also increased from 44.4 percent in 2010 to 84.3 percent in 2014. The following tables describe the blood levels of THC and alcohol within the driver comparison groups.

Table 32: Blood Alcohol Concentration and Cannabinoid Blood Level Ranges

	Total Drivers	Variable	Total Results[11]	Mean	Median	Min	Max
ALC<.079 ONLY	46	Alcohol BAC	46	0.04	0.05	0.01	0.07
ALC≥.080 ONLY	314	Alcohol BAC	314	0.19	0.18	0.08	0.42
C-THC+ALC ONLY	41	Alcohol BAC	41	0.17	0.18	0.02	0.29
C-THC+DRUGS+ALC	19	Alcohol BAC	19	0.18	0.2	0.03	0.26
OTH DRUGS+ALCOHOL	101	Alcohol BAC	101	0.16	0.16	0.02	0.37
THC+ALC<.079	13	Alcohol BAC	13	0.06	0.07	0.01	0.07
THC+ALC≥.080	83	Alcohol BAC	83	0.18	0.19	0.08	0.39
THC+DRUGS+ALC<.079	6	Alcohol BAC	6	0.04	0.04	0.03	0.06
THC+DRUGS+ALC≥.080	18	Alcohol BAC	18	0.15	0.15	0.08	0.23
THC ONLY	56	THC ng/ml	56	8.96	6.85	1.1	27
THC+ALC<.079	13	THC ng/ml	13	5.55	4.1	1.2	14
THC+ALC≥.080	83	THC ng/ml	82	9.72	5.95	1.2	65
THC+DRUGS ONLY	39	THC ng/ml	39	14	5.7	1	70
THC+DRUGS+ALC<.079	6	THC ng/ml	6	3.83	2.25	1	11
THC+DRUGS+ALC≥.080	18	THC ng/ml	18	7.49	7.25	1.4	23
C-THC ONLY	37	Carboxy-THC	31	14.15	11	5	57
C-THC+ALC ONLY	41	Carboxy-THC	32	22.01	17.55	5.5	86
C-THC+DRUGS ONLY	30	Carboxy-THC	25	44	19	5.5	475
C-THC+DRUGS+ALC	19	Carboxy-THC	16	22.37	17.5	5	91
THC ONLY	56	Carboxy-THC	54	66.28	52.5	9.2	220
THC+ALC<.079	13	Carboxy-THC	12	36.73	29.6	5.8	100
THC+ALC≥.080	83	Carboxy-THC	74	64.54	36.55	5	234
THC+DRUGS ONLY	39	Carboxy-THC	39	88.52	70.7	5.3	400
THC+DRUGS+ALC<.079	6	Carboxy-THC	6	51.18	26.5	8.1	200
THC+DRUGS+ALC≥.080	18	Carboxy-THC	18	63.44	39.5	10	169.8

Drivers with alcohol greater than/equal to BAC .08 had the highest average level of THC. However, drivers with only THC had a median level (the point at which half of drivers are above and below) of 6.85 ng/ml, second only to drivers with a combination of THC, alcohol greater than/equal to BAC .08, and other drugs. The high mean and median THC levels for drivers with the combination of THC, alcohol greater than/equal to BAC .08, and other drugs may be indicative of excessive or binge drug use.

Table 33: THC >5ng/ml Blood Level Ranges

	Total Drivers	Variable	Total Results[11]	Mean	Median	Min	Max
THC ONLY	33	THC ng/ml	33	13.2	11	5.1	27
THC+ALC<.079	5	THC ng/ml	5	10.12	8.7	6.7	14
THC+ALC>.080	48	THC ng/ml	48	14.54	9.55	5.2	65
THC+DRUGS ONLY	23	THC ng/ml	23	22.13	11	5.1	70
THC+DRUGS+ALC<.079	2	THC ng/ml	2	8.15	8.15	5.3	11
THC+DRUGS+ALC>.080	12	THC ng/ml	12	10.07	8.4	5.1	23
THC ONLY	33	Carboxy-THC	31	73.58	70	9.2	220
THC+ALC<.079	5	Carboxy-THC	4	38.25	35	18	65
THC+ALC>.080	48	Carboxy-THC	43	80.8	65.3	5	234
THC+DRUGS ONLY	23	Carboxy-THC	23	127.47	110	8.3	400
THC+DRUGS+ALC<.079	2	Carboxy-THC	2	116	116	32	200
THC+DRUGS+ALC>.080	12	Carboxy-THC	12	83.82	64	18.6	169.8

Among drivers exceeding the THC per se limit of 5 ng/ml, the mean and median values for THC alone or in combination with other drugs were more than double the per se limit. The highest THC level was 70 ng/ml for a driver who also tested positive for other drugs, followed by a level of 65 ng/ml for a driver who also had alcohol greater than/equal to BAC .08. The maximum THC level among drivers with THC only was 27 ng/ml.

Table 34: THC <5ng/ml Blood Level Ranges

	Total Drivers	Variable	Total Results[11]	Mean	Median	Min	Max
THC ONLY	23	THC ng/ml	23	2.87	2.9	1.1	4.7
THC+ALC<.079	8	THC ng/ml	8	2.69	2.4	1.2	4.7
THC+ALC>.080	34	THC ng/ml	34	2.91	2.9	1.2	4.7
THC+DRUGS ONLY	16	THC ng/ml	16	2.3	2.45	1	4.3
THC+DRUGS+ALC<.079	4	THC ng/ml	4	1.68	1.5	1	2.7
THC+DRUGS+ALC>.080	6	THC ng/ml	6	2.35	2.05	1.4	4
THC ONLY	23	Carboxy-THC	23	56.44	27.1	12	200
THC+ALC<.079	8	Carboxy-THC	8	35.96	29.6	5.8	100
THC+ALC>.080	34	Carboxy-THC	30	42.33	26.55	5.8	200
THC+DRUGS ONLY	16	Carboxy-THC	16	32.53	17.95	5.3	110
THC+DRUGS+ALC<.079	4	Carboxy-THC	4	18.78	19.5	8.1	28
THC+DRUGS+ALC>.080	6	Carboxy-THC	6	22.68	16.45	10	49

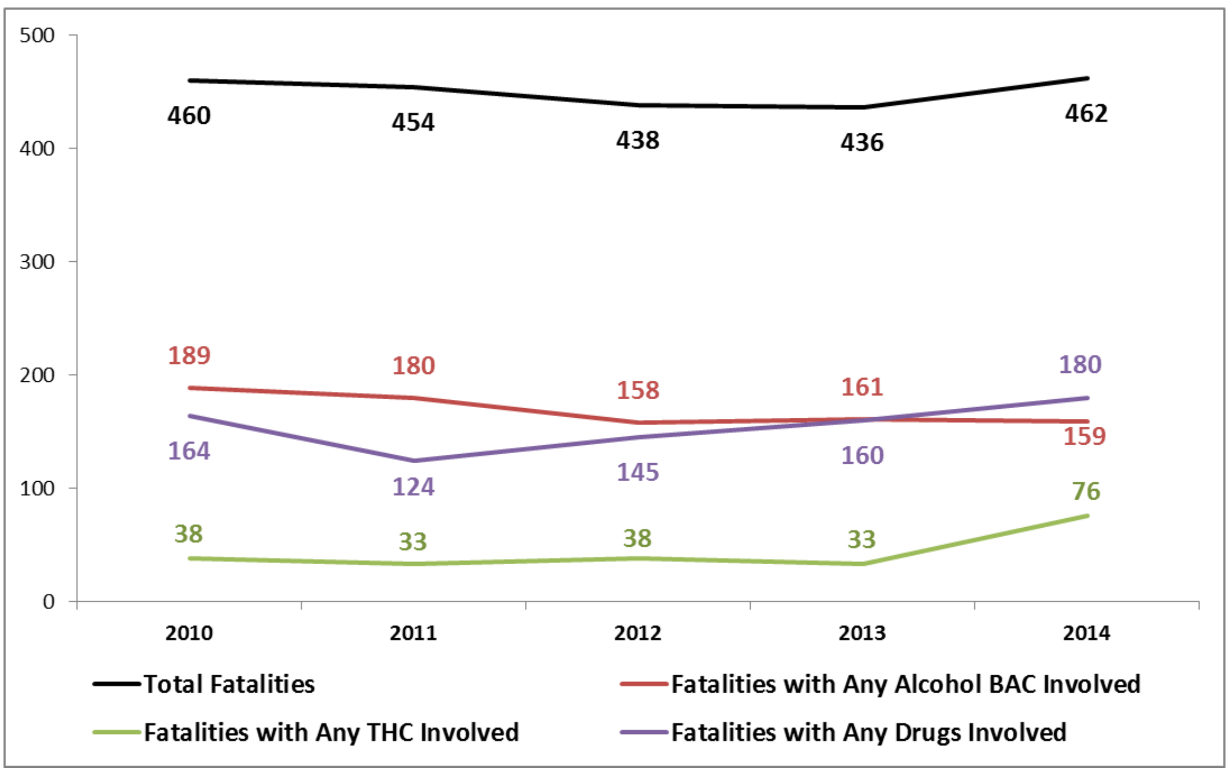
Due to the high rate of metabolism of THC in the blood and the amount of time lapse between crash incident and blood draw, drivers not dead at the scene confirmed to be under the THC 5 ng/ml per se limit may have been over the limit at the time of the crash.

Fatalities Involving THC-Positive Drivers

Table 35: Total Fatalities Involving Any Alcohol or Any THC

Year	Total Fatalities	Fatalities Involving a Driver with Any Alcohol	Proportion of All Fatalities	Fatalities Involving a Driver with Any THC	Proportion of All Fatalities
2010	460	189	41.1%	38	8.3%
2011	454	180	39.6%	33	7.3%
2012	438	158	36.1%	38	8.7%
2013	436	161	36.9%	33	7.6%
2014	462	159	34.4%	76	16.5%
TOTAL	**2,250**	**847**	**37.6%**	**218**	**9.7%**

Figure 14: Total Fatalities Involving Any Alcohol, Any Drugs, and Any THC



The proportion of fatalities that involved a driver positive for any THC, alone or in combination with alcohol or other drugs, more than doubled in 2014, from 7.6 percent of fatalities in 2013 to 16.5 percent of fatalities in 2014. Fatalities involving a driver with any alcohol remained stable from 2012 through 2014. However, fatalities involving a driver with any drugs have been steadily rising since 2011. Fatalities increased 6 percent in 2014 from the previous year.

Table 36: Total Fatalities by Involved Driver Comparison Groups

	2010	2011	2012	2013	2014
Other Fatalities	337	335	330	325	328
Alcohol Only ≥.08	71	76	62	75	52
THC Only	9	7	12	6	25
Carboxy-THC Only	11	10	8	3	5
THC + Alcohol ≥.08	19	17	13	16	25
THC + Drugs	6	3	10	6	18
THC + Drugs + Alcohol ≥.08	4	6	2	3	8
Alcohol ≥.08 Driver AND Carboxy-THC Driver	3	0	0	0	1
Alcohol ≥.08 Driver AND THC Driver	0	0	1	2	0

Fatalities that involved a driver with only alcohol greater than/equal to BAC .08 dropped 36.5 percent in 2014 compared to the previous four-year average. In 2014 there were notable increases in fatalities involving a driver positive for THC, alone or in combination with alcohol or other drugs. The highest increase was among fatalities involving a driver positive for only THC (an increase of 194 percent over the previous four-year average); followed by fatalities involving a driver positive for THC and other drugs (an increase of 188 percent).

Table 37: Fatal Person Type by Involved Driver Comparison Groups

	This Driver	Other Driver	Occupants with This Driver	Occupants with Other Driver	Pedestrians	Bicyclists	Unk/Oth Person Type
Alcohol Only ≥.08	257	13	5	1	13	1	0
THC Only	33	9	5	2	9	1	0
Carboxy-THC Only	19	5	11	5	2	2	0
THC + Alcohol ≥.08	64	7	8	1	1	1	1
THC + Drugs	31	4	5	2	2	0	0
THC + Drugs + Alcohol ≥.08	14	1	45	7	1	0	0
Alcohol ≥.08 Driver AND Carboxy-THC Driver[11]		2		2	0	0	0
Alcohol ≥.08 Driver AND THC Driver[12]		2		1	0	0	0

Across all driver comparison groups, the person who died was most commonly the driver positive for alcohol or drugs and/or occupants in the vehicle with that driver. Although the number of fatalities that involved a driver with only alcohol greater than/equal to BAC .08 was much higher than the number of fatalities that involved a driver positive for only THC, the number of pedestrian deaths are comparatively high in the only THC driver comparison group. From 2010-2014, nine pedestrians deaths involved a driver positive for only THC, compared to 13 pedestrian deaths involving a driver with only alcohol greater than/equal to BAC .08. Drivers positive for the combination of THC, alcohol greater than/equal to BAC .08, and other drugs had a much higher proportion of same vehicle occupant deaths (persons in the same vehicle as the impaired driver) than any other driver comparison group.

[11] Two crashes involved both a driver with alcohol>.08 and a driver with carboxy-THC. In one crash the alcohol driver died, in the other crash the carboxy-THC driver died.
[12] Two crashes involved both a driver with alcohol>.08 and a driver with THC. In both crashes the THC drivers died.

Summary and Conclusions

The information compiled in this report is a necessary first step toward gaining a better understanding of the role marijuana plays in fatal crash events occurring in Washington State. Second to alcohol, marijuana has persisted as the dominant drug involved in fatal crashes for over a decade. In 2014, the proportion of drivers involved in fatal crashes testing positive for THC increased, and therefore the number of fatalities involving THC also increased. While this report explains that trend and the characteristics of these drivers, this information is not sufficient to determine if marijuana directly contributed to the cause of these crashes.

The existing literature on crash risk associated with marijuana use is mixed. However, two recent and robust metastudies both independently concluded that marijuana influence doubles an individual driver's crash risk. All factors or behaviors that result in an increased crash risk must be addressed if Washington is to realize its vision of zero traffic fatalities and serious injuries by 2030.

The information in this report does lend itself to some significant observations. In terms of fatal crash factors and outcomes, the impairing influence of THC is very different than the impairing influence of alcohol. While users of alcohol and THC who drive and are involved in fatal crashes have some demographic similarities, the co-occurrence of other high risk behaviors, such as speeding and not using a seatbelt, are very different. Of specific concern is the combination of alcohol and THC as these drivers emerged as the most high risk group of drivers involved in fatal crashes.

The Washington Traffic Safety Commission continues to compile this information. While data available now is insufficient for performing robust inference analysis, we continue to explore methods and approaches for future reports. This report is merely a beginning to establishing a better understanding of the impact of legalized recreational marijuana on traffic safety.

One of the biggest challenges we face in addressing the issue of drugged driving, not only in our state but nationally, is the lack of good, complete data. Fatal crash data is a limiting source of information for describing the population as a whole, but having ongoing linked toxicology outcomes to drivers involved in fatal crashes is a significant step forward. In the absence of databases, such as FARS, that record true toxicology outcomes, states must find creative and innovative ways to repurpose and link existing data. Washington continues to explore these options in all facets of traffic safety to better support data-driven decision making.

For Washington State, an important step forward in acquiring better data would be the development of an electronic system for creating, filing, and adjudicating driving under the influence (DUI) charges. Electronic data is critical for efficient and accurate criminal and administrative processing of these offenses. The Statewide Electronic Collision and Ticket Online Records (SECTOR) application already provides the infrastructure and law enforcement user-base to make this functionality possible. Adding the DUI arrest forms and supporting processes to SECTOR would not only create efficiencies in the arrest and adjudication process, but also enhance data quality and timeliness for future analysis.

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Appendix B: Methodology

The Washington State Fatality Analysis Reporting System (FARS) unit maintains paper fatal crash case files, including copies of toxicology reports, according to federal and state retention requirements. Before and after the passage of Initiative 502 (marijuana reform), the FARS unit received several data requests for marijuana involvement in fatal crashes that could not be fulfilled due to the limitations of how drug information is recorded in the FARS database. In response to the increase in data requests, a project was formed to manually abstract the complete toxicology information into an electronic format that could be later merged with the original FARS record for meaningful analysis.

The retained FARS case files have a copy of the original toxicology report for deceased persons. The FARS Analysts reviewed every toxicology report from these case files and manually abstracted the complete toxicology information to an excel spreadsheet. The following guidelines were provided to the FARS analysts for the abstraction process:

- Always verify and record the case number, vehicle number, and person number (as assigned by FARS). The accuracy of these fields is vital to successful linkage of the files for analysis.
- Use CAPS or lower-case consistently in data entry
- Date fields are pre-formatted in the spreadsheet
- List ALL drugs on the report – even if they were already entered in MDE.
- For DRUG1, DRUG2, etc. – enter the entire drug name as reported on the toxicology report, consistently use either CAPS or lower-case
- For RES1, RES2, etc. – enter the VALUE of the result (ex: <0.13, 2.5, 0.6) exactly as it appears on the toxicology report
- For UNITS1, UNITS2, etc. – enter the measurement unit (ex: ng/ML, mg/L)
- For duplicate results (verified by both blood/urine), record the more conclusive result (blood).
- For results verified by urine only (no blood test), and there is no result (only POS), record the drug name in the DRUG field, put 888 in the RES field, and leave the UNITS field blank.
- For results that were verified by urine, but not blood and both tests were performed, record the urine results in addition to the blood results (but not duplicates) same as the above bullet. For example, Cannabinoids in urine (POS), diazepam in blood but no cannabinoids – record BOTH the cannabinoid (888, blank) AND the diazepam (0.01, mg/L).

For the original FARS case files, surviving driver toxicology information was provided by the WSP Toxicology Lab in a minimal format as required to code the FARS case. In order to receive the detailed toxicology outcomes, the surviving drivers had to be compiled for all years (2008-2014) and resent to the WSP Toxicology Lab for abstraction. The team at the Lab manually abstracted the detailed toxicology information in the same format and fashion as described above for the deceased driver file abstraction.

Once all information was abstracted, data validation was performed. Quality assurance checks and verification using chart review were conducted to ensure the highest level of abstraction accuracy. The toxicology information was merged back to the original FARS records for the detailed analysis contained in this report. Washington State FARS Analysts now abstract complete toxicology information to a spreadsheet as it is received. The Research and Data Division is currently exploring ways to automate the linkage between toxicology and fatal crash records.

Manual data abstraction is a resource intensive effort and is subject to error at a much higher rate than automated processes. In order to address the higher error rate, data validation approaches must be thorough and well considered. While manual approaches to data abstraction are not ideal, the Washington Traffic Safety Commission continues to support this effort in lieu of not having the right data to accurately monitor the impact of legalized recreational marijuana on traffic safety. Other state FARS units that have access to toxicology reports have a similar opportunity. The Washington Traffic Safety Commission encourages states facing legalized recreational marijuana to consider limitations to existing data and approaches to addresses those limitations.

Appendix C: Drug Lists

In accordance with the Fatality Analysis Reporting System (FARS) Coding Manual, drugs that have been determined by a chemical test by the coroner, medical examiner or state toxicology lab will be coded using the FARS translation table to assign the three-digit FARS code. If the drug is not on the list, FARS analysts are directed to use 996 (Other Drug). This element excludes caffeine, nicotine, and aspirin/acetaminophen. Further, guidance states the FARS Analyst will 'exclude drugs explicitly indicated to have been administered after the crash.' If documentation is not provided confirming the administration of drugs post-crash, then those drugs are coded according to the hierarchy described below.

In Washington, the FARS unit receives official drugs results from the WSP Toxicology Lab. FARS Analysts then record the results, up to three separate drug test results, and the test type (blood, urine, or both) using the FARS guidance. If there are more than three drugs chemically determined in the toxicology test, then we use the categories as a hierarchy (i.e. narcotics over depressants over stimulants, etc.) to determine the three drugs for coding. Cannabinoids are fifth in the hierarchy of eight drug families. The following tables describe the frequency of other drugs (excluding cannabinoids) as coded in the Washington FARS data 2010-2014.

FARS Code	Drug Family	Drug Name	Number of Drivers
417	Stimulants	Methamphetamine	108
401	Stimulants	Amphetamine	97
395	Depressants	Depressants type Unk	84
996	Other	Other drug not listed	70
177	Narcotics	Morphine	54
348	Depressants	Midazolam	39
189	Narcotics	Oxycodone	37
304	Depressants	Benzodiazepines	35
321	Depressants	Diazepam	34
407	Stimulants	Cocaine	30
402	Stimulants	Benzoylecgonine	28
155	Narcotics	Hydrocodone	26
167	Narcotics	Methadone	24
157	Narcotics	Hydromorphone	15
351	Depressants	Nordiazepam	14
300	Depressants	Alprazolam	11

Drugs occurring in ten or fewer drivers:

FARS Code	Drug Family	Drug Name	Number of Drivers
295	Narcotics	Narcotics type Unk	9
128	Narcotics	Codeine	8
337	Depressants	Lorazepam	7
316	Depressants	Clonazepam	6
522	Hallucinogens	Ketamine	6
151	Narcotics	Fentanyl	3
187	Narcotics	Opium	3
303	Depressants	Barbiturates	3
367	Depressants	Temazepam	3
387	Depressants	Zolpidem	3
495	Stimulants	Stimulants type Unk	3
513	Hallucinogens	Methylenedioxymethamphetamine (MDMA)	3
995	Inhalants	Inhalants type Unk	3
313	Depressants	Chlordiazepoxide	2
343	Depressants	Meprobamate	2
358	Depressants	Phenobarbital	2
423	Stimulants	Phentermine	2
702	PCP	Phencyclidine	2
101	Narcotics	Acetorphine	1
129	Narcotics	Cyprenorphine	1
161	Narcotics	Levomoramide	1
165	Narcotics	Meperidine (Pethidine)	1
188	Narcotics	Oxymorphone	1
208	Narcotics	Propoxyphene	1
308	Depressants	Butalbital	1
309	Depressants	Camazepam	1
400	Stimulants	Amphetamine Sulfate	1
418	Stimulants	Methylphenidate	1
595	Hallucinogens	Hallucinogens type Unk	1