Investigation of the Accuracy of Alcohol and Drug Involvement Reporting

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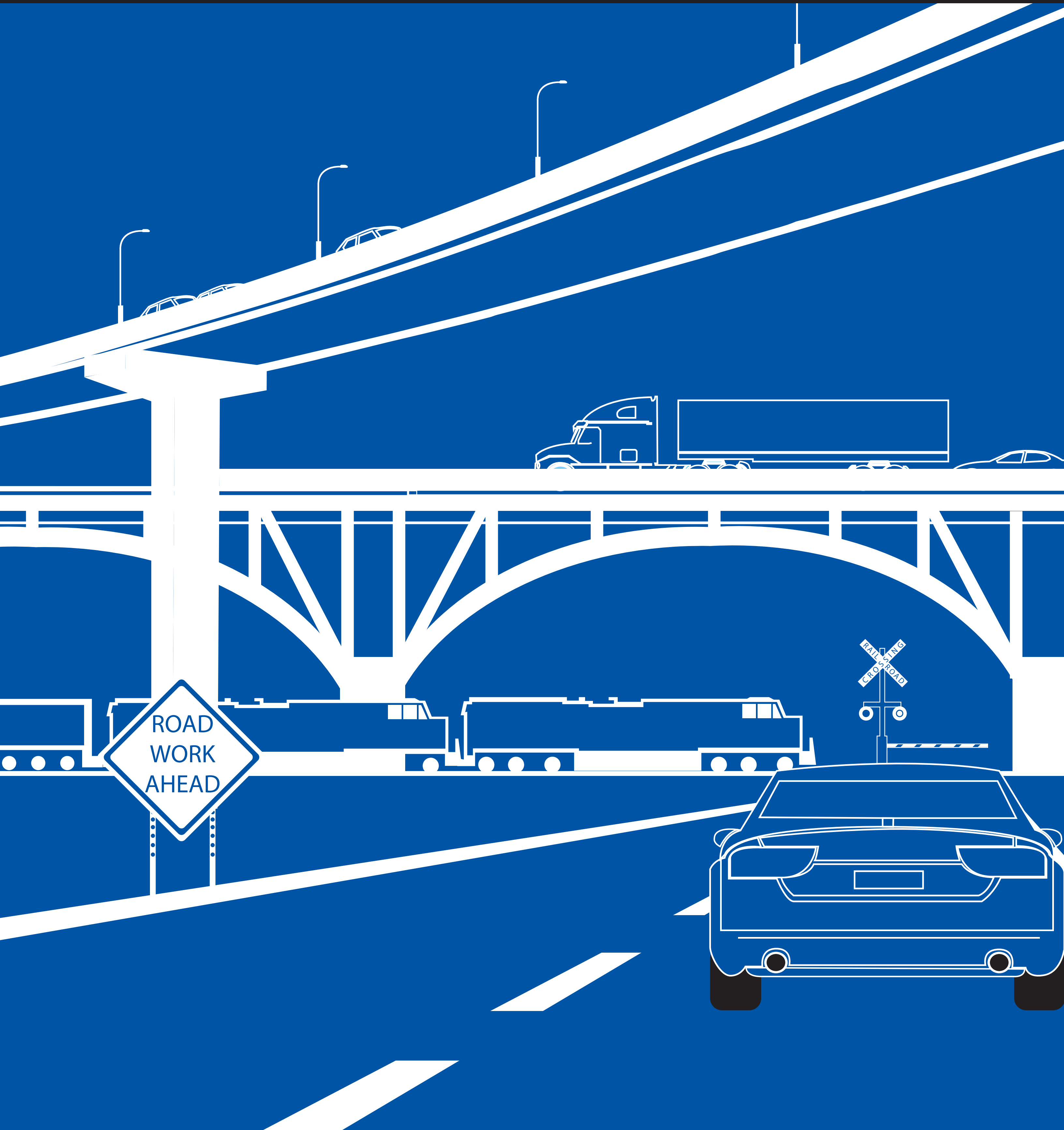

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College of Engineering, University of Kentucky, Lexington, Kentucky

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Research Report
KTC-19-29/M3DA-19-04-1F

Investigation of the Accuracy of Alcohol and Drug Involvement Reporting

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Table of Contents

List of Tables

List of Figures

Executive Summary

Researchers compared the 2013 to 2017 fatal crash data from the KSP database to the crash data from the FARS database to check the consistency and accuracy of alcohol and drug involvement reporting for drivers in the KSP database. The indications of alcohol and drug involvement in the FARS database were used as the ground truth due to the inclusion of laboratory test results confirming the presence of alcohol and/or drugs in a driver's system. For the five-year study period, the indications for alcohol involvement were 85.8% consistent and the indications of drug involvement were 66.2% consistent between the two databases. Of the fatal crashes where FARS confirmed alcohol involvement for a driver, KSP crash reports only identified 64.2% as involving alcohol. Of the fatal crashes where FARS confirmed drug involvement for a driver, KSP crash reports only identified 11.8% as involving drugs.

When comparing officer identification of alcohol or drug involvement to the confirmed presence either alcohol or drugs in FARS, consistency was 66.6% on average. Of the crashes shown by FARS to involve a driver testing positive for drugs or alcohol, officers identified 39.5% of these crashes as alcohol or drug involved. This increase in percentage compared to the consistency and accuracy of identification of drug involvement suggests that officers are aware that a driver may be under the influence of a substance, but they may not be indicating the correct substance.

The inclusion of drug concentrations found in a driver's system in the FARS database could help make the distinction between drug presence that might affect driving abilities and drug presence due to a simple prescription, which may not affect driving ability. More training for officers to identify the signs of drug involved driving would also be useful to increase the percentage of drug involved driving identified by police.

Analysis of the crash characteristics from the KSP crash database showed that 93% of all alcohol involved fatal crashes occurred at nighttime, on a weekend, or as a single vehicle crash. Furthermore, alcohol involved fatal crashes were nearly two times more likely to occur at nighttime and three times more likely to occur on a weekend at nighttime than non-alcohol involved fatal crashes. Alcohol involved fatal crashes were also shown to occur more frequently in residential and rural areas than non-alcohol involved fatal crashes.

Alcohol and drug involved fatal crash rates were shown to be highest in Eastern Kentucky counties, with drug involved crash rates being higher, on average, than alcohol involved crash rates.

1. Introduction

1.1 Background

Kentucky State Police (KSP) crash reports indicate whether police officers noted that alcohol or drugs contributed to a crash. These reports are stored in a comprehensive database. The National Highway Traffic Safety Administration's (NHTSA) Fatality Analysis Reporting System (FARS) houses a significant amount of data on fatal crashes. But unlike the KSP database, it catalogues the laboratory results of drivers involved in fatal crashes who were tested for drugs and/or alcohol. It reports blood alcohol concentrations (BAC) and lists up to three drugs found in a person's system (drug concentrations are not available). Problematically, information on drug- or alcohol-related fatal crashes in KSP's database does not always match up with information stored in FARS. Analysis of the records of fatal crashes that occurred in Kentucky in 2016 found that police officers listed alcohol as a contributing human factor in 114 fatal crashes — but FARS notes that drivers of just 95 of those crashes tested positive for alcohol. Overall for 2016, FARS lists 160 alcohol-related fatal crashes, meaning that law enforcement failed to identify the presence of alcohol in 65 crashes. Similar trends were observed for drug-related fatal crashes (Staats et al. 2018). The significant inconsistency between the FARS and KSP databases suggests that inaccurate reporting of alcohol and drug involvement is an issue for not just fatal crashes but crashes of all severities.

When officers code crashes, it is not always apparent to them whether alcohol or drugs played a role. In addition to human factors, different combinations of crash elements may indicate a crash was likely drug- or alcohol-related. For this study, the Kentucky Transportation Center (KTC) research team investigated crash types and contributing factors that have known associations with alcohol- and drug-related fatal crashes to develop a methodology which uses FARS data to gauge the likelihood of alcohol or drugs factoring into a crash. This methodology can be applied to all crashes.

If researchers and practitioners are to identify effective countermeasures, it is critical for the KSP crash database to contain accurate data on the number of drivers involved in fatal crashes who tested positive for alcohol and/or drugs.

1.2 Goals

Project goals included the following:

- Calculate the percentage of alcohol- and drug-related fatal crashes identified accurately in the KSP database.
- Investigate trends in crash characteristics for fatal alcohol- and/drug-related crashes.
- Develop of a methodology for identifying alcohol- and drug-related crashes to enhance current police officer reporting.
- Identify counties in Kentucky with high rates of alcohol- and drug-related fatal crashes.
- Propose strategies to reduce alcohol- and drug-related crashes.

2. Literature Review

2.1 Previous Research

Many of the studies that present surrogate measures for identifying crashes that involve impaired drivers are quite dated and not specific to Kentucky. In 1977, an NHTSA-funded study analyzed 35 Alcohol Safety Action Plans using nighttime fatal crashes as a surrogate for alcohol-involved fatalities (Voas and Klein 1977).

Several studies in the 1980s and 1990s investigated the characteristics of crashes in which alcohol was involved, including time of day, day of week, and crash type. Smith and Heeren (1985) used fatal crash data from Vermont and Delaware to test the relationship between nighttime crashes and alcohol involvement. Adopting a threshold BAC of 0.1, they determined that nighttime (defined as 8:00 pm–5:00 am) fatal crashes was an appropriate surrogate for alcohol impairment. Rogers's (1995) investigation of fatal crashes in California confirmed Smith and Heeren's results; it also identified a strong correlation between single-vehicle nighttime fatal crashes and alcohol involvement. Using data from California and Florida, Voas et al. (2009) reaffirmed that nighttime fatal crashes is a valid surrogate measure for detecting alcohol-related crashes, but also proposed that late-nighttime (i.e., after midnight) single-vehicle crashes is a more accurate surrogate measure for alcohol involvement in nonfatal crashes. Maistros (2015) did a statistical analysis of drug- and alcohol-related fatal crashes to assess relationships between key crash factors (e.g., gender, age, restraint usage, speed) and crash types. He found that the presence of drugs in a driver's system is strongly correlated with alcohol impairment, and that impaired drivers and speeding drivers are less likely to use safety restraints than drivers who do not engage in those behaviors. Thus, drivers willing to make one risky decision are likely to make multiple risky decisions.

2.2 Kentucky Impaired Driving Efforts

Law enforcement officers who respond to fatal crashes must investigate whether alcohol or drugs were involved.[1] An officer can also investigate the role of alcohol or drugs in non-fatal crashes if they believe a driver was under the influence (DUI) of drugs or alcohol. Toxicology screenings for DUI cases are usually limited to blood and urine tests; drug analysis can only be performed if both blood and urine are submitted as evidence (KSP 2018). Drug screenings are only done upon request. Unless screenings for other drugs are requested, the KSP toxicology lab screens for only the following drugs (KSP 2001):

- Amphetamines,
- Barbiturates,
- Tricyclic antidepressants,
- Phenytoin,
- Propoxyphene,
- Opiates, and
- Benzodiazepines.

[1] In accordance with KRS 189A.105, which reads: "If the incident involves a motor vehicle accident in which there was a fatality, the investigating peace officer shall seek such a search warrant for blood, breath, or urine testing unless the testing has already been done by consent."

In November 2019, Kentucky Impaired Driving Task Force plans to release its four-year Impaired Driving Strategic Plan, which will assess impaired driving issues that are currently problematic in Kentucky, and propose strategies to combat impaired driving (Lockridge). Members of the Impaired Driving Task Force — including experts in KSP's toxicology lab — have observed that laboratory testing of DUIs and fatal crashes is closed if it returns a positive result for alcohol impairment as this is sufficient to proceed with a DUI case in court. However, doing so may hinder a court's ability to properly sentence, or remand to treatment, DUI offenders.[2] A court is unable to assign an offender to the proper treatment program if it cannot determine whether an offender was under the influence alcohol, drugs, or both.

[2] According to KRS 189A.040, "the court shall sentence the person to attend an alcohol or substance abuse education or treatment program subject to the following terms and conditions for a first offender or a person convicted under KRS 189A.010(1)(f)."[2]

3. Data Sources

3.1 Kentucky State Police

KSP collects and houses all Kentucky crash data. It maintains the Kentucky Open Portal Solution (KYOPS), a database which lets registered users who have signed a memorandum of understanding (MOU) access crash data (KSP 2018a). KSP also has a public-facing website on which individuals without a signed MOU can access a smaller subset of crash attributes for all crashes (KSP 2018b).

KTC researchers have permission to use an offline version of KSP's crash database. Each year KTC receives an annual extract of all crash records, which includes 22 separate Record databases. Each Record database stores a specific group of data about all crashes for a given year (e.g., Record 1 documents crash attributes, Record 2 has vehicle attributes). For this study, the research team retrieved data from Records 1, 3, and 11, which contain crash- level data, personal-level data, and human factor codes, respectively.

3.2 Fatality Analysis Reporting System

NHTSA maintains FARS, a nationwide census of crashes that involve fatal injuries. FARS is one of the nation's most comprehensive sources of impaired driving data because it houses records of laboratory results for drivers involved in fatal crashes. It reports BACs and lists up to three drugs found in a person's system. FARS, however, does not furnish information on levels of drug concentration (NHTSA).

The number of crash records in FARS with drug and alcohol test results is tied to what data are collected at the state level. In Kentucky (pursuant to KRS 189A.105) a warrant should be sought for blood, breath, or urine to test for alcohol and drugs for all fatal crashes. Which means, ideally, drug and alcohol testing would be done for all fatal crashes, with those data reported to NHTSA and entered into the FARS database. But this is not the case, and not all crash records in FARS include both drug and alcohol test data. Nonetheless, the system is the most robust source of alcohol and drug testing information for crashes that have occurred in Kentucky — the state's crash reports only contain data on an officer's assessment of drug or alcohol involvement. No laboratory testing is included to substantiate their evaluations.

4. Methodology

The research team developed a methodology to assist in identifying alcohol- and drug-related crashes, one that does not rely on the assessments of law enforcement officers. At the project's outset, FARS fatal crash data for 2013 to 2017 was acquired. Researchers also obtained extracts of KSP Records 1, 3, and 11. After linking crashes from the two databases, crashes were assigned to six groups based on whether alcohol or drugs were involved (as reported in the FARS database):

- Alcohol
  1. Present
  2. Absent
- Drug
  3. Present
  4. Absent
- Alcohol or Drug
  5. Present
  6. Absent

The team studied crash attributes from the KSP crash records to identify trends. For each category — *Alcohol*, *Drug, Alcohol or Drug* — crashes were assigned to one of two groups based on whether drugs and/or alcohol were involved. Each crash is represented in each category. The *Alcohol or Drug* category was included to account for incidents where law enforcement correctly determined that a motorist had consumed a substance but noted the incorrect substance (e.g. an officer believed a driver to be under the influence of alcohol when they were actually impaired by drugs). The *Alcohol or Drug Present* group contains crashes for which FARS indicated drug or alcohol involvement (or both).

4.1 Linking Crash Databases

Each fatal crash in the FARS database and the KSP Records have unique IDs (ST_CASE and Masterfile Number, respectively). The databases lack a common identifier for crashes, however, both databases contain data on to the location, date, and time of each crash. Using these data, the research team linked the two databases. Both databases contain the latitude and longitude of each crash. For each year of the study period, crashes were plotted by locations based on the latitudes and longitudes from the FARS and KSP datasets. This initial mapping resulted in 10 layers of crash data (two for each year). The FARS and KSP crash layers were spatially joined for each year. This joined each crash from the FARS database to the nearest crash from the KSP database for each year. Figure 1 shows a snapshot of the dataset in ArcMap.

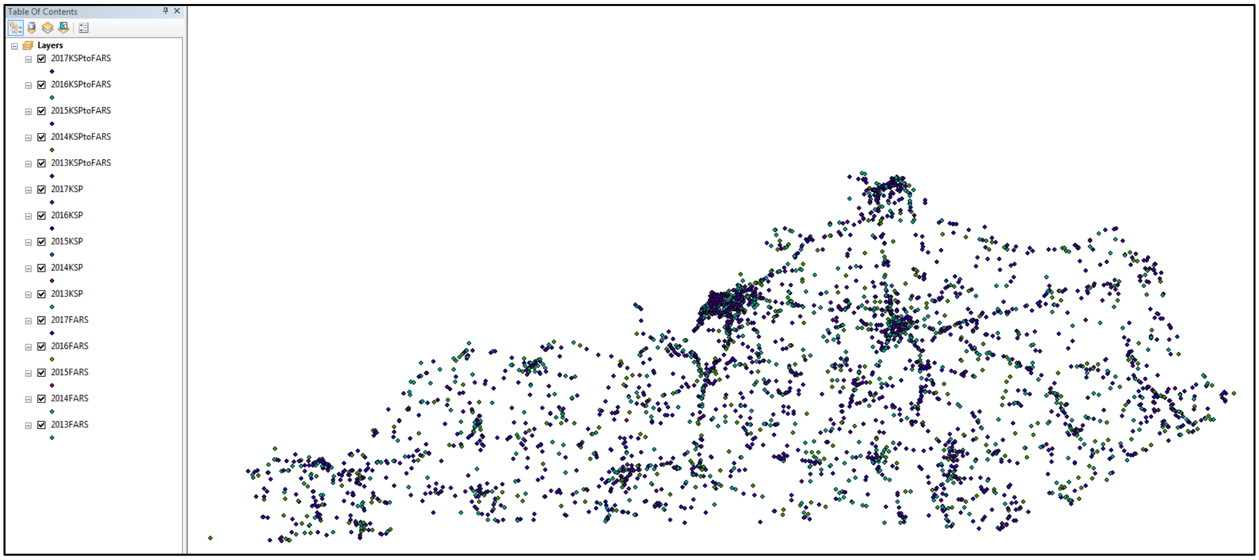

Figure 1 FARS and KSP Crash Data Join

This analysis revealed several inconsistencies between databases with respect to the location, date, and time of fatal crashes (Staats et al. 2018). Each of the five layers generated through the spatial join contained a new field in their attribute tables that recorded the distance between each FARS crash and the nearest KSP crash. This field was used to evaluate the consistency of locational data between the two databases. Ideally, both databases would contain the same latitude and longitude points for corresponding crashes. In which case the crashes would plot in the same location and the distance between FARS and KSP crash would be zero. The team scrutinized joined crashes where the distance was greater than zero to ensure the points from each database represented the same crash. In most cases, the two points represented the same crash even though they did not plot in the same location. This occurred due to rounding errors in the latitudes and longitudes of each database.

After performing quality control checks on the joined layers, researchers validated the associations between the FARS and KSP databases by reviewing the dates and times recorded for each crash. Several instances of crashes matched by location that did not have identical dates and/or times in each dataset were discovered. However, these differences appeared to be result of data entry errors (e.g., transposing numbers, mistyping data).

Through this process, each crash record in the FARS database was matched to a corresponding crash record in the KSP database. Linking the databases allowed for an association of the alcohol and drug test results from FARS with crash attributes housed in the KSP records.

4.2 Defining Alcohol and Drug Involvement

Because FARS includes laboratory test data, this database was used to flag crashes in which alcohol or drugs were a contributing factor. Although FARS contains data on non-motorized users and non-driver passengers, only the test results for drivers were used to flag a crash for alcohol or drug involvement. The team made no attempt to assign the status of *impaired* or *under the influence* to a driver based on a positive alcohol or drug test. While the database's BAC data could be used to determine if a driver was impaired, it was decided not to base analysis on this definition of impairment because tests could have been performed too late to capture the full BAC when the crash occurred. Likewise, because FARS does not include data on drug concentrations it is it impossible to draw conclusions about drug impairment. Therefore, researchers focused solely on the *presence* of alcohol and drugs in fatal crashes. If FARS data did not include a positive indication for alcohol or drug involvement, that crash was treated as unrelated to impairment by alcohol or drugs.[3]

4.3 Combining Crash Attributes

The only FARS data used in this study were indications of alcohol and drug involvement. All other data were obtained from KSP crash records. By using only the crash data law enforcement already collect, the research team sought to identify key crash attributes that correlate with alcohol or drug involvement. Officers could then use these attributes as surrogates to consider if alcohol or drugs contributed to crashes (where they otherwise may not have). The following crash attributes from KSP Records were used to investigate their relationships to alcohol and drug involvement:

- Data from Record 1
  - Time, date, location, hit and run indication, manner of collision, location of first crash event, light condition, land use, directional analysis, and police suspicion of alcohol or drug involvement
- Data from Record 3
  - Age, gender, and restraint usage
- Data from Record 11
  - Human factors (including possible alcohol and drug involvement)

Record 1 documents crash-level information (i.e., in a crash record, there is only one value for each attribute). Conversely, Records 3 and 11 contain driver-level data; thus, for each attribute there can be multiple values for a single crash depending on the number drivers. To merge data from Records 3 and 11 to Record 1 researchers counted the number of drivers in each crash who had a particular driver-level characteristic and appended that information to Record 1 crash-level data. A brief example describing how this process worked for restraint usage clarifies this method. Restraint usage has nine possible codes:

- Shoulder/Lap Belt,
- Installed/Not in Use,
- Lap Belt Only,
- Shoulder Belt Only,
- Child Safety Seat,
- Helmet,
- Helmet Not Used,
- Other Passive Restraint, and
- Not Installed.

[3] While this assumption could be invalid for some crashes (e.g., circumstances prevented testing for alcohol or drugs, testing for alcohol and drugs was performed too late), it was beyond the scope of this study to confirm or disconfirm these special circumstances.

Instead of appending a single field to the end of Record 1 for restraint use, nine fields (one for each code) were appended. Then the number of drivers using the corresponding form of restraint for each crash was recorded in the appropriate field(s).

The research team associated the remaining driver-level attributes with crash-level data using the same approach employed for coding restraint usage. Age was divided into 10 categories with 10-year intervals. Gender was coded as male, female, or left blank. Twenty-six human factor codes were used for drivers. All individual codes were also appended to the end of the Record 1 crash-level data. The number of drivers having each characteristic was denoted in the correct field. The effort yielded a single database containing all KSP records summarized at the crash level, including driver-level characteristics. The linked database IDs (see Section 4.1) were used to combine FARS data on alcohol or drug involvement with the KSP crash-level summary. This produced a master database to use to analyze the relationship between crash characteristics and alcohol and drug involvement.

5. Data Analysis

For each crash group, researchers summarized the KSP crash attributes of interest from Records 1, 3, and 11 to highlight trends between alcohol- and drug-related crashes and those that were not alcohol- or drug-related. Based on these summaries, the research team determined which crash attributes may indicate the involvement of alcohol or drugs.

5.1 Current Alcohol and Drug Identification Accuracy

Two inconsistencies can arise in how the KSP and FARS databases report the presence of alcohol and/or drugs: 1) the KSP database does not identify alcohol or drug involvement while FARS does, and 2) the KSP database indicates drug or alcohol involvement but FARS lacks laboratory testing data to substantiate that claim. The first discrepancy may result in drivers not being criminally punished for alcohol or drug involvement, while the second can be the product of testing not being done, it being performed too late, or from a lack of follow through on collecting a sample to test. Law enforcement could also mistakenly identify alcohol or drug involvement when there was none. Tables 1 and 2 illustrate the discrepancies between FARS and KSP data.

Table 1 Alcohol and Drug Reporting Consistency for Fatal Crashes by Total Crashes from 2013-2017

		Alcohol Involvement				Drug Involvement				Alcohol or Drug Involvement			
Year	Total Crashes	Police Yes, FARS Yes	Police Yes, FARS No	Police No, FARS Yes	Police No, FARS No	Police Yes, FARS Yes	Police Yes, FARS No	Police No, FARS Yes	Police No, FARS No	Police Yes, FARS Yes	Police Yes, FARS No	Police No, FARS Yes	Police No, FARS No
2013	590	107	38	46	399	24	5	194	367	127	30	161	272
2014	612	96	37	50	429	27	6	201	378	124	24	178	286
2015	694	102	37	64	491	26	10	239	419	133	29	209	323
2016	763	98	38	64	563	38	12	255	458	132	31	238	362
2017	721	88	54	50	529	32	13	208	468	120	42	188	371

Table 2 Alcohol and Drug Reporting Consistency for Fatal Crashes by Percentage from 2013-2017

	Alcohol Involvement				Drug Involvement				Alcohol or Drug Involvement			
Year	Police Yes, FARS Yes	Police Yes, FARS No	Police No, FARS Yes	Police No, FARS No	Police Yes, FARS Yes	Police Yes, FARS No	Police No, FARS Yes	Police No, FARS No	Police Yes, FARS Yes	Police Yes, FARS No	Police No, FARS Yes	Police No, FARS No
2013	18.1%	6.4%	7.8%	67.6%	4.1%	0.8%	32.9%	62.2%	21.5%	5.1%	27.3%	46.1%
2014	15.7%	6.0%	8.2%	70.1%	4.4%	1.0%	32.8%	61.8%	20.3%	3.9%	29.1%	46.7%
2015	14.7%	5.3%	9.2%	70.7%	3.7%	1.4%	34.4%	60.4%	19.2%	4.2%	30.1%	46.5%
2016	12.8%	5.0%	8.4%	73.8%	5.0%	1.6%	33.4%	60.0%	17.3%	4.1%	31.2%	47.4%
2017	12.2%	7.5%	6.9%	73.4%	4.4%	1.8%	28.8%	64.9%	16.6%	5.8%	26.1%	51.5%
Avg.	14.7%	6.1%	8.1%	71.1%	4.3%	1.3%	32.5%	61.9%	19.0%	4.6%	28.8%	47.7%

Tables 1 and 2 split fatal crashes into four groups for each substance type: alcohol, drugs, and alcohol or drugs. The four groups represent all possible combinations of KSP and FARS reporting:

- Group 1: Police Yes, FARS Yes
  - Police indicate the involvement of a substance.
  - FARS *confirms* the involvement.
- Group 2: Police Yes, FARS No
  - Police indicate the involvement of a substance.
  - FARS *does not* confirm it.
- Group 3: Police No, FARS Yes
  - Police do not indicate the involvement of a substance.
  - FARS *indicates* the involvement of a substance.
- Group 4: Police No, FARS No
  - Police do not indicate the involvement of a substance.
  - FARS *confirms* the lack of involvement.

This method of classification allows the researchers to pinpoint instances when law enforcement failed to correctly detect the presence or absence of drug and/or alcohol involvement. With Groups 2 and 3, there is a mismatch between the KSP and FARS data. Table 3 lists the percentage of alcohol-related, drug-related, and alcohol- or drug-related crashes for which KSP and FARS data either did (*Consistent*) or did not (*Inconsistent*) match.

Across the study period, KSP and FARS data aligned for approximately 86% of alcohol-related crashes; for drug-related crashes they aligned for 66% of all cases. Law enforcement had a more challenging time identifying the presence of drugs. For almost 33% of crashes FARS reports as being drug-related, police failed to detect the presence of drugs.

Table 3 Consistency of Alcohol and Drug Reporting between KSP and FARS Databases

	Alcohol Involvement		Drug Involvement		Alcohol or Drug Involvement	
Year	Consistent	Inconsistent	Consistent	Inconsistent	Consistent	Inconsistent
2013	85.8%	14.2%	66.3%	33.7%	67.6%	32.4%
2014	85.8%	14.2%	66.2%	33.8%	67.0%	33.0%
2015	85.4%	14.6%	64.1%	35.9%	65.7%	34.3%
2016	86.6%	13.4%	65.0%	35.0%	64.7%	35.3%
2017	85.6%	14.4%	69.3%	30.7%	68.1%	31.9%
Average	85.8%	14.2%	66.2%	33.8%	66.6%	33.4%

As noted, Group 2 crashes may be the product of outside circumstances that prevented laboratory testing. However, it cannot be assume that all the crashes where police reported the presence of alcohol or drugs but FARS provides no confirmation are problematic (i.e., that law enforcement was incorrect). Reducing the number of crashes in Group 3 will prove most useful as these are the cases where law enforcement failed to correctly identify alcohol or drugs as a contributing factor. More crashes fall into Group 3 than Group 2, underlining that more improvement is possible.

5.2 Crash-Level Data Analysis

The research team analyzed the six FARS-based alcohol and drug groups by individual crash characteristics. Table 4 presents the number of fatal crashes between 2013 and 2017 that fall into each group.

Table 4 Total Fatal Crashes by Alcohol and Drug Group (2013-2017)

Total Crashes						
	Alcohol Present	Alcohol Absent	Drug Present	Drug Absent	Alcohol or Drug Present	Alcohol or Drug Absent
Total Crashes	765	2615	1244	2136	1610	1770

During the study period there were 3,380 fatal crashes in Kentucky. FARS data indicate alcohol was detected in at least one driver in 765 crashes, drugs were detected in at least on driver in 1,244 crashes, and in 1,610 crashes there was at least one driver with alcohol or drugs present.

Table 5 Police Reporting of Alcohol Involvement by Alcohol and Drug Group (2013-2017)

Police-Reported Alcohol Involvement						
	Alcohol Present	Alcohol Absent	Drug Present	Drug Absent	Alcohol or Drug Present	Alcohol or Drug Absent
NO	35.82%	92.20%	73.71%	82.77%	65.22%	92.37%
YES	64.18%	7.80%	26.29%	17.23%	34.78%	7.63%

Table 5 summarizes data for police-reported, alcohol-related crashes. Of the crashes in the *Alcohol Present* group, 36% were recorded in the KSP database as being unrelated to alcohol. Of the crashes in the *Drug Present* group 26% were documented as alcohol-related by police. It is possible that in some cases alcohol and drugs could have both played a role or that police officers mistook the effects of drugs for the effects of alcohol.

Table 6 turns to police-reported, drug-related crashes. Of the crashes in the *Drug Present* group, the KSP database recorded just 12% as having involved drugs. Law enforcement possibly confounded the presence of alcohol with drugs in a small number of cases — approximately 7.5%. As with alcohol-related crashes, some of these may have been drug-related while other cases officers potentially mistook the effects of alcohol for the effects of drugs.

Table 6 Police Reporting of Drug Involvement by Alcohol and Drug Group (2013-2017)

Police-Reported Drug Involvement						
	Alcohol Present	Alcohol Absent	Drug Present	Drug Absent	Alcohol or Drug Present	Alcohol or Drug Absent
NO	92.42%	94.84%	88.18%	97.85%	90.37%	97.85%
YES	7.58%	5.16%	11.82%	2.15%	9.63%	2.15%

Table 7 shows the percentage of crashes in each group in which police indicated the presence of alcohol, drugs, or both. Compared to data reported in Tables 5 and 6, the percentage of cases with a positive indication of alcohol or drug involvement are higher. The increase observed in each of these groups is attributable to the likelihood of officers misinterpreting the effects of alcohol and drugs. This demonstrates that officers are aware that a driver may be under the influence of a substance, but they may not recognize the correct substance.

Table 7 Police Reporting of Alcohol or Drug Involvement by Alcohol and Drug Group (2013-2017)

Police-Reported Alcohol or Drug Involvement						
	Alcohol Present	Alcohol Absent	Drug Present	Drug Absent	Alcohol or Drug Present	Alcohol or Drug Absent
NO	35.56%	88.57%	67.60%	81.79%	60.50%	91.19%
YES	64.44%	11.43%	32.40%	18.21%	39.50%	8.81%

Table 8 lists the percentage of crashes coded as a hit and run for each group. *Alcohol Present* and *Drug Present* crashes have a higher percentage of hit and run crashes than their absent counterparts. However, the *Alcohol or Drug* group shows a greater percentage of alcohol or drug absent crashes are hit and run crashes than the present counterpart.

Table 8 Hit and Run Indication by Alcohol and Drug Group (2013-2017)

Hit and Run						
	Alcohol Present	Alcohol Absent	Drug Present	Drug Absent	Alcohol or Drug Present	Alcohol or Drug Absent
NO	96.47%	97.44%	98.47%	96.49%	97.83%	96.67%
YES	3.53%	2.56%	1.53%	3.51%	2.17%	3.33%

Table 9 summarizes fatal crashes by day of the week for each group. It also indicates the percentage of crashes for which law enforcement left the day of week code blank. Fatal crashes involving alcohol were most common on Friday, Saturday, and Sunday. Conversely, fatal crashes that did not involve alcohol were more evenly distributed throughout the week. A similar trend is apparent the *Drug Present* and *Drug Absent* groups. For the *Alcohol or Drug Present* group, the percentage of crashes occurring on Saturday and Sunday was higher than for the *Alcohol or Drug Absent* group.

Table 9 Day of Week of Crash by Alcohol and Drug Group (2013-2017)

Day of Week						
	Alcohol Present	Alcohol Absent	Drug Present	Drug Absent	Alcohol or Drug Present	Alcohol or Drug Absent
Blank	4.84%	3.17%	3.94%	3.32%	4.22%	2.94%
Sunday	17.91%	12.66%	13.42%	14.09%	14.91%	12.88%
Monday	8.24%	13.69%	12.14%	12.64%	11.06%	13.73%
Tuesday	10.46%	14.91%	14.87%	13.34%	13.54%	14.24%
Wednesday	10.46%	14.95%	13.10%	14.42%	12.61%	15.14%
Thursday	12.81%	14.91%	14.87%	14.19%	14.04%	14.80%
Friday	16.86%	15.56%	15.11%	16.29%	15.78%	15.93%
Saturday	18.43%	10.13%	12.54%	11.70%	13.85%	10.34%

Table 10 and Figure 2 show the distribution of crashes in each category by time of day. Each point plotted in Figure 2 represents the percentage of crashes that occurred between the labeled hour and the preceding hour. For example, dots plotted at *Hour 1* represent crashes that took place between 12:00 am and 1:00 am.

Table 10 Time of Crash by Alcohol and Drug Group from 2013-2017

Time of Day						
Time (24-hr)	Alcohol Present	Alcohol Absent	Drug Present	Drug Absent	Alcohol or Drug Present	Alcohol or Drug Absent
0-59	5.23%	2.22%	2.65%	3.04%	3.35%	2.49%
100-159	5.10%	1.80%	2.49%	2.57%	3.23%	1.92%
200-259	5.10%	1.26%	1.93%	2.25%	2.92%	1.41%
300-359	6.14%	1.38%	3.30%	1.97%	3.85%	1.19%
400-459	5.23%	1.72%	2.33%	2.62%	3.23%	1.86%
500-559	2.48%	2.45%	2.09%	2.67%	2.30%	2.60%
600-659	1.83%	3.06%	2.73%	2.81%	2.48%	3.05%
700-759	2.75%	5.28%	5.39%	4.31%	4.66%	4.75%
800-859	1.18%	3.79%	2.97%	3.32%	2.55%	3.79%
900-959	1.44%	3.40%	2.81%	3.04%	2.67%	3.22%
1000-1059	0.78%	4.74%	2.57%	4.59%	2.30%	5.25%
1100-1159	2.35%	4.86%	4.02%	4.45%	3.60%	4.92%
1200-1259	1.70%	5.16%	4.58%	4.26%	3.85%	4.86%
1300-1359	2.48%	6.54%	5.47%	5.71%	4.72%	6.44%
1400-1459	2.35%	6.50%	5.55%	5.57%	4.72%	6.33%
1500-1559	2.75%	7.11%	5.63%	6.41%	5.03%	7.12%
1600-1659	3.53%	6.81%	5.87%	6.18%	5.22%	6.84%
1700-1759	6.80%	6.77%	7.80%	6.18%	7.14%	6.44%
1800-1859	5.36%	5.43%	5.63%	5.29%	5.34%	5.48%
1900-1959	7.19%	4.47%	4.50%	5.43%	5.40%	4.80%
2000-2059	6.80%	4.67%	5.06%	5.20%	5.40%	4.92%
2100-2159	7.71%	4.40%	6.03%	4.63%	6.15%	4.24%
2200-2259	7.97%	3.90%	5.06%	4.68%	5.65%	4.07%
2300-2359	5.75%	2.29%	3.54%	2.81%	4.22%	2.03%

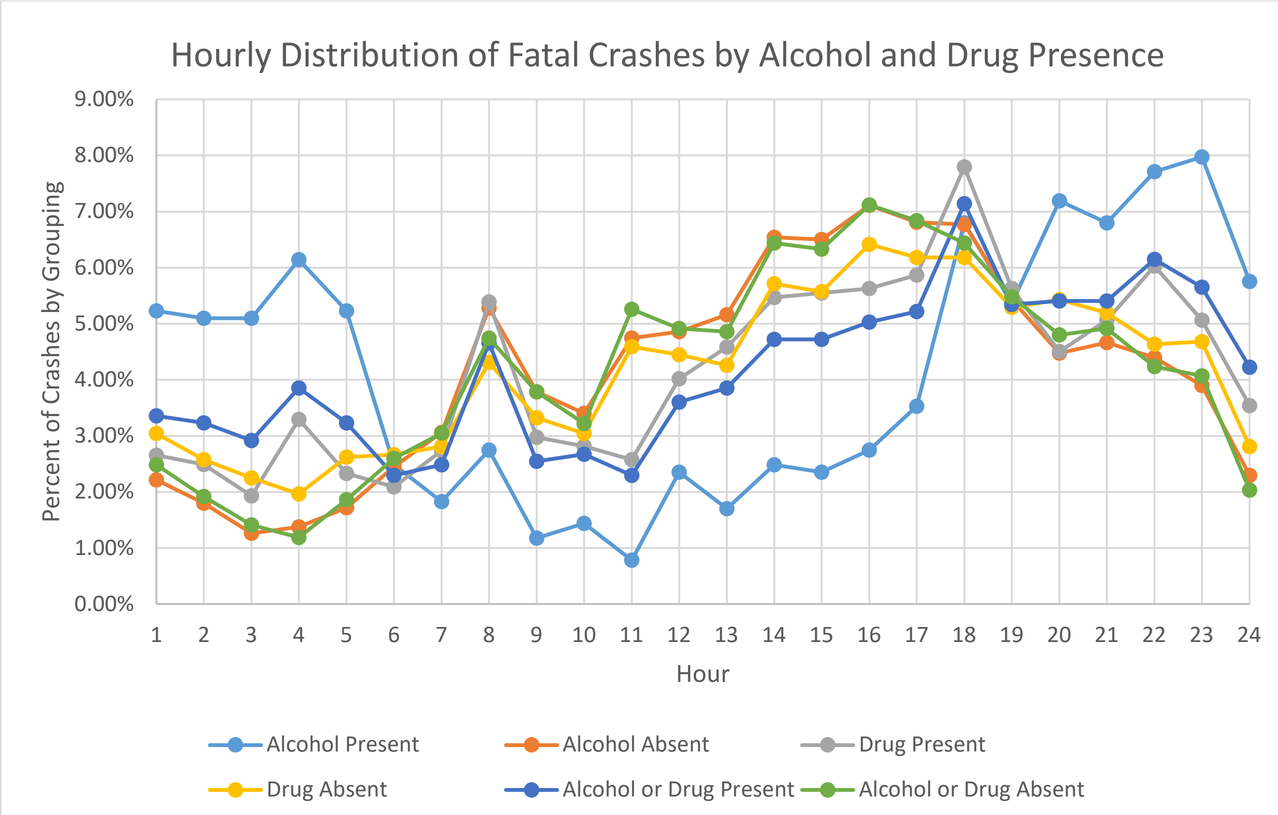

Figure 2 Time of Crash by Alcohol and Drug Group (2013-2017)

Approximately 62% of fatal crashes which involved alcohol occurred between 7:00 pm and 5:00 am, a trend consistent with previous research. All groups evince definite peaks at 8:00 am and 6:00 pm — daily peak travel times. The drug and alcohol or drug present/absent group pairs do not vary significantly throughout the day.

Police reports record light condition at the time of a crash. Light condition is useful for identifying crashes that occurred at night without setting a time-based definition of night. Table 11 summarizes the percentages of crashes in each group based on light condition. Alcohol-related crashes were most common in dark conditions on unlighted highways. Conversely, most of the fatal crashes that did not involve alcohol happened during daylight hours. However, irrespective of the category, most fatal crashes occurred either in the day or at night in unlighted conditions (approximately 70 to 80 percent).

Table 11 Light Condition at Time of Crash by Alcohol and Drug Group (2013-2017)

Light Condition						
	Alcohol Present	Alcohol Absent	Drug Present	Drug Absent	Alcohol or Drug Present	Alcohol or Drug Absent
Dawn	1.70%	3.06%	3.22%	2.48%	2.73%	2.77%
Daylight	32.29%	62.83%	54.66%	56.65%	49.13%	62.09%
Dusk	3.79%	2.07%	3.05%	2.11%	3.11%	1.86%
Darkness-Highway Lighted/Off	5.49%	2.41%	4.10%	2.53%	4.22%	2.09%
Darkness - Highway Lighted/On	13.07%	8.15%	7.32%	10.39%	8.88%	9.60%
Darkness - Highway not Lighted	42.22%	20.84%	26.77%	25.05%	30.93%	20.90%
Dark (Unknown Roadway Lighting)	1.44%	0.61%	0.80%	0.80%	0.93%	0.68%
Other	0.00%	0.04%	0.08%	0.00%	0.06%	0.00%

Table 12 looks at land use types at crash locations. For each category, the highest number of fatal crashes was recorded in rural areas. Another interesting trend worth noting pertains to land zoned for business — crashes in which alcohol, drugs, or alcohol or drugs were present were less likely to occur in these locations than crashes where substances played no role.

Table 12 Land Use at Location of Crash by Alcohol and Drug Group (2013-2017)

Land Use						
	Alcohol Present	Alcohol Absent	Drug Present	Drug Absent	Alcohol or Drug Present	Alcohol or Drug Absent
Business	13.99%	21.34%	16.16%	21.72%	15.71%	23.28%
Industrial	1.31%	1.45%	1.85%	1.17%	1.74%	1.13%
Limited Access	9.67%	14.30%	11.90%	14.04%	11.49%	14.86%
Park	0.26%	0.15%	0.16%	0.19%	0.12%	0.23%
Private Property	0.13%	0.08%	0.08%	0.09%	0.12%	0.06%
Residential	16.60%	13.69%	12.38%	15.50%	13.85%	14.80%
Rural	57.91%	48.76%	57.32%	47.05%	56.83%	45.37%
School	0.13%	0.23%	0.16%	0.23%	0.12%	0.28%

In Kentucky, the location of first event refers to the place on the road where the action which initiated a crash occurred. Table 13 summarizes the location of first event for each group. Higher percentages of crashes where alcohol, drugs, and drugs or alcohol were present began on shoulders than their respective counterparts (i.e., absent). The inverse is true for crashes that began on roads.

Table 13 Location of the First Event of the Crash by Alcohol and Drug Group from 2013-2017

Location of First Event						
	Alcohol Present	Alcohol Absent	Drug Present	Drug Absent	Alcohol or Drug Present	Alcohol or Drug Absent
Gore	0.00%	0.08%	0.16%	0.00%	0.12%	0.00%
Median	1.44%	1.64%	1.45%	1.69%	1.37%	1.81%
On Roadway	45.10%	66.96%	58.52%	64.04%	55.28%	68.14%
Outside Shoulder, Left	19.08%	8.64%	13.26%	9.69%	14.60%	7.74%
Outside Shoulder, Right	23.92%	15.26%	17.77%	16.90%	19.50%	15.14%
Shoulder	4.58%	3.86%	4.02%	4.03%	4.16%	3.90%
Other Property	5.88%	3.56%	4.82%	3.65%	4.97%	3.28%

Manner of collision denotes how cars made contact during a crash; Table 14 summarizes these data. Most of the crashes in each group were single-vehicle crashes, although a higher percentage of alcohol-related incidents were single-vehicle crashes (67%) than crashes which did not involve alcohol. The proportion of drug-related head-on crashes was approximately twice that of head-on crashes that did not involve drugs.

Table 14 Manner of Collision of the Crash by Alcohol and Drug Group from 2013-2017

Manner of Collision						
	Alcohol Present	Alcohol Absent	Drug Present	Drug Absent	Alcohol or Drug Present	Alcohol or Drug Absent
Angle	10.46%	20.42%	17.60%	18.49%	15.71%	20.40%
Backing	0.00%	0.19%	0.08%	0.19%	0.06%	0.23%
Head-On	12.42%	14.03%	18.73%	10.72%	16.83%	10.79%
Opposing Left Turn	1.44%	2.33%	1.45%	2.53%	1.55%	2.66%
Rear End	4.71%	7.42%	6.43%	7.02%	6.27%	7.29%
Rear to Rear	0.13%	0.08%	0.08%	0.09%	0.06%	0.11%
Sideswipe, Opposite Direction	2.48%	2.26%	3.22%	1.78%	2.92%	1.75%
Sideswipe, Same Direction	1.70%	1.84%	1.21%	2.15%	1.37%	2.20%
Single Vehicle	66.67%	51.43%	51.21%	57.02%	55.22%	54.58%

Directional analysis codes provide more detailed information on the manner of collision. They capture data on crash location, units involved in the crash (e.g., vehicle, pedestrian, cyclist, objects), and travel direction at the time of crash. Table 15 summarizes the six crash groups based on the directional analysis codes. For all six crash groups, the most common directional analysis codes were *Collision with Fixed Object* and *Ran off Roadway*, both of which are for single-vehicle crashes. Comparing alcohol-, drug-, and alcohol- or drug-related groups to their counterparts (no substances present) indicated the former had higher percentages of crashes for these crash types, but the differences were the greatest between the alcohol groups. Crashes due to a *Vehicle Going in Wrong Direction* were much more likely to occur when a substance was involved than when one was not. Collisions with pedestrian and cyclists were more common when drugs and alcohol were not a factor. The disparity between alcohol-related and non-alcohol-related crashes was greater for more crash characteristics than the other pairings.

Table 15 Directional Analysis Code by Alcohol and Drug Group (2013-2017)

Directional Analysis						
	Alcohol Present	Alcohol Absent	Drug Present	Drug Absent	Alcohol or Drug Present	Alcohol or Drug Absent
Collision with Fixed Object	28.89%	16.44%	20.66%	18.45%	22.80%	16.05%
Head-on Collision	8.89%	11.43%	15.11%	8.38%	13.42%	8.53%
Collision with Pedestrian at Intersection	0.39%	2.22%	0.72%	2.43%	0.75%	2.77%
Collision with Non-Fixed Object	0.26%	0.31%	0.16%	0.37%	0.25%	0.34%
Angle Collision - Both Vehicles Going Straight at Intersection	1.83%	2.79%	1.61%	3.14%	1.80%	3.28%
Collision with Pedestrian	2.09%	8.45%	2.57%	9.60%	2.48%	11.13%
Rear End - One Vehicle Turning Left at Intersection	0.00%	0.04%	0.08%	0.00%	0.06%	0.00%
Angle Collision - One Vehicle Turning Left at Intersection	1.57%	3.29%	2.89%	2.90%	2.36%	3.39%
Other Roadway or Mid-Block Collision	2.35%	2.72%	2.09%	2.95%	2.17%	3.05%
Ran off Roadway (1 vehicle with/earth embankment, ditch)	23.40%	14.30%	18.89%	14.89%	19.57%	13.45%
1 Vehicle Entering/Leaving Entrance	4.97%	9.41%	8.92%	8.10%	7.89%	8.87%
Other Collisions on Shoulder	5.23%	3.75%	4.82%	3.65%	4.84%	3.39%
Rear End in Traffic Lanes – Both Vehicles Moving	2.35%	4.59%	4.18%	4.03%	3.79%	4.35%
Collision with Fixed Object at Intersection	2.61%	1.95%	1.85%	2.25%	2.17%	2.03%
Sideswipe Collision - Opposite Direction	2.09%	1.57%	2.41%	1.26%	2.24%	1.19%
Collision with Bicycle at Intersection	0.00%	0.23%	0.00%	0.28%	0.00%	0.34%
1 Vehicle Parked Position (not Parking Lot, driveway)	0.92%	1.07%	0.72%	1.22%	0.87%	1.19%
Occupant Fell from Moving Vehicle	0.26%	0.42%	0.24%	0.47%	0.25%	0.51%

Collision with Animal	0.26%	0.65%	0.24%	0.75%	0.25%	0.85%
Collision with Train	0.26%	0.57%	0.32%	0.61%	0.37%	0.62%
Other Ramp Related Collisions not Listed Above	0.13%	0.19%	0.08%	0.23%	0.12%	0.23%
Overturned in Roadway	1.44%	1.26%	0.88%	1.54%	1.06%	1.53%
Sideswipe Collision - Same Direction	0.78%	0.92%	0.72%	0.98%	0.75%	1.02%
Opposite Direction - Both Vehicles Going Straight Ahead at Intersection	0.78%	1.07%	1.05%	0.98%	0.99%	1.02%
Angle Collision - Other at Intersection	0.65%	1.80%	1.53%	1.54%	1.30%	1.75%
Non-Collision Object Collision at Intersection	0.39%	0.57%	0.24%	0.70%	0.31%	0.73%
Median Cross-Over Collision	0.00%	0.08%	0.08%	0.05%	0.06%	0.06%
Opposing Left Turn at Intersection	0.78%	1.34%	0.72%	1.50%	0.75%	1.64%
Rear End - on Ramp	0.26%	0.19%	0.40%	0.09%	0.31%	0.11%
Collision with Fixed Object not in Gore	0.65%	0.19%	0.32%	0.28%	0.43%	0.17%
Rear End - Other at Intersection	0.13%	0.46%	0.32%	0.42%	0.31%	0.45%
Vehicle Going in Wrong Direction	1.57%	0.73%	1.53%	0.56%	1.37%	0.51%
Rear End in Traffic – One Vehicle Stopped	0.26%	0.46%	0.32%	0.47%	0.37%	0.45%
Collision with Bicyclist	0.26%	0.69%	0.40%	0.70%	0.43%	0.73%
Rear End on Shoulder	0.00%	0.15%	0.00%	0.19%	0.00%	0.23%
Overturned on Ramp	0.13%	0.15%	0.00%	0.23%	0.06%	0.23%
Rear End - One Vehicle Stopped at Intersection	0.13%	0.11%	0.08%	0.14%	0.12%	0.11%
1 Vehicle Entering or Leaving Parked Position (not Parking Lot)	0.00%	0.15%	0.24%	0.05%	0.19%	0.06%
Other Intersection Collisions	0.13%	0.42%	0.24%	0.42%	0.25%	0.45%
Collision With Parked Vehicle at Intersection	0.00%	0.08%	0.00%	0.09%	0.00%	0.11%
Angle Collision - One Vehicle Turning Right at Intersection	0.00%	0.15%	0.00%	0.19%	0.00%	0.23%
Sideswipe, Same Direction at Intersection	0.26%	0.11%	0.24%	0.09%	0.25%	0.06%
Vehicle Backing	0.00%	0.04%	0.00%	0.05%	0.00%	0.06%
Collision in Parking Lot	0.00%	0.15%	0.08%	0.14%	0.06%	0.17%
Multiple Vehicle Collision on Ramp	0.00%	0.04%	0.00%	0.05%	0.00%	0.06%

Ramp - Vehicle Ran off Roadway	0.13%	0.00%	0.00%	0.05%	0.06%	0.00%
Rear End - Both Vehicles Going Straight at Intersection	0.13%	0.00%	0.08%	0.00%	0.06%	0.00%

*Nighttime was defined as a dusk or dark light condition.

The research team conducted further analysis on the effects of the day of week, light condition, and manner of collision. Table 16 summarizes several combinations of crash attributes. For each crash attribute, researchers list the number of crashes and what percentage that figure is of the total number of crashes in the *Alcohol Present* and *Alcohol Absent* categories, respectively. Compared to fatal crashes in which alcohol played no role, alcohol-related fatal crashes were:

- Three times more likely to occur on the weekend at night,
- Almost twice as likely to occur at night,
- 1.8 times more likely to occur on the weekend as a single vehicle crash,
- 1.4 times more likely to occur on a weekend,
- 1.3 times more likely to be a single vehicle crash, and
- 1.25 times more likely to be a single vehicle nighttime.

Ninety-three percent of all alcohol-related fatal crashes occurred on the weekend, at night, or were single-vehicle crashes (compared to 77% for fatal crashes that did not involve alcohol). Thus, when a fatal (or even non-fatal) crash meets at least one of these criteria, police officers during their field investigation may want to examine the possibility of alcohol being involved.

Table 16 Comparison of Key Crash Characteristic Combinations between Alcohol Present and Alcohol Absent Crash Groups

Crash Attribute	Alcohol Present	Alcohol Absent
Total Crashes	765	2615
Identified as Alcohol Involved	491 (64%)	204 (8%)
Nighttime	405 (66%)	891 (34%)
Weekend (Fr-Su)	407 (53%)	1003 (38%)
Single Vehicle	510 (67%)	1345 (51%)
Single Vehicle and Nighttime	345 (45%)	942 (36%)
Nighttime and Weekend	275 (36%)	321 (12%)
Single Vehicle and Weekend	279 (36%)	528 (20%)
Single Vehicle or Nighttime	670 (88%)	1639 (63%)
Nighttime or Weekend	637 (83%)	1573 (60%)
Single Vehicle or Weekend	638 (83%)	1821 (70%)
Single Vehicle, Weekend, or Nighttime	709 (93%)	2013 (77%)

This in depth analysis was only performed for the *Alcohol Present* and *Alcohol Absent* groups because they showed trends that are more distinct across multiple crash characteristics than the drug and alcohol or drug groups.

5.3 Driver Level Data Analysis

Using the FARS-based crash groups, the research team investigated the characteristics of drivers involved in fatal crashes. The characteristics looked at included gender, age, safety restraint usage, and human factors. Because many crashes involved more than one driver, the percentages for each FARS-based group do not sum to 100%.

5.3.1 Gender

The analysis of gender found that a male driver was involved in 87% alcohol-related fatal crashes, 85% of drug-related fatal crashes, and 86% of alcohol- or drug-related fatal crashes (Table 17). In all categories, a larger percentage of males than females were involved in crashes. Looking just at female drivers, the percentage of female drivers involved in fatal crashes was higher for those in which drugs or alcohol were not found (the opposite dynamic can be observed for men).

Table 17 Gender of Drivers by Alcohol and Drug Group from 2013-2017

Gender						
	Alcohol Present	Alcohol Absent	Drug Present	Drug Absent	Alcohol or Drug Present	Alcohol or Drug Absent
Blank	0.13%	0.08%	0.08%	0.09%	0.06%	0.11%
Female	25.10%	38.70%	35.13%	35.91%	32.55%	38.42%
Male	87.19%	81.53%	85.69%	81.13%	86.02%	79.89%

5.3.2 Age

Table 18 examines the relationships between age and fatal crashes. Compared to crashes that had no alcohol involvement, a higher percentage of alcohol-related crashes involved drivers between the ages of 20 and 49 (the largest difference was within the 30–39 age group). One comparison that is worth highlighting is the disparity between teenage and older drivers (> 60). While roughly 10% of non-alcohol related crashes involved teens, only 6.5% of alcohol-related crashes did. On the other hand, roughly 36% of non-alcohol-related crashes involved drivers over the age of 60 — nearly three times the rate of alcohol-related crashes. Similar trends are apparent in the drug- and non-drug-related groups, but with the largest discrepancy in the 40–49 age group.

Table 18 Driver Age by Alcohol and Drug Group (2013-2017)

Age						
	Alcohol Present	Alcohol Absent	Drug Present	Drug Absent	Alcohol or Drug Present	Alcohol or Drug Absent
<=19	6.54%	10.52%	7.15%	11.05%	7.14%	11.86%
20-29	32.68%	28.99%	33.04%	27.95%	33.11%	26.84%
30-39	27.71%	22.41%	28.46%	20.79%	28.07%	19.55%
40-49	24.97%	22.26%	27.89%	19.94%	26.58%	19.49%
50-59	22.09%	24.51%	25.40%	23.13%	23.98%	23.95%
60-69	9.15%	17.32%	13.67%	16.53%	12.98%	17.74%
70-79	3.40%	11.63%	5.55%	12.22%	5.47%	13.67%
80-89	0.52%	5.16%	1.53%	5.62%	1.37%	6.61%
90-99	0.00%	0.92%	0.40%	0.89%	0.31%	1.07%
>=100	0.13%	0.00%	0.08%	0.00%	0.06%	0.00%
Blank	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0	0.13%	0.11%	0.00%	0.19%	0.06%	0.17%

5.3.3 Safety Restraint Usage

Crash reports indicate if drivers and passengers used safety restraints. If officers cannot verify the use of safety restraints, they make an educated inference. Table 19 summarizes data related to the use of safety restraints. Two codes — *Installed/Not in Use* and *Helmet Not Used* — indicate that no safety restraint was used. Consistent with previous research, researchers found that drivers who were in fatal crashes were less likely to use a proper safety restraint. This finding is also substantiated by examining the past five years of Kentucky fatal crash data. Compared to fatal crashes that did not involve alcohol, alcohol-related crashes were 1.6 times more likely to involve a driver who did not use a seatbelt and 1.56 times more likely to involve a helmetless motorcyclist. Conversely, fatal crashes that were not alcohol-related were 1.7 times more likely to involve a driver using a seatbelt and 1.3 times more likely to involve a helmeted motorcyclist than crashes that were alcohol-related. One can detect similar trends when comparing drug- and alcohol- or drug-related crashes to those in which those substances did not factor. However, the magnitude of differences is less extreme.

Table 19 Driver Safety Restraint Use by Alcohol and Drug Group (2013-2017)

Safety Restraint Use						
	Alcohol Present	Alcohol Absent	Drug Present	Drug Absent	Alcohol or Drug Present	Alcohol or Drug Absent
Blank	0.26%	0.27%	0.08%	0.37%	0.19%	0.34%
Shoulder/Lap Belt	40.78%	69.60%	58.12%	65.96%	54.60%	70.79%
Installed/Not in Use	56.99%	35.83%	50.16%	35.07%	51.06%	31.13%
Lap Belt Only	0.52%	0.88%	0.64%	0.89%	0.68%	0.90%
Shoulder Belt Only	0.13%	0.50%	0.32%	0.47%	0.31%	0.51%
Child Safety Seat	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Helmet	3.92%	5.16%	5.23%	4.68%	4.97%	4.80%
Helmet Not Used	15.03%	9.64%	12.06%	10.16%	12.48%	9.38%
Other Passive Restraint	0.13%	0.04%	0.16%	0.00%	0.12%	0.00%
Not Installed	1.18%	0.73%	1.13%	0.66%	1.06%	0.62%

5.3.4 Human Factors

In crash reports, police officers record human factors that may have contributed to a crash. They are either confirmed by drivers or suspected by an officer. Table 20 summarizes data on human factors. In 59% of alcohol-related crashes, at least one driver was coded for alcohol use. (Ideally, this figure would be 100%.) The codes *Not Under Proper Control*, *Exceeding Stated Speed Limit*, *Drug Involvement*, and *Too Fast for Conditions* were overrepresented in alcohol-related crashes compared to those which did not involve alcohol. Similarly, compared to crashes that involved no substances, these same human factor codes tended to be overrepresented in drug- and alcohol- or drug-related crashes.

Table 20 Human Factor of Drivers by Alcohol and Drug Group (2013-2017)

Human Factor						
	Alcohol Present	Alcohol Absent	Drug Present	Drug Absent	Alcohol or Drug Present	Alcohol or Drug Absent
Alcohol Involvement	58.82%	3.33%	19.86%	13.58%	29.07%	3.90%
Cell Phone	0.78%	0.96%	0.96%	0.89%	1.06%	0.79%
Disregard Traffic Control	4.31%	4.40%	3.62%	4.82%	3.98%	4.75%
Distraction	1.96%	3.29%	2.33%	3.37%	2.42%	3.50%
Drug Involvement	8.50%	5.16%	12.86%	1.87%	10.43%	1.81%
Emotional	1.57%	0.50%	0.72%	0.75%	0.99%	0.51%
Exceeded Stated Speed Limit	19.35%	6.92%	12.06%	8.38%	13.85%	5.99%
Failed to Yield Right of Way	6.54%	13.04%	11.66%	11.52%	10.12%	12.88%
Fatigue	0.78%	1.11%	1.29%	0.89%	1.12%	0.96%
Fell Asleep	0.92%	1.91%	2.01%	1.50%	1.68%	1.69%
Following Too Close	0.26%	0.99%	1.05%	0.70%	0.87%	0.79%
Improper Backing	0.13%	0.04%	0.08%	0.05%	0.06%	0.06%
Improper Passing	1.18%	1.19%	1.61%	0.94%	1.61%	0.79%
Inattention	15.16%	22.45%	19.29%	21.68%	18.39%	22.99%
Lost Consciousness/Fainted	0.52%	2.45%	1.29%	2.43%	1.06%	2.88%
Medication	0.52%	0.54%	0.96%	0.28%	0.75%	0.34%
Misjudge Clearance	0.65%	2.45%	1.77%	2.20%	1.55%	2.49%
Not Under Proper Control	42.75%	34.30%	42.28%	32.68%	42.17%	30.79%
Overcorrecting/Oversteering	11.50%	9.41%	10.13%	9.74%	10.25%	9.55%
Physical Disability	0.13%	0.50%	0.32%	0.47%	0.25%	0.56%
Sick	0.13%	0.92%	0.72%	0.75%	0.56%	0.90%
Too Fast for Conditions	8.37%	6.92%	8.04%	6.79%	7.89%	6.67%
Turning Improperly	0.39%	0.69%	0.64%	0.61%	0.62%	0.62%
Weaving in Traffic	0.65%	0.57%	0.80%	0.47%	0.68%	0.51%
Other	10.33%	13.19%	14.15%	11.61%	13.29%	11.86%
None Detected	32.16%	57.82%	49.92%	53.23%	45.47%	57.97%

5.4 County Summaries

Table 21 lists the counties with the highest average annual fatal crash totals across the study period for three categories: Alcohol-Related Fatal Crashes, Drug-Related Fatal Crashes, and Alcohol- or Drug-Related Fatal Crashes. Counties with larger populations and higher traffic volumes had the most fatal crashes involving drugs and alcohol. Jefferson County and Fayette County — which are Kentucky's most populous — are the first and second ranked counties in each category.

Table 21 Top 10 Counties by Average Fatal Crashes/Year for Alcohol, Drug, and Alcohol or Drug Fatal Crashes (2013-2017)

Alcohol Fatal Crashes		Drug Fatal Crashes		Alcohol or Drug Fatal Crashes	
County	Average Crashes/year	County	Average Crashes/year	County	Average Crashes/year
Jefferson	22.8	Jefferson	28.6	Jefferson	40
Fayette	8.4	Fayette	10	Fayette	14.2
Warren	4	Pike	7.4	Pike	8.2
Pike	3.2	Warren	5.2	Warren	7
Kenton	2.8	Madison	4.4	Madison	5.8
Pulaski	2.8	Hardin	4.4	Hardin	5.8
Whitley	2.8	Floyd	4.4	Floyd	5
Graves	2.6	Boone	4.2	Boone	5
Madison	2.6	Clay	4	Daviess	4.8
Scott	2.6	Nelson	3.8	Kenton	4.8

However, using crash totals alone can be misleading. As such, researchers calculated *fatal crash rates* for each category using total county vehicle miles traveled (VMT) to distinguish counties in which fatal crashes occur at disproportionately high rates compared to total travel. Crash rates were calculated per hundred million vehicle-miles traveled (HMVMT) and then mapped to locate which counties suffered the highest alcohol- and drug-involved fatal crash rates (Figures 3-5).

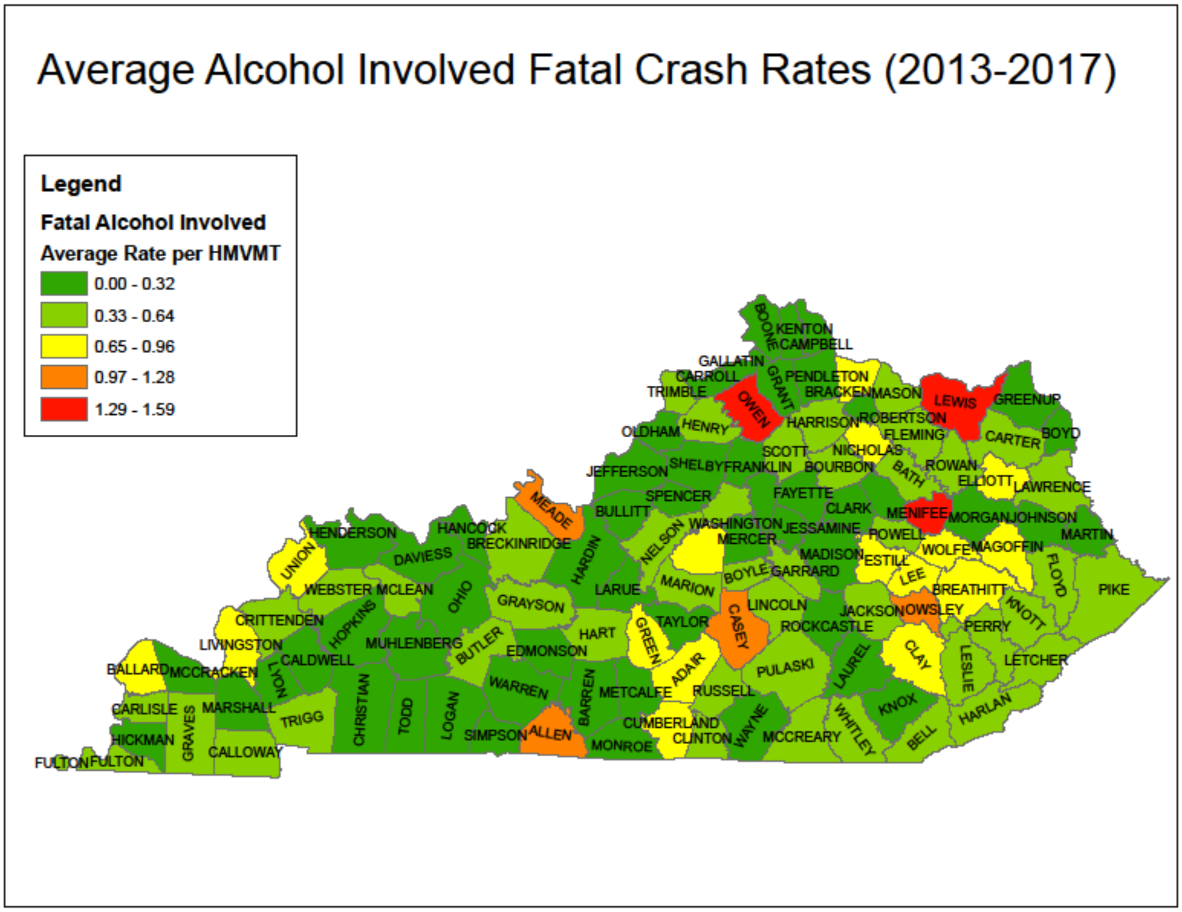

Figure 3 Average Alcohol Involved Fatal Crash Rate per HMVMT in Kentucky (2013-2017)

The counties with the highest alcohol-related fatal crash rates were Lewis, Owen, and Menifee (Figure 3). In contrast, very populous counties (e.g., Fayette, Jefferson, Kenton, Warren) had much lower fatal alcohol-related crash rates. While they recorded more fatal crashes, this was offset by their much higher traffic volumes. Figure 4 depicts drug-related fatal crash rates. These rates peaked in eastern Kentucky (e.g., Menifee, Breathitt, Clay, and Leslie Counties) Drug-related fatal crash rates tended to be higher throughout the state than alcohol-related fatal crash rates, which suggests drug-related crashes are a more pressing issue in Kentucky and may warrant greater attention. Lastly, Figure 5 portrays countywide fatal crash rates for alcohol- or drug-related crashes. When drug- and alcohol-related fatal crashes are combined, the counties with the highest average fatal crash rates were Cumberland, Lewis, Menifee, Breathitt, and Clay. Counties with the highest rates in this category tend to be clustered in eastern Kentucky. Table 10 lists the counties with the highest fatal crash rates in each of the three categories. Comparing Tables 21 and 22 reveals that just one county ranked in the top 10 for average number of alcohol-, drug-, and alcohol- or drug-related fatal crashes per year had a fatal crash rate that ranked it in the top 10 — Clay County. Clay County ranked eighth in average number of drug-related fatal crashes per year and second for drug-related fatal crash rate.

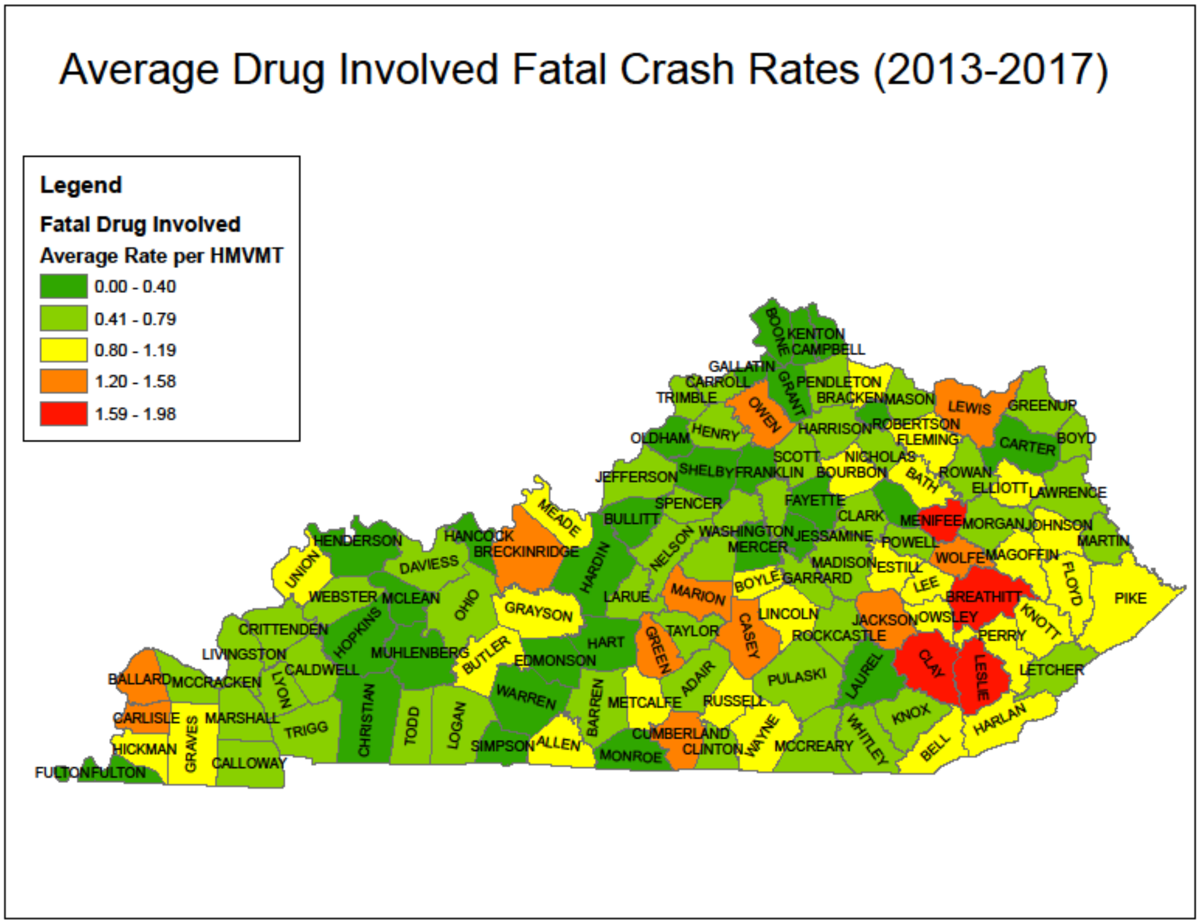

Figure 4 Average Drug Involved Fatal Crash Rate per HMVMT in Kentucky (2013-2017)

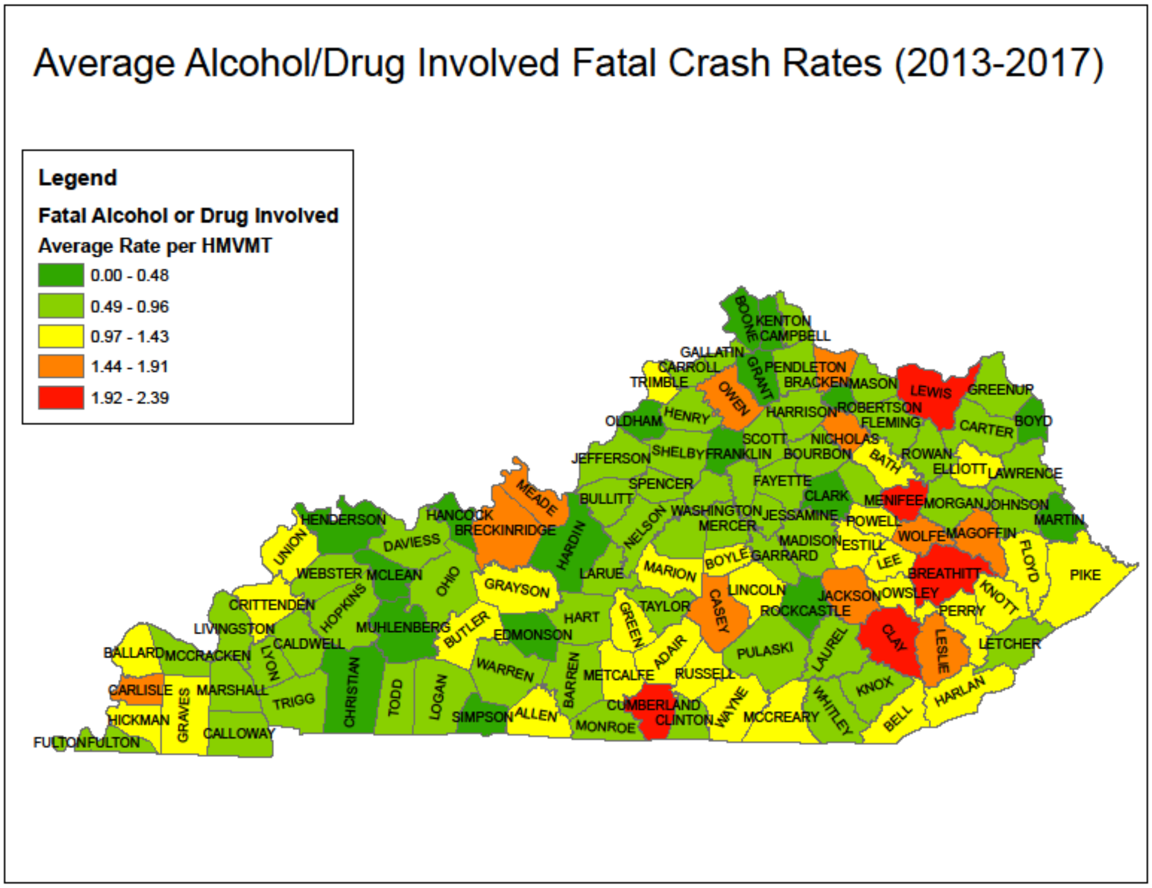

Figure 5 Average Alcohol or Drug Involved Fatal Crash Rate per HMVMT in Kentucky (2013-2017)

Table 22 Top 10 Counties by Average Alcohol, Drug, and Alcohol or Drug Involved Fatality Rates (2013-2017)

Alcohol Involved Fatal Crashes		Drug Involved Fatal Crashes		Alcohol or Drug Involved Fatal Crashes	
County	Average Rate (per HMVMT)	County	Average Rate (per HMVMT)	County	Average Rate (per HMVMT)
Menifee	1.59	Breathitt	1.98	Menifee	2.39
Lewis	1.49	Clay	1.93	Breathitt	2.28
Owen	1.39	Leslie	1.74	Clay	2.02
Casey	1.25	Menifee	1.58	Lewis	1.94
Owsley	1.11	Casey	1.53	Cumberland	1.94
Meade	1.08	Wolfe	1.53	Owen	1.85
Allen	1.04	Jackson	1.53	Casey	1.81
Magoffin	0.93	Lewis	1.49	Breckinridge	1.81
Elliott	0.88	Carlisle	1.47	Leslie	1.74
Clay	0.87	Cumberland	1.39	Meade	1.74

6. Summary

Researchers compared the 2013 to 2017 fatal crash data from the KSP database to the crash data from the FARS database to check the consistency and accuracy of alcohol and drug involvement reporting for drivers in the KSP database. The indications of alcohol and drug involvement in the FARS database were used as the ground truth due to the inclusion of laboratory test results confirming the presence of alcohol and/or drugs in a driver's system. The research team identified two possible inconsistencies for alcohol and drug reporting:

- FARS showing the presence of an alcohol or drug without an officer indicating the involvement of alcohol or drugs in the crash report.
- An officer indicating the involvement of alcohol or drugs in the crash report, but FARS showing testing was not done to confirm this indication, or test results were negative for alcohol or drug involvement.

Table 3 summarizes the consistency for alcohol, drug, and alcohol or drug reporting between the two databases. For the five-year study period, the indications for alcohol involvement were 85.8% consistent and the indications of drug involvement were 66.2% consistent between the two databases. Of the fatal crashes where FARS confirmed alcohol involvement for a driver, KSP crash reports only identified 64.2% as involving alcohol. Of the fatal crashes where FARS confirmed drug involvement for a driver, KSP crash reports only identified 11.8% as involving drugs.

When comparing officer identification of alcohol or drug involvement to the confirmed presence either alcohol or drugs in FARS, consistency was 66.6% on average. Of the crashes shown by FARS to involve a driver testing positive for drugs or alcohol, officers identified 39.5% of these crashes as alcohol or drug involved. This increase in percentage compared to the consistency and accuracy of identification of drug involvement suggests that officers are aware that a driver may be under the influence of a substance, but they may not be indicating the correct substance.
The low percentage of drug involved crashes correctly identified by police indicates that either not all the drugs being reported FARS are not impacting the driver's abilities, or that symptoms of drug involvement are more difficult for officers to identify. The inclusion of drug concentrations found in a driver's system in the FARS database could help make the distinction between drug presence that might affect driving abilities and drug presence due to a simple prescription, which may not affect driving ability. More training for officers to identify the signs of drug involved driving would also be useful to increase the percentage of drug involved driving identified by police.

Analysis of the crash characteristics from the KSP crash database showed that 93% of all alcohol involved fatal crashes occurred at nighttime, on a weekend, or as a single vehicle crash. Furthermore, alcohol involved fatal crashes were nearly two times more likely to occur at nighttime and three times more likely to occur on a weekend at nighttime than non-alcohol involved fatal crashes. Alcohol involved fatal crashes were also shown to occur more frequently in residential and rural areas than non-alcohol involved fatal crashes.
Head-on crashes occur at nearly twice the rate in the drug present fatal crash group than the drug absent fatal crash group. Drug involved fatal crashes occurred more frequently in rural areas than non-alcohol involved fatal crashes.

Hit and run crashes accounted for a larger percentage of the alcohol and drug involved fatal crash groups than the non-alcohol and non-drug involved fatal crash groups. Both alcohol and drug involved fatal crashes showed a strong relationship with high-risk human factors such as “Not Under Proper Control”, “Exceeding Stated Speed Limit”, and “Too Fast for Conditions”, when compared to the non-alcohol and non-drug involved fatal crash groups. Alcohol and drug involved fatal crashes also showed a strong relationship to drivers not using proper safety restraints (seatbelts for passenger vehicles and helmets for motorcyclists).

Alcohol and drug involved fatal crash rates were shown to be highest in Eastern Kentucky counties, with drug involved crash rates being higher, on average, than alcohol involved crash rates. The top 10 counties for alcohol, drug, and alcohol or drug involved crash rates are shown in Table 22.

7. Recommendations

Based on review and analysis of 2013-2017 fatal crash data, the research team developed several recommendations pertaining to enforcement, public involvement, and data collection. The latter focus on reducing inconsistencies between KSP crash reports and information stored in the FARS database.

7.1 Enforcement

- Increase enforcement of impaired driving regulations. Prioritize enforcement in counties with the highest alcohol- and drug-related fatal crash rates (see Section 6.4).
- Alcohol- and drug-related fatal crashes occurred at disproportionately high rates in rural areas. Officers can use this information to hone enforcement.
- Law enforcement could use nighttime, weekend, or single-vehicle crashes as indicators of alcohol involvement given that these types of crashes are more likely to involve alcohol.
- Human factors such as speeding and not using safety restraints could be used to flag crashes for potential alcohol or drug involvement.
- Provide Advanced Roadside Impaired Driving Enforcement (ARIDE) (NHTSA 2018) and Drug Recognition Expert (DRE) (NHTSA 2016) training to as many officers as possible to increase the accuracy and the identification of alcohol- and drug-related crashes.

7.2 Public Involvement

- Use the upcoming Impaired Driving Task Force Strategic Plan (see Section 3.2) to combat impaired driving.
- Continue public information campaigns related to impaired driving (i.e. Drive Sober or Get Pulled Over) (KOHS 2019a).
- Continue public information campaigns on safety restraint usage (i.e. Click It or Ticket, Local Heroes Program) (KOHS 2019b).

7.3 Data Collection

- Ensure that location, date, and time of fatal crashes documented in crash reports match the FARS summaries before submitting Kentucky's FARS data to NHTSA.
- Obtain warrants to test all drivers and non-motorized persons involved in fatal crashes for alcohol and drugs. This will let courts prescribe the most effective corrective treatments for drivers under the influence.
- Update KSP fatal crash reports with the more accurate FARS data to ensure both databases have consistent alcohol and drug reporting.
- Update non-fatal crash reports with alcohol and drug test results (when applicable) to enhance identification of alcohol- and drug-related crashes.
- Develop a process through which researchers can access drug concentration data for fatal crashes. These data will let researchers to study the effect of drug impairment on roadway safety.
- Test for both alcohol and drugs whenever possible for all potential DUI crashes to determine which substances, if any, impaired the driver. Again, this will allow the courts to prescribe the most effective corrective treatments for drivers under the influence.

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